

## High-Performance Home Technologies: Solar Thermal & Photovoltaic Systems

### Case Study: Grupe – Carsten Crossings Rocklin, CA



#### Zero Energy Sets Sacramento Area Builder Apart

In the volatile California housing market, zero energy construction has helped Stockton area home builder Grupe to stand out from the competition. “Zero energy has definitely helped us close deals,” said Mark Fischer, a senior vice president at Grupe.

Sacramento’s new home market took a nosedive with sales dropping by up to 45% between 2005 and March 2006, just when the first 10 of the 144 homes at Grupe’s Carsten Crossings project were completed. “We sold 23 of our first 30 homes in the first three months, even though the market in Sacramento is very slow right now; it is the slowest housing market in the country. Our project is doing better than most of our competitors,” said Fischer.

The cost of doing business, and a major part of profitability, is driven by the time required to sell out a community. Reducing this time by selling houses faster has a significant affect on the builder’s costs. Mark Fischer reported at a builders conference that Grupe achieved a sales rate of 4.6 home sales per month versus 1.9 for their competitors, a rate 2.5 times faster than their competition. Grupe has calculated that if only about 19% of their increased sales rate was due to energy efficiency, solar PV, and green features, the increased cost of \$2.6 million in marketing and increased materials costs paid for

them self. If the trend continues, Grupe will save a total of \$14 million.

In this first solar development for Grupe, solar was made a standard feature on all 144 houses. “We certainly like the fact that it makes us unique, and we feel good about offering it because we think solar is the right thing to do,” said Fischer. Photovoltaics are only part of the equation. Grupe anticipates that Carsten Crossings homeowners will see annual utility savings of up to 70% more than homes built to the California energy code thanks to both the photovoltaics, and an impressive mix of energy-efficient features that are being offered as standard features by Grupe.

“Making solar a standard feature instead of an optional upgrade is the way to do it,” said David Springer of Davis Energy Group, which is a partner in the U.S. Department of Energy’s Building America program. Springer worked with Grupe on the Carsten Springs Project. “That’s been our experience on previous projects. Grupe was able to negotiate a much better deal with their contractors by making it standard across the project,” said Springer.

Other builders have found that when solar is offered as an upgrade, buyers will often choose

Grupe chose to make photovoltaics a standard feature on every one of the 144 homes it is building at Carsten Crossings in Rocklin, California.

#### BUILDER PROFILE

**Builder’s Name:** Grupe

**Where:** Stockton, CA

**Founded:** 1966, 50,000 homes built as of September 2006

**Employees:** 70

**Development:**  
Carsten Crossings at Whitney Ranch in Rocklin, CA

**Size:** 144 homes

**Square footage:** 2,168-2,755 sq.ft.  
(3-5 bedroom, 3 baths)

**Price:** From \$478,000 to \$528,000

**Number of homes per year:**  
300 to 400 homes

**Solar status:**  
First zero energy development, an ENERGY STAR builder for 10 years



Grupe’s Carsten Crossing Community won the gold award for moderate climate production homes in the 2007 Energy Value Housing Award competition held by the National Association of Home Builders Research Center.



SunPower integrated solar roof tiles blend in with surrounding roof tiles to provide up to 2.4 kW of clean, quiet energy year round.



## KEY FEATURES

2.4 kW roof-mounted photovoltaic system

Tankless gas-powered hot water heaters

Energy-efficient windows

High-efficiency, variable speed furnace 90+AFUE

SmartVent automatic night ventilation cooling

“FreshVent” continuous ventilation system

Dual-zone equalizer two-zone heating and cooling system

Energy-efficient lighting

ENERGY STAR dishwasher

R49 attic insulation

Radiant barrier sheathing in attic ceiling to reduce cooling

1-inch rigid foam-wrapped building envelope

Ducts in attic covered with blown-in cellulose insulation

Wall insulation soy-based foam (option)

Homerun parallel piping manifold plumbing

Third-party duct and air sealing testing

more immediately visible options like upgraded countertops or flooring. A RAND Corporation study done for Building America partner ConSol in 2006 shows that the majority of buyers are interested in energy-efficient and green construction. But, as Bill Dakin of Davis Energy Group pointed out, it's much easier to actually sell solar when it's in the context of an all-solar community where it is included in the price of the home, than to sell the home buyer solar as a \$15,000 to \$20,000 upgrade perceived to be an extra out-of-pocket expense.

