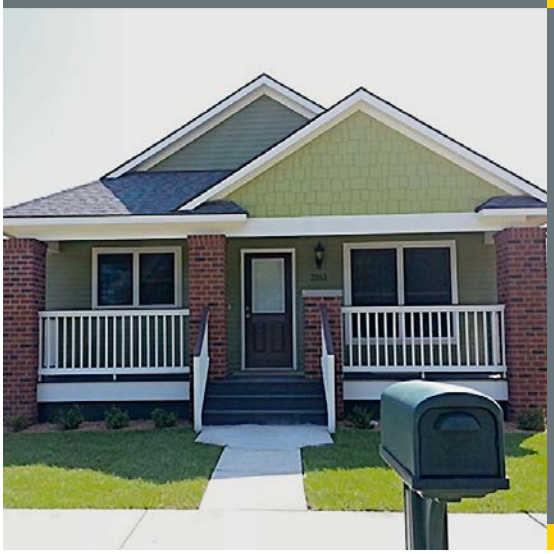


Building America Case Study

Savannah Gardens

Savannah, Georgia

PROJECT INFORMATION

Construction: New home

Type: Single-family, affordable

Partners:
Savannah Housing Department
Chatham Home Builders
Southface Energy Institute

Size: 1,200 ft^2

Price Range: About $160,000

Date Completed: 2013

Climate Zone: Hot-humid

PERFORMANCE DATA

Home energy rating system index: 54
Builder standard practice = 63

Projected annual energy cost savings: $174

Incremental cost of energy-efficiency measures: $2,130

Incremental annual mortgage: $129

Annual cash flow: $45 savings

Billing data: Monthly average electricity cost is $87, which is 70% below the average single-family affordable housing usage (Residential Energy Consumption Survey 2005)

Building AMERICA SM
U.S. Department of Energy

The Savannah Housing Department is leading sustainable and affordable housing development in Georgia. It partnered with Southface Energy Institute, a member of the U.S. Department of Energy's Partnership for Home Innovation Building America research team, to seek cost-effective solutions for increasing the energy efficiency of the Savannah Housing Department's standard single-family home plans in the Savannah Gardens Community. Based on engineering, cost, and constructability analyses, the combined research team chose to pilot two technologies to evaluate efficiency and comfort impacts for homeowners: a heat-pump water heater in an encapsulated attic and an insulated exterior wall sheathing.

The team sought to determine the impacts of the heat-pump water heater on space conditioning in the home—in addition to real-world efficiency. The team upgraded the typical wall assembly from Huber Zip Sheathing to Zip-R Sheathing with a ½-inch layer of rigid foam insulation adhered to the oriented strand board (OSB). This assembly provides a thermal break around the entire structure, and it raises the clear-wall R-value by 24%.

Despite this increase, energy modeling predicted a mere 2% reduction in total energy consumption. The impacts of these two technologies were quantified by comparing measured data to a neighboring home built to the standard plan.

The test home was designed as a prototype for this community of more than 500 EarthCraft-certified single- and multifamily affordable homes and for other developers. The water heater and foam insulation were chosen because they required minimal additional trades training, and they had the potential to contribute significantly to reducing homeowner energy usage, which is especially important for income-constrained families.

Ducted heat-pump water heater installed in attic encapsulated with open-cell spray polyurethane foam. This setup was predicted to save 12% in total annual energy consumption compared to a standard electric-resistance tank.

Key Energy-Efficiency Measures

HVAC

- Ground-source heat pump 18.6 energy efficiency ratio, 3.7 coefficient of performance
- Well-sealed R-8 flex ducts and air handler in encapsulated attic; duct leakage to outside = 0 cfm at 25 pascals
- Energy recovery ventilator spot-ventilation system
- Kitchen and bath fans vented to outside.

ENVELOPE

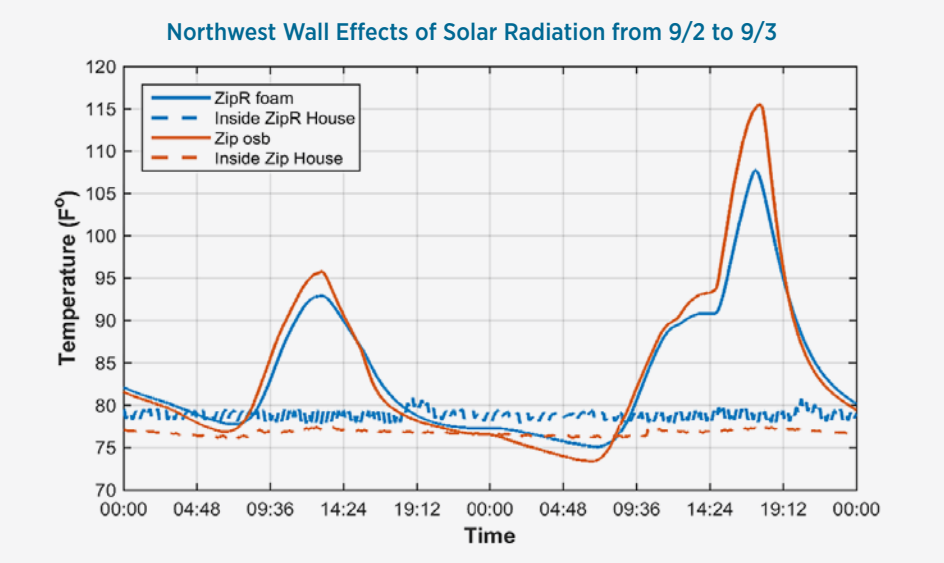
- R-20 open-cell spray polyurethane foam encapsulated attic
- Huber Zip System R sheathing (R-3.6 continuous)
- R-13 grade-1 batt insulation in 2×4 frame wall
- Double-pane low-e vinyl windows; U factor = 0.34, solar heat gain coefficient = 0.26
- Tightly sealed house; air changes per hour at 50 pascals = 1.9.

LIGHTING, APPLIANCES, AND WATER HEATING

- 90% compact fluorescent lamps, 10% linear fluorescent lamps
- ENERGY STAR® appliances
- Heat-pump water heater 2.33 energy factor.

For more information read the Building America report *Advancing Replicable Solutions for High-Performance Homes in the Southeast* at *buildingamerica.gov*.

Image credit: All images were created by the Partnership for Home Innovation team.



Both the Zip and ZipR (Test Home) homes are certified EarthCraft and built to Savannah Housing Department guidelines. Peak wall temperatures inside the Zip R wall cavity were consistently closer to temperatures inside the living zone. Also note the difference between the cloudy (9/2/14) and sunny (9/3/14) days.

Lessons Learned

Some of the many lessons learned are the following:

- Peak wall temperatures were reduced by a daily average of 3.4°F in the summer and increased by 6.4°F in the winter, and diurnal swings in temperature were reduced.
- Exterior insulation reduced the time duration that wall-cavity temperatures were below dew point—and thus at risk for condensation.
- The test home with exterior insulation experienced reduced heating, ventilating, and air-conditioning (HVAC) run times and decreased total HVAC electricity consumption by up to 39%.
- The heat-pump water heater only impacts attic temperature and humidity while it is running; attic temperature and humidity return to previous levels shortly after the water heater stops running.
- The heat-pump water heater should not be used as a dehumidifier or as part of a fresh-air ventilation system because run times are intermittent and conditioning impact is slight.
- A heat-pump water heater is a cost-effective water heater—especially for all-electric homes.
- Different ducting configurations of heat-pump water heaters expand the variety of locations in which they can be installed without negatively impacting performance.

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

For more information visit
buildingamerica.gov

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

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