Building America Case Study

Zero Energy Ready Home Multifamily Project: Mutual Housing at Spring Lake

Woodland, California

PROJECT INFORMATION

Construction: New home

Type: Multifamily, affordable

Partners:

Developer: Mutual Housing California, *mutualhousing.com*

Builder: Sunseri Construction, *sunsericonstruction.com*

Alliance for Residential Building Innovation, *arbi.davisenergy.com*

Size: 709 ft²–1,515 ft²

Date Completed: 2015

Climate Zone: Hot-dry

PERFORMANCE DATA

2013 Title-24 Compliance Margin: 17%–23%

Percentage better than ZERH target home: 13%–15%

Projected annual energy cost savings: $113/apartment without PV; $936/apartment with PV

Incremental cost of energy-efficiency measures: $8,247/apartment

The 62-unit Spring Lake project developed by Mutual Housing California (MH) is the first multifamily project nationwide to be certified under the U.S. Department of Energy's (DOE's) Zero Energy Ready Home (ZERH) program. MH is a nonprofit developer whose mission is to develop, operate, and advocate for sustainable housing in Sacramento and Yolo counties. Its Spring Lake project in Woodland, California, includes 62 affordable apartment flats and townhomes for agricultural workers and their families. The DOE Building America team Alliance for Residential Building Innovation (ARBI) worked with MH throughout this project to provide support for ZERH certification as well as the Leadership in Energy & Environmental Design (LEED) for Homes program.

The key to increasing the adoption of high-performance homes by builders and developers in the California market is to help them to leverage and navigate through development agreement requirements, code compliance requirements, incentives, and competitive market advantages of ZERH certification. An objective of this project was to gain a highly visible foothold for residential buildings that are built to the ZERH specification and that can be used to encourage participation by other California builders.

Exterior walls were framed using 2×6 studs 16 in. on center with high-density R-21 fiberglass batt. Quality insulation installation (QII) is more challenging with fiberglass batts than with foam or blown fiberglass or cellulose; however, the insulation job at Spring Lake easily passed the QII inspection. Structural requirements precluded the use of such advanced framing techniques as 24 in. on-center spacing, but corners and intersecting walls were insulated to minimize thermal shorts. All other ENERGY STAR® Thermal Enclosure System Checklist items were verified.

Building America SM U.S. Department of Energy

Key Energy-Efficiency Measures

HVAC

- Inverter-driven variable-speed air-to-water heat pumps deliver hot and chilled water to fan coils in each unit and also heat water.
- In flats, ductwork is placed in dropped soffits. In townhomes, top-floor ductwork is buried under 3.5 in. of blown attic insulation. All air handling units are in interior closets.
- Duct leakage to outside = 8 CFM–21 CFM @ 25 Pascals.
- Return-air transfer grilles were provided in all bedrooms.

ENVELOPE

- Light-colored shingle roof, Cool Roof Rating Council-certified
- R-49 blown ceiling insulation in vented attic
- R-21 grade-1 batt insulation in 2×6 frame wall
- Double-pane, low-e vinyl windows: U = 0.29, solar heat gain coefficient = 0.19
- Tightly sealed enclosures, ACH50 = 1.7–4.0

LIGHTING, APPLIANCES, AND WATER HEATING

- 100% compact fluorescent lamps and light-emitting diode bulbs
- ENERGY STAR exhaust fans
- ENERGY STAR refrigerator and dishwasher
- Heat pump water heating.

For more information see the Building America report *Implementing a Zero Energy Ready Home Multifamily Project* at *buildingamerica.gov*.

Image credit: All images were created by the ARBI team.

A three-function air-to-water heat pump provides space heating and cooling along with water heating. The “hydrobox” (left image) includes a refrigerant-to-water heat exchanger and distributes hot or chilled water to a fan coil. The hot water storage tank is also shown.

Lessons Learned

- The success of high-performance homes relies on effective communication early in the design process and throughout the project. The team recommends that roles and responsibilities be clearly defined and that an individual be identified to manage and coordinate ZERH-related work.
- Early design meetings and periodic reviews of construction documents should be conducted to ensure that all measures and testing requirements are addressed to help avert change orders and reduce costs.
- Detailed scopes of work that list unique ENERGY STAR and ZERH requirements should be provided to the bidding contractors and reviewed again before construction begins. Compliance should be reviewed as construction progresses.
- Sealing can be a challenge in multifamily buildings. The air barrier should be explicitly defined in construction documents. Particular care should be taken in sealing rim joists and drywall to top plates, which requires coordination between the drywall contractor and insulator.
- Proper design, installation, and sealing of ductwork is important even when ducts are located fully within conditioned living space. Duct and equipment sealing, methods for avoiding pressure imbalances, and air-balancing requirements must be clearly addressed in the design and managed during construction.
- Low-leakage air handling units and adequate access in mechanical closets to seal equipment to plenums will reduce the efforts required to mitigate leakage when systems do not pass initial pressure tests.
- Higher-than-expected incremental costs were caused by the lighting package and heat pumps, which represented 74% of the total incremental cost for measures. Limited options for hydronic heat pumps have been approved for use in California under the Title-24 energy code. The $1,700 per unit incremental costs for light-emitting diodes were a major contributor and will be code-required in 2017.

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

For more information visit
buildingamerica.gov

The U.S. Department of Energy’s Building America program is engineering the American home for energy performance, durability, quality, affordability, and comfort.

DOE/GO-102015-4690 • September 2015