Carsten Crossings is the second largest community to meet the California Energy Commission Zero Energy New Homes initiative criteria and one of the largest all-solar communities in northern California. It is the first all-solar community for Grupe, a Stockton-based production builder producing 200 to 300 homes per year.

“The Carsten Crossings project has been a positive learning experience for Grupe” said Lew Pratsch, the DOE Project Manager for Integrated Onsite Power.

Davis Energy Group (DEG), part of Building America's Consortium for Advanced Residential Buildings (CARB) team, has helped Grupe on several aspects of the project, including selecting energy-efficiency measures, preparing bid specifications for the photovoltaic system, testing and inspections during construction, and long-term monitoring of energy use and production post construction. DEG also helped develop educational materials for staff and the public.

Zero energy construction can be a great selling tool if sales staff know how to use it. “If you are going to put it in, be prepared to train your whole organization on why it's a good deal, especially sales staff. You have to train them so that they can tell potential buyers why zero energy construction is so great,” said Fischer.

To further the learning experience, Grupe turned the garage of one of its model homes into an energy efficiency and solar show room for training sales staff and educating potential buyers. It's worked well. “Grupe's sales staff is sold on solar; they are passionate about it,” said Bill Dakin of Davis Energy Group.

To learn more about the energy savings, Davis Energy Group and Building America conducted duct blaster and blower door testing on the homes to test air leakage in the ducts and whole house during construction. Davis Energy Group also monitored energy use in one occupied house for a whole year to evaluate heating and cooling usage and energy production from the PV system.

## The Solar System

For its solar system, Grupe chose to go with SunPower (known at that time as PowerLight), a manufacturer and supplier of commercial photovoltaic systems that had recently turned to the residential market with a roof-integrated product called SunTile. Rather than sitting on top of the roof like traditional solar panels, these integrated solar tiles, which are equivalent in size to a row of five concrete roof tiles, are used in place of some of the roofing tiles or shingles,



in an overlapping pattern that blends in with the surrounding roofing materials.

“What really affects the power production of the PV cells is orientation toward the sun,” said Fischer. “We don’t limit ourselves to putting these tiles on the backs of our houses. We put tiles on the front, back, or sides of the houses, wherever they will get the most solar gain. They blend in so well with the cement tiles that buyers have no objection to seeing them. You almost can’t tell they’re there.”

SunPower also offers a complete turn-key package, including delivering and installing the tiles, 5 years of free post-installation performance monitoring, and an extensive warranty covering parts, workmanship and repairs.

“We had no difficulty at all working solar into the production schedule. The solar installation does not interfere with any other critical path in the construction process. It really doesn’t add any time for installation,” said Fischer. According to Fischer, it didn’t add time for extra inspections either. “The PV system was inspected while the city inspectors were already on site doing other inspections. That may vary by jurisdiction, but that was the case in Rocklin,” said Fischer.

Post-installation performance monitoring enables the installer to make sure each system is producing power. Homeowners can also access the information through a user-friendly website that lets them see how much power their PV system is producing on a given day, and how much greenhouse gas emissions from traditional power sources their PV system is displacing.

