Building America
U.S. Department of Energy
Research Toward Zero Energy Homes

Builders Challenge Guide to 40% Whole-House Energy Savings in the Hot-Dry and Mixed-Dry Climates

Case Study:
Treasure Homes

FALLEN LEAF AT RIVERBEND | SACRAMENTO, CA

Treasure Homes' Fallen Leaf project was named a California Green Builder Community by the California Building Industry Association for its energy efficient and green building practices.

A California Building Industry Award Winner

Treasure Homes' Fallen Leaf at Riverbend, a 32-home development started in 2006, is the first solar community built in Sacramento. Homes in Fallen Leaf save their homeowners as much as 50% on their utility costs. The savings are a result of collaboration between Treasure Homes and the Sacramento Municipal Utility District (SMUD), the U.S. Department of Energy's Building America program, the National Renewable Energy Laboratory (NREL), and consultant ConSol, a Building America team lead.

As a result of this creative teamwork, Fallen Leaf was named a California Green Builder Community in 2006 by the California Building Industry Association. The project was also honored with two Awards of Merit by the Association's Gold Nugget Award program, which recognizes creative achievements in architectural design and land use.

Education is Key

In spite of this positive press and the obvious need for energy efficiency with increasing energy costs, the company initially found it difficult to convince its first-time-buyer customer base.

"I underestimated the challenge of educating people about the benefits of energy efficiency," said Jim Bayless, the president of Treasure Homes. Thankfully, he adds, since the initial opening of Fallen Leaf at Riverbend, "there has been a cultural shift in the awareness of the benefits of solar and energy-efficient homes. Now I can't turn on the TV or open the paper without hearing or reading something about energy efficiency. This has really helped us close out the community on a strong note."

BUILDER PROFILE

Builder's Name:
Treasure Homes

Where:
Sacramento, CA

Development:
Fallen Leaf

Size:
32-lot development

Square Footage:
1,026 to 2,271 sq. ft.

Completed:
2006

Solar panels can meet nearly 70% of the energy needs of a Fallen Leaf home.

KEY FEATURES

- R-13 wall +1-inch EPS foam; R-38 attic; R-30 floor above garage; R-4 buried ducts in attic
- Radiant barrier in roof
- SmartVent system automatically circulates fresh, filtered air
- Mechanically designed HVAC system with mastic-sealed ducts
- Double-pane windows with Solarban glazing: U-Factor: 0.38; SHGC: 0.29
- 13 SEER A/C unit with a thermal static expansion valve 0.90 AFUE furnace
- Tankless water heater, with a minimum factor of 0.82 and R-4 insulated pipes
- Tyvek housewrap
- ENERGY STAR appliances and fluorescent lighting
- Non-toxic insect and mold deterrants
- 2.4-kW PV solar roof panels

A Model for Education

Even with a cultural shift toward valuing energy efficiency, Jim Bayless and his team took a pro-active approach to educating potential homeowners. Treasure Homes converted the garage of a model home into an energy-efficiency room where buyers followed a path of "fallen leaves" to different displays showcasing the energy-efficient features of the homes and their financial and environmental benefits. Sales agents viewed the room as a valuable sales tool for selling the affordable 1,000- to 2,300-square-foot homes.

The homes have numerous features to highlight which, when working as a system, reduce homeowners' utility bills by 50% and more.

Energy Saving Features

To reach their total energy savings goals, the homes at Fallen Leaf contain the following features:

For the home's shell, the wall insulation is R-13 plus 1-inch EPS foam. The attic insulation is rated at R-38. Ducts are insulated at R 4.2 and buried in the attic insulation. The floor above the garage has an R-30 rating. The roof contains a radiant barrier sheathing. A Tyvek housewrap also protects the house from water and air infiltration while allowing moisture vapor to escape.

The dual-pane windows are coated with "Solarban" glazing to reduce radiant heat gain. Their U factors are 0.38 for sliding and fixed windows and patio doors.

(left) Treasure Homes marketed the exceptional energy saving features of its Fallen Leaf homes by converting the garage of the model home into an energy-efficiency information center where potential homebuyers followed a path of fallen leaves to different displays showcasing the homes' environmental benefits.

