

High-Performance Home Technologies: Solar Thermal & Photovoltaic Systems

Case Study: Premier Homes – Premier Gardens Sacramento, CA



A view of the 95 homes of Premier Gardens, all today's zero energy. Photo courtesy of Sacramento Municipal Utility District.

Side by Side But Energy Use Difference is a Mile Wide

Folks living in Premier Homes' all-solar Premier Gardens development in Sacramento can't stop talking about their low energy bills. And their neighbors are getting a little miffed.

Premier Homes built 95 entry-level homes in Rancho Cordova near Sacramento in 2004, across the street from 98 similar homes built by another builder. The homes are nearly identical in size and price but the Premier Homes are near zero energy homes with advanced energy-saving features and a 2.2-kW photovoltaic system on every roof. And when Premier Gardens' homeowners started moving into their homes in fall 2004, their September energy bills averaged \$20 while their neighbors were paying around \$70, according to ConSol, a U.S. Department of Energy Building America Team Partner that worked on the project.

Both developments were designed for energy efficiency but the Premier homes are drawing on average 54% less power from the grid. The difference in net savings between the two groups of homes would have been even greater but the neighboring homes were built as SMUD Advantage homes, with cooling energy usage estimated to be 30% lower than a standard California Title 24-compliant home. If the neighboring homes had been standard Title

24 homes (which are themselves more efficient than the national average), the savings difference would have been more than 60%, according to Bruce Baccei of ConSol who worked with Premier Homes and the Sacramento Municipal Utility District (SMUD) on the project.

Premier Gardens is the Sacramento area's first near zero energy home community designed to cut energy bills at least 50% and the first Premier community offering solar energy as a standard feature. Premier had offered solar as an optional upgrade on previous developments and the Roseville builder has been committed to energy-efficient construction for more than a decade.

"It is an opportunity to set ourselves apart as a small builder," said John Ralston, vice president of sales and marketing for Roseville-based Premier Homes. "The market will be wanting more energy efficiency in California as time goes on and we want to stay ahead of it."

Premier hopes to differentiate themselves from other builders in a very competitive market dominated by large corporate production home builders, according to Rob Hammon of ConSol. The development was open for sales in August 2004 and the

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Kevin Yttrup, President of Premier Homes

BUILDER PROFILE

Builder's Name:

Premier Homes
www.builtbypremier.com

Where: Roseville, CA

Founded: mid 1980s

Development:

Premier Gardens - Sacramento, CA

Size: 95 homes

Square footage: 1,285 - 2,248 sq.ft.
(3 to 6 bedrooms)

Price range: \$245,000 to \$335,000

Number of homes per year: 70-90

Solar status: First all ZEH development, have offered solar in the past



The unobtrusive integrated photovoltaic cells are placed for best solar orientation depending on the home's orientation on the lot, whether that be on the front, side or back of the house. The integrated photovoltaic cells are barely noticeable.

KEY FEATURES

2-kW GE Energy AC photovoltaic system

Tankless hot water heater and R-4 pipe insulation on all major hot water lines

An engineered heating and air conditioning system

Furnace AFUE .91; AC SEER 14

Dual-pane, vinyl frame spectrally selective glass windows, with u-factor of .33-.37 and SHGC of .32-.35

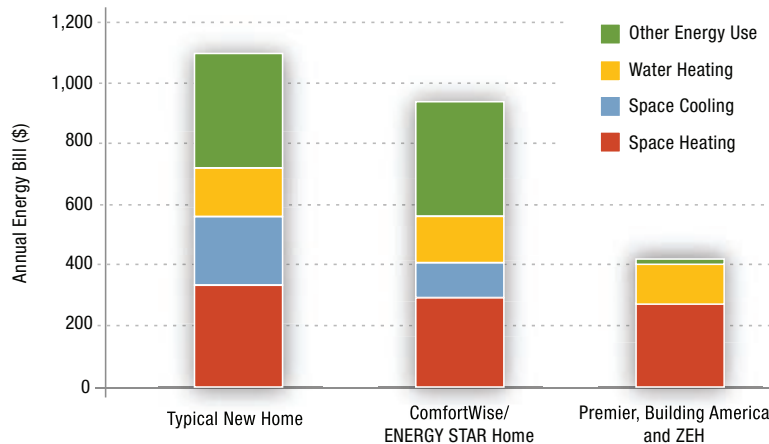
Tightly sealed air ducts buried in attic insulation, duct blaster tested

Fluorescent lighting in all permanent fixtures

Insulation R-38 in attic, R13 batt to R-19 in walls, 1" rigid foam house wrap, R4.2 duct insulation

HERS score of 90 (based on pre-July 2006 HERS system)

Annual Energy Bill Comparison



Thanks to energy savings and PV produced electricity, Premier Gardens home owners paid \$600 less per year on their energy bills than homeowners in standard construction homes and \$400 less than those in ComfortWise homes.

last home was sold in December 2005, faster than nearby subdivisions.