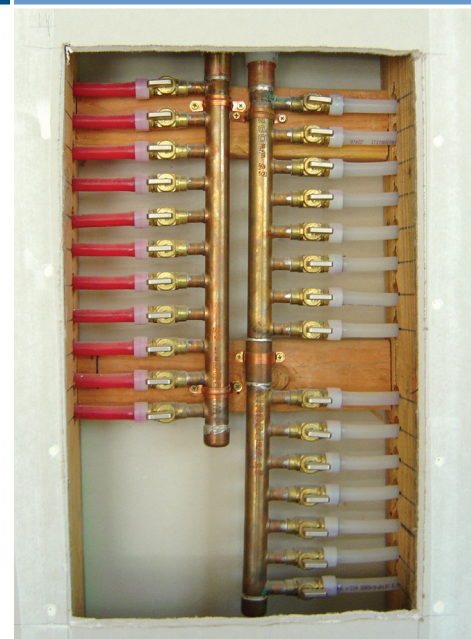
By early summer 2006, 12 California developers had announced plans to use SunPower solar tiles in communities totaling hundreds of new homes. Centex Homes is installing 3.5-kw roof tile systems on \$1 million-plus homes in its Avignon community in Pleasanton. Another developer, Lennar, plans to incorporate the solar roof tiles in 450 homes it is building in Roseville over the next two years. Victoria Homes expects to integrate solar roofs in hundreds of homes in a Victorville subdivision for first-time and middle-income buyers. In addition to these California developments, deals are expected in New Jersey, Colorado, and Arizona, which have all passed alternative-energy incentives, according to Bill Kelly, vice president of SunPower’s residential division.

## Energy Efficient, Innovative, Green

Solar photovoltaics alone will never get a home to zero energy bills. A super-efficient building envelope and high-performance appliances are key to cutting energy costs.

All of the Carsten Crossings homes feature energy-efficient low-emissivity windows, energy-efficient lighting, tankless gas-powered “on-demand” hot water heaters with a parallel piping manifold, high-efficiency variable speed 90+ AFUE furnaces, “FreshVent” continuous ventilation systems (CVS), and dual-zone equalizers.

To cut cooling costs, the homes will employ SmartVent automatic night ventilation cooling. The system uses a thermostat-controlled damper to automatically bring in cool filtered air when outdoor temperature drops at night. “Think of it as

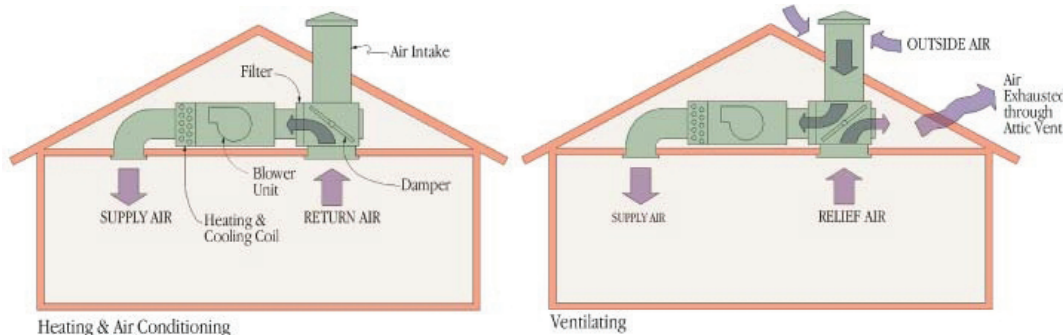


Plumbing manifold gets hot water to its destination faster.

## Solar in California - A Snap Shot

The California Energy Commission reported in 2006 that 16,684 homes and businesses have installed rooftop solar units since 1981, and California produces 130 megawatts of solar power annually. This puts California third globally in solar production after Germany and Japan according to Bernadette Del Chiaro, clean energy advocate for Santa Monica-based Environment California. Still, the state’s solar production represents just a fraction of the 33,032 megawatts that California produces on average each year. The number of installations on rooftops is a mere sliver (0.1%) of the 12.2 million homes and apartment buildings in California.

In 2005, California home builders received permits to build 154,853 new single-family homes and 53,000 new apartments and condominiums, according to the Construction Industry Research Board. But statewide, they have built only 1,500 to 1,600 new homes with solar systems already included according to the California Energy Commission.