(right) The garage is separated from the conditioned space which is well insulated with R-30 unfaced fiberglass batt above the garage. The exterior walls are filled with R-13 blown insulation covered with 1 inch of EPS rigid foam exterior insulation.

A tankless water heater (with R-4 insulation on all trunk lines) produces up to 8.5 gallons of hot water per minute, which saves up to 30% in energy costs per year. A traditional water heater constantly heats water held in the storage tank, even when hot water is not needed. In addition to the energy cost savings, the tankless system takes up less space than a conventional water heater.

The state-of-the-art HVAC system is 13 SEER rated with a thermostatic expansion valve for maintaining the air conditioning capacity and a 90 AFUE furnace. The HVAC and duct design were engineered for right sizing of the heating and cooling equipment and more even distribution of conditioned air. Ducts were sealed and tested for tightness. A Smart Vent system was installed to use the HVAC ductwork to circulate fresh cool filtered outside air. The zoned heating and cooling provides comfortable indoor temperatures for the two-story homes.

The florescent energy-efficient fixtures last 10 times longer and use 75% less energy than incandescent lighting. ENERGY STAR appliances contribute to utility bill savings.

Fallen Leaf homes are outfitted with low-flow showerheads that use only 2.5 gallons per minute instead of the typical 7 gallons. Dual-flush toilets save up to 6,000 gallons a year. Efficient faucets and smaller pipes further help to save water and reduce energy usage.

Treasure Homes uses the BP Solar 2.4-kW-solar photovoltaic Integra, which mounts to the asphalt shingle roof with a two-inch profile. The system is offered with a 25-year warranty and is expected to meet nearly 70% of the energy needs of the typical household. SMUD helped defray the PV cost with a $6,000 rebate.

"The homes at Fallen Leaf are directly connected to the electric grid," said Mike Keesee the coordinator of SMUD's solar advantage program. "They will be generating free energy from the sun during the day, even if no one is home. If a homeowner uses less energy than their home [produces]…, they will have a 'zero' energy bill from SMUD." According to Keesee, homeowners can "bank" a certain amount of energy from SMUD that they can draw from during the months when they use more energy than they've produced.

"In a time when energy conservation is a huge concern for all of us, we are putting our efforts into creating homes that can truly create more energy than their residents use. Not only is that a fantastic benefit for our environment, but homeowners will also see a direct, positive benefit to their pocketbooks."

Jim Bayless, Treasure Homes President

(left) Roof and window flashing help keep rain out of walls and roof assemblies. Dual-pane, vinyl frame windows with solarban glazing help keep out unnecessary heat gain.

(right) The roof is lined with radiant barrier to reflect solar heat, minimizing the heat gain to the attic.

Performance Results

Real-use data show that the Fallen Leaf homeowner's electric bills are averaging 58% less than the average SMUD residential customer's electric bill. One home owner achieved 88% savings over the average SMUD customer. The electric bills at Fallen Leaf have ranged from a low of $9.17 to a high of $52.72 per month. Equally as important to Treasure Homes, at the first annual homeowners association meeting—a meeting traditionally full of complaints—the home owners gave testimonials of their energy savings, not their problems.

Dollars and Sense

The 2.0-kW PV system costs $16,397 to purchase and install. Other energy-efficiency measures including the Smart Vent System, higher efficiency furnace and AC, tankless water heater, pipe insulation, fluorescent lighting, and third-party inspections added $5,640 to the cost for a total additional cost of $22,037.

Local and state incentives, including SMUD's $500 hook-up fee discount, a $200 incentive per home for ENERGY STAR lighting, and a $3/watt SMUD PV buy down of $6,126, reduced the total incremental cost to the buyer to $15,211 (not counting federal incentives).

Building America partner ConSol calculated that energy-efficiency improvements not including solar will reduce annual utility bills by $766 per year, while the increased cost of the energy-efficiency improvements will increase the annual mortgage cost by $395 (not counting solar) for a positive annual net cash flow to the consumer of $371. When solar is added into the equation, the energy savings increased an additional $233 per year and annual mortgage costs increased $700, for a net cash flow to the consumer of -$299.