Premier branded Premier Gardens as a “Premier ProEnergy Community” and said it was the first Sacramento area all-solar development to offer entry-level buyers so many energy features as part of the standard package. “We are excited to bring the first standard “near zero energy” community to Sacramento and we are confident buyers will be amazed at the savings,” Kevin Yttrup, president of Premier Homes, told the media when Premier Gardens was announced. “Premier Gardens is a unique opportunity for first-time homebuyers to live in an extremely energy-efficient home that will provide them with a solid value, both now and in the years to come.”

While the builder next door made granite countertops standard, Premier chose to make the photovoltaic systems standard, along with a host of other energy-efficient features including high-efficiency furnaces and air conditioners, tankless water heaters, high-performance windows, and better insulation. Homes in both developments sold for similar prices.

All of the Premier Gardens homes meet the DOE Building America goal for today’s zero energy house with their 60% reduction in power drawn from the grid and reduced natural gas consumption. SMUD certified the homes as SMUD Solar Advantage homes, which means the homes exceed the current California Title 24 energy cooling requirements by

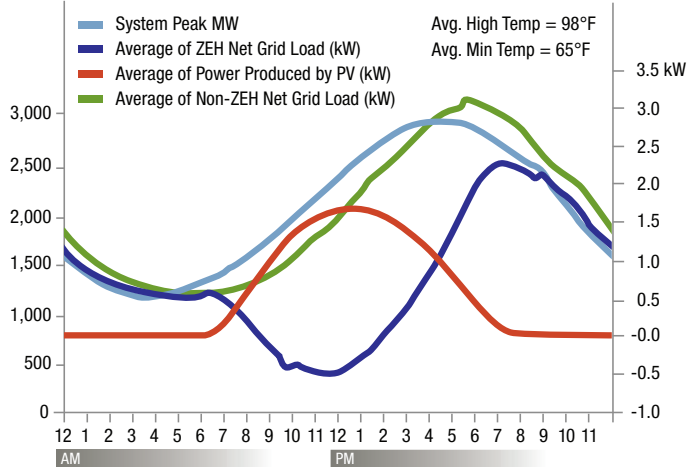
as much as 30%. In addition, the homes met state ENERGY STAR® Homes requirements.

ConSol conducted air leakage testing of the ducts and whole house through its ComfortWise program as each house was completed in Premier Gardens.

The Sacramento Municipal Utility District (SMUD) tracked the electric bills of all the homes in both developments and collected data every 15 minutes on electric consumption at 18 homes in Premier Gardens and 18 of the neighboring community. SMUD also collected PV production data every 15 minutes on the Premier Gardens homes. SMUD shared this data with ConSol, which evaluated it both for the Building America Program and to determine potential benefits to the utility. SMUD helped to subsidize the project at \$7,000 per home and provided \$20,000 in marketing support in hopes that this and future PV projects can help SMUD shave its summer afternoon load peaks.

For utilities dealing with peak load issues and for consumers who may face higher peak rates, the Premier Gardens project provides some tantalizing results. In July 2005, while Building America and SMUD were doing their research, Sacramento experienced its hottest July on record. With everyone turning on their air conditioners, the utility broke their all-time-peak demand record three days in a row. But, while the sun was high, the PV systems on the near zero energy homes cranked away and the Premier Gardens homes had peak demands that

Average 15 Minute Interval Peak Demand ZEH vs. Non-ZEH July, 2005



A look at peak demand in July shows how much lower the near zero energy home's demand is than that of nearby energy-efficient houses without PV.

were 75% lower than their neighbors. “The ability of solar to level out air conditioning-driven peak demand makes it a desirable investment for utilities and for consumers who want to help decrease the likelihood of rolling blackouts and sky-high utility prices,” said Baccei.

“Zero Energy Homes provide multiple benefits—lower energy bills for the homeowner and reduced energy demand on hot summer days when electricity is more expensive and the power grid most utilized,” said Paul Bender, SMUD manager of power production.

Solar System

The 2.2-kW photovoltaic system installed on Premier Gardens’ homes is an integrated tile PV product manufactured by GE Energy called Gecko modules. The tiles are similar in dimension to cement roof tiles and lay on the roof shingle fashion to blend with surrounding roofing. The system consists of 48 GT-55 modules and a SMA Sunny Boy 2500 inverter. SMUD supplied each home with a PV meter to record the solar electric system’s energy output; this figure appears on the homeowner’s monthly electric bill along with their electricity usage.