Every home is equipped with a high-efficiency furnace and air conditioner plus the SmartVent ventilation system, which requires very little power to circulate cool night air through the home in the summer months.



(top) Grupe is marketing the zero energy homes as GrupeGreen homes. With their bundle of energy-efficiency measures, the homes meet the criteria of Building America's Zero Energy Homes, the California Energy Commission's Zero Energy New Home (ZENH) Initiative, and the ENERGY STAR homes program. Grupe is also participating in the LEED (Leadership in Energy and Environmental Design) Homes Green Building certification program.

(bottom) Using a real-time monitoring system, the solar installer can check the PV system's performance from a portable computer or Blackberry at any time.

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[www.buildingamerica.gov](http://www.buildingamerica.gov)

an intelligent whole-house fan. It provides filtered outside air to a specific set point, say 65 degrees, to cool off the house at night without having to open the windows," said Dakin. He added that DEG's year-long monitoring should show just how much cooling savings is achieved with the SmartVent system.

The attics are equipped with R-49 blown cellulose and the heating and cooling system ducts are wrapped, sealed, and buried in the attic insulation. The attic ceilings are lined with a radiant barrier to keep out heat. The 2x4" house walls are filled with blown-in fiberglass or soy-based foam insulation. In addition, all of the homes' exterior walls are blanketed with a 1-inch-thick layer of rigid foam insulation. Duct and whole house air sealing is independently confirmed through duct blaster and blower door testing conducted by Davis Energy Group.

"By using a Building America consultant like Bill Dakin, not only do we get third-party credibility," said Fisher, "we ourselves become incredibly educated about the things we can do to save energy while building sustainable and beautiful communities" (as quoted in the *San Francisco Chronicle* July 2, 2006).

"The Grupe Company has been a leader in energy efficiency," said Pratsch, who noted Grupe was among the first ENERGY STAR builders in its area to use blown-in insulation. "We hope the Carsten Crossings zero energy home project will provide a model that other builders will follow."

## Dollars and Sense

In its first foray into an all-solar development, Grupe did get a leg up from the California Public Utilities Commission. In January 2006, the Commission approved a 10-year, \$2.9 billion program to give homeowners or builders a \$7,000 per home subsidy to add solar units to their homes. (The subsidy will decrease as program volume increases).

This brings Grupe's cost for adding solar down to about \$16,000, or \$18,000 for solar plus all of the energy efficiency measures said Dakin. According to Springer, Grupe is absorbing some of the additional cost to offer the homes to buyers at competitive prices in a market that has softened recently.

In addition to the \$7,000 subsidy, homeowners get a \$2,000 federal tax credit (which goes directly to the homeowner and not to the builder or developer), providing additional benefit to the homeowner.

Utility savings can range from \$500 to \$1,300 annually. Building America plans to verify these numbers by monitoring. According to Springer, even based on a PV system cost of \$18,000 to \$20,000 for a PV system bundled with energy efficiency improvements, if that cost is included in a 30-year mortgage with a 6.5% mortgage rate, the annual utility bill savings is usually greater than the annual increase in mortgage cost. "When we compared the incremental mortgage cost to annual energy savings, we showed a positive cash flow," said Springer.

According to SunPower's vice-president Bill Kelly, PV systems add to the home's resale value. And the peace of mind they provide is even harder to calculate. Californians who still vividly recall the rolling blackouts of the early 2000's can rest easier with a clean, quiet, emissions-free power plant nestled into the roof over their heads.

## The Bottom Line

For Grupe, zero energy homes make a lot of environmental sense, but they also make sense from a business standpoint. "They have been selling better than comparable competitor's homes," said Dakin. "In fact, they are outselling the competition 2.5 to 1." The faster sales rate translates into millions of dollars of greater profits for the builder—more than enough to pay for added material and marketing costs.

Said Grupe's Fischer, "In a few years, you will see this everywhere."

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*Mark Fischer, a senior vice president at Grupe (as quoted in the San Francisco Chronicle July 2, 2006)*