



Revive Properties and Philgreen Construction

The Lupine Model
Fort Collins, CO



BUILDER PROFILE

Revive Properties and Philgreen Construction
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FEATURED HOME/DEVELOPMENT:

Project Data:

- Name: The Lupine Model
- Location: Fort Collins, CO
- Layout: 2 bdrm, 2.5 bath, 3 fls, 1,576 ft²
- Climate: IECC 5B, cold
- Completed: February 2019
- Category: multifamily

Modeled Performance Data:

- HERS Index: without PV 49; with PV -1
- Projected Annual Energy Costs: without PV \$1,050; with PV \$50
- Projected Annual Energy Cost Savings: (vs typical new homes) without PV \$1,500; with PV \$2,550
- Projected Annual Energy Savings: without PV 9,200 kWh; with PV 19,500 kWh
- Added Construction Cost: without PV \$15,400; with PV \$27,400
- Savings in the First 30 Years: \$107,600

For the second year in a row, Revive Properties, LLC, and Philgreen Construction have won the highest designation, the Grand award, in the U.S. Department of Energy's Housing Innovation Awards for their multifamily Lupine model in the Revive neighborhood of Fort Collins, Colorado.

The Revive-Philgreen team is amassing a string of building awards including 2017 and 2016 DOE Housing Innovation Awards. And in 2015, their North Star model home was selected as the "Best Green Home" in the North Colorado Home Builders Association's Street of Dreams. As early as 2016, HERS (Home Energy Rating System) scores were revealing the Revive neighborhood as "the greenest neighborhood in Colorado."

"The Revive community has gained some local standing mainly due to our participation in the DOE Zero Energy Home program," said Sue McFaddin, with Revive Properties, LLC. "If energy efficiency in neighborhoods is discussed in our market, Revive comes up as the example of how to build. Our marketing is done through word of mouth and reputation. This program sets us apart from other builders in our market. We are honored to be a grand winner."

However, it's the homeowners who feel like the real grand winners: "The utilities in homes we lived in before ranged from \$150–300 a month. At our townhome last month, our utility bills were \$11. Immediately after we moved there were several large snowstorms and it was quite cold. Our house stayed warm without the heat kicking on every 10 minutes," said the owner of one of the Fort Collins townhomes.



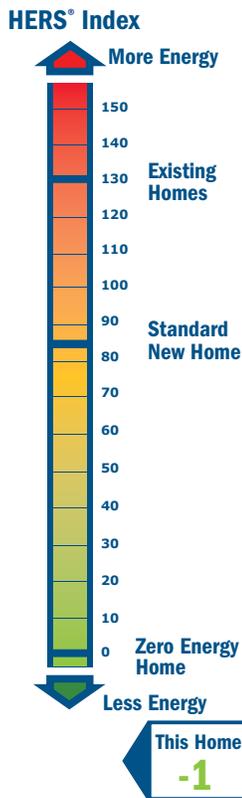
The U.S. Department of Energy invites home builders across the country to meet the extraordinary levels of excellence and quality specified in DOE's Zero Energy Ready Home program. Every DOE Zero Energy Ready Home starts with ENERGY STAR Certified Homes Version 3.0/3.1/3.2 for an energy-efficient home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

Revive Properties and Philgreen Construction built this 1,576-ft² multifamily project in Fort Collins, Colorado, to the high performance criteria of the U.S. Department of Energy Zero Energy Ready Home (ZERH) program. With 7.04 kW of solar panels on the unit's rooftop producing as much power as the unit is expected to use over the course of the year, the home will be a true net zero energy performer with a HERS score of -1 and projected electric bills of less than \$5 per month.



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.



Such low utility bills are just one feature of the townhomes constructed to the criteria of the DOE Zero Energy Ready Home certification, a designation that only the top 1% of U.S. home builders achieve. To earn this certification, these homes meet all of the requirements of ENERGY STAR Certified Homes Version 3.0 or 3.1, the U.S. Environmental Protection Agency's Indoor airPLUS program, the hot water distribution requirements of the EPA's WaterSense program, and the insulation requirements of the 2015 International Energy Conservation Code.

For these three-story 1,576-ft² townhomes (2-bedroom/2.5 bath with a two-car garage), it starts with an attention to detail at the foundation. The slabs and attached garage floor are insulated with R-10 of closed-cell spray foam that is sprayed on the ground under the slabs. R-10 of rigid polystyrene wraps the slab edges. In Colorado's cold climate, this foundation system provides a constant ground temperature for the home. Because radon gas is a risk in Fort Collins, each home is equipped with a passive radon-gas-reduction system.

The above-grade walls are constructed with 2x4s staggered on 2x6 top and bottom plates allowing the R-23 of dense-packed blown-in fiberglass insulation to wrap around the sides of the studs to minimize thermal bridging (or heat transfer) through the walls. This staggering of 2x4s is a cost-effective way to maximize insulation within the space limitations of the 20-foot-wide lots. The party walls between the units are insulated with blown-in cellulose to an insulation value of R-13. The rim joists are insulated with open-cell spray foam. The coated OSB sheathing is taped at the seams to serve as the weather-resistant barrier under the fiber cement siding. After sealing any seams or holes wider than a half inch with caulk or spray foam an aerosol sealant is applied inside the home to air seal any minute cracks in the building envelope. This extra step helped to air seal the home to 1.66 air changes per hour at 50 Pascals. That's almost twice as tight as is required by the newest energy code. (The 2015 International Energy Conservation Code requires 3 ACH 50 or less.) With a home this tight, it is important to ensure fresh air enters the home and stale air is expelled. A continually operating energy recovery ventilator (ERV) with a MERV 10 filter on the outside air intake ensures clean air is provided to the home.