ConSol and SMUD reported in March 2006 that the PV systems were performing exceptionally well and consistently exceeding estimated kilowatt hour

production by 10% over the course of the first year. The homes produced about 3,330 kWh per year out of a total average of 7,007 kWh consumed per household between September 2004 and September 2005.

The systems were installed by an installation company founded by Premier Homes’ owners. Premier liked the aesthetics of the roof-integrated PV panels and found homebuyer acceptance was high. Some home builders are hesitant to install PV systems on the fronts of homes. Others believe that the visibility of PV systems can be desirable for home buyers who want to “show off” their photovoltaic systems.

Energy-Efficient Features and Innovations

“The first step in designing a near zero energy home is to significantly reduce the home’s overall energy use. This enables the home builder to install a smaller, less expensive PV system to meet the home’s electrical needs,” said Rob Hammon of ConSol.

Building America, through its team leader ConSol, provided an energy analysis to help Premier select energy-efficient measures for the five house plans featured in the community. Each home is equipped with a high-efficiency .91 AFUE furnace and a correctly sized SEER 14 air conditioner. Ducts are

Selling Solar

Some of Premier’s most dedicated solar fans are its sales staff. “I am their walking, living, breathing advertisement for solar out here,” said Sheri Gage, sales manager and owner of one of the first solar homes completed at Premier Meadows, a 65-unit Premier Homes development at Live Oak 50 miles north of Sacramento.

“I’ve been in since December 2005, and my electric bills have ranged from a high of \$70 to a low of \$1.60 per month (for a 1,990 sq ft home),” said Gage. “People have been walking into my sales office who are paying between \$250 and \$800 a month on their electric bills,” said Gage.

PG&E has raised the rates several times in the last two years. In August 2006, they announced another rate increase in September with two more likely to follow.”

To show home buyers they have a choice, Premier Homes has run a very successful campaign advertising \$30 a month bills. “We did an analysis of the Premier Gardens homes for a 9-month period in 2005. All 95 homes averaged \$30 per month,” said Don Rives, sales manager at Premier Homes Premier Gardens and now Premier Bay Drive Estates, another all solar Premier development.

tightly sealed and buried in the attic insulation for an insulation value equivalent to R-13. Each home has a tankless on-demand hot water heater so power isn't wasted keeping a 60-gallon tank of water hot 24 hours per day, 365 days per year, and all of the major hot water lines are insulated with R-4 pipe insulation.

The windows are high-performance, dual-pane, vinyl-frame spectrally selective glass windows. Fluorescent lights are installed in all of the recessed downlights and other installed light fixtures in the home. There is R-38 insulation in the attic and R-13 batt insulation in the wall cavities. In addition the outside walls are sheathed in a 1-inch layer of rigid foam insulation, which takes the place of house wrap and provides an additional insulation and water barrier. The homes have received an average Home Energy Rating Score (HERS) of 90 (based on pre-July 2006 HERS rating system).

Even without the solar, the homes used 22% less energy than homes in SMUD's service territory built to California's Title 24 standard and 13% less than the homes in the neighboring development built to SMUD Advantage home standards.

Dollars and Sense

The PV systems and the energy-efficiency features together add about \$10,000-15,000 to the cost of a home. SMUD contributed financially to the project, committing to provide Premier about \$7,000 per home toward the cost of each PV system and \$200 per home for advanced energy-efficiency features. As previously stated, Premier priced the homes so

the near zero energy homes cost no more than the neighboring homes. According to a RAND study, one of the Premier Gardens residents calculated that the homes in the two developments cost the same per square foot at the time he purchased his new home. Thus at Premier Gardens homeowners are getting "today's zero energy homes" at prices that are competitive with the much less efficient homes of their neighbors. And the project has continued to generate positive press for Premier Homes.

The Bottom Line

Premier Homes took the success of its solar-powered energy-efficient homes down the road to Roseville, where the builder has offered the same features standard at another Premier ProEnergy community, Premier Oaks. The 49 homes at Premier Oaks are slightly larger than the Premier Gardens homes (1,800 to 3,300 sq ft) and expected savings are 60%-63% above a home built to Title 24.

Premier is also offering PV as a standard feature at its 35-home Premier Bay Drive Estates in Yuba City, the first all-solar community in Yuba City, with homes up to 3,000 sq. ft. selling for \$200,000 and up.

Premier has become so convinced of the selling power of solar that in July 2006, half way through construction on its 65-home Premier Meadows development north of Sacramento, it switched from solar as an option to making solar a standard feature. "If we believe in this stuff we just have to do it," said Premier sales manager Don Rives.

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