



Evaluation Results for Initial Community Scale Projects

TASK ORDER

Deliverable Number 12.D.2

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Project Overview

Executive Summary

The Premier Homes community, Premier Oaks, located in Roseville, CA offers Near ZEH features standard. Premier Homes leveraged their technical and commercial success at their Premier Gardens community in nearby Rancho Cordova, CA reaching new levels of efficiency. As modeled, these homes are predicted to save more than 60% whole house energy use compared to a basecase employing the Building America Program's (BAP) benchmark.

Like Premier Gardens, what makes Premier Oaks unique is the gathering of real electricity use by each of the forty-five homes built at Premier Oaks. Roseville Electric is a small non-profit electricity provider that has committed to energy efficiency and solar power. Roseville supports this project by providing Premier Homes with substantial rebates for Near ZEH features and BIRA with electricity data. Roseville Electric also provides marketing support to this Near ZEH project.

The Near ZEH features for all plans cost between \$13,890 and \$14,355 after all rebates and inspections. When compared to the energy bill savings afforded by these features, all Premier Oaks' homes are cost-effective and provide positive monthly cash flows for homeowners. The cash flows were considerably better for the larger homes.

Much of the analysis was concentrated on individual plans. The variability between home plans was not as divergent as the difference intra-plan. For instance, the exact same home occupied by different families across 12 months used 156 kWh and 12,748 kWh each. Although there was some correlation between size and electricity use, a larger sample is needed to normalize human behavior.

Premier Oaks' homes were compared to the existing Premier Gardens' homes and found to use less energy per square foot, but more overall due to larger size homes. BIRA's expectations of energy savings appear to be within an average of 10% of actual electricity consumption. However, more data will need to be evaluated to determine modeling accuracies.

The Premier Oaks community is another success for Premier Homes with high customer satisfaction and energy savings. In fact, the current Mayor of Roseville lives in a Premier Oaks' home, and would recommend it to any new homebuyer.

Task 12.D.2 Evaluation Results for Initial Community Scale Project