The wall effectiveness is complemented by the highly efficient casement windows. These double-pane, argon-filled, vinyl-framed windows have an insulating U-factor of 0.28 and a solar heat gain coefficient (SHGC) of 0.18, meaning the windows perform well at preventing unwanted solar heat gain from Colorado's intense summer sun. Also, the townhomes are situated on the lots for southern exposure for both daylighting and solar panels.



LED lighting, EPA WaterSense labeled plumbing fixtures, and ENERGY STAR appliances will save energy and water, while low- and no-VOC finishes and ERV continuous ventilation will help ensure clean air in the efficient home.

All of the units are designed with monoplane shed roofs to achieve optimal south-facing angles for solar electric production from the 7 kilowatts of photovoltaic panels on the roofs. The 14-inch I joists which comprise the unvented, vaulted ceilings are filled with 14 inches (R-50) of open-cell spray foam. The roof decking of 1 $\frac{5}{32}$ -inch OSB is completely covered with ice-and-water shield and topped with storm-resistant asphalt shingles.

All units are heated and cooled with a ground source (geothermal) heat pump with a heating coefficient of performance (COP) of 4.18. Conditioned air is distributed throughout the unit through rigid metal ducts that are located entirely within the conditioned space of the home.

A desuperheater on the ground source heat pump preheats water that is further heated with an electric tank water heater to provide domestic hot water with a heating efficiency of 2.16 COP. Water conservation features, such as dual flush toilets and EPA WaterSense compliant hot water distribution, including a recirculation pump to the top-floor bathrooms, reduce water use inside the home, while landscaping incorporates low water-use plants outside.

The winning home, with its standard features, achieved a HERS index of 49 without PV, which is far better than the typical HERS score of 80 to 100 for new homes built to code across the country. When the solar energy production from the 7.04 kW of solar panels is included in the calculation, the townhome's HERS score drops to a negative 1. A score of 0 would mean a home that is net zero, or one that produces as much energy as it uses in a year. A score of minus 1 means the home is producing more energy than it uses in a year. The Lupine model home has its own electric car charging station to use some of that surplus power.

The Lupine model townhouse has a calculated annual energy bill of \$60 with the PV and is estimated to provide annual energy savings to its homeowners of \$2,531 compared to a home built to the local energy code, which is equivalent to the 2012 International Energy Conservation Code.

The low energy bills are not the only thing that attracted the homeowners to these townhouses. "The main factor that led to our decision to buy in the Revive neighborhood is the quality of the buildings. The standard to which they are built far exceeds typical U.S. construction. Although we also love the renewable features and the excellent interior finishes, having a solid basis for all that really provides comfort and peace of mind."

HOME CERTIFICATIONS

DOE Zero Energy Ready Home Program

ENERGY STAR Certified Homes Version 3.0

EPA Indoor airPLUS

EPA WaterSense

LEED for Homes

"We like the way the neighborhood is set up because it does not feel crowded at all, but open, cheerful and welcoming (including the neighbors)." *Homeowner*



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.



R-10 of insulation covers the ground under the slab and an additional R-10 of rigid insulation wraps the edges of the slabs for the slab-on-grade foundations of these townhomes.

of edible fruit trees and a community garden provides home owners with their own local food source. Pervious pavers are used in the alley and selected parking areas to increase storm water infiltration.

The developer installed solar-powered street lights throughout the development. Although the developer received no rebates for the street lights, they were still less expensive than traditional street lights because the builder didn't have to dig trenches and run wires.

Photos courtesy of Philgreen Construction

Like all DOE Zero Energy Ready certified homes, the home incorporates the requirements of the U.S. Environmental Protection Agency's Indoor airPLUS, with construction details to minimize water entry, ventilation to reduce mold risks and hard flooring surfaces in kitchens, bathrooms, and entries to reduce moisture damage risks. No- and low-VOC and formaldehyde products also help to minimize air quality issues, as does the continuous fresh air ventilation.

Revive's commitment to efficiency and the environment are visible throughout the entire development. In addition to the townhomes and duplexes, the 10-acre site includes three acres of open space including an irrigated park with bioswales, trails, and turf. Homes are constructed around two orchards

KEY FEATURES

- **Walls:** 2x4 staggered studs on 2x6 plate, advanced framing; R-23 total: ½" drywall, R-23 blown fiberglass, 7/16" coated OSB sheathing, cement board siding.
- **Roof:** Shed roof, ½" drywall, 14" I-joist, 15/32" OSB, ice-and-water guard, asphalt shingles.
- **Attic:** Unvented vaulted ceilings, 14" R-50 open-cell spray foam in I-joist cavity.
- **Foundation:** Slab on grade with frost wall and footing, R-10 insulation under slab.
- **Windows:** Double-pane, argon-filled, low-e, vinyl casement frames, U=0.28, SHGC=0.18.
- **Air Sealing:** 1.66 ACH 50.
- **Ventilation:** ERV with programmed timer, 85 cfm continuous ventilation, MERV 10 filter on HVAC.
- **HVAC:** Combined heat and hot water; ground-source heat pump, 4.18 COP; rigid metal ducts in conditioned space.
- **Hot Water:** Ground-source heat pump with desuperheater, 2.16 COP, 40-gal.; electric tank backup; hydronic gravity loop distribution.
- **Lighting:** 100% LED, daylighting.
- **Appliances:** ENERGY STAR dishwasher.
- **Solar:** 7.04-kW PV system.
- **Water Conservation:** EPA WaterSense fixtures and toilets, porous pavers, bioretention pond for water runoff.
- **Energy Management System:** Smart thermostat.
- **Other:** Low-to-no-VOC products, passive radon system, ready for electric car charging station.

"We enjoy every minute of living in this house." Philgreen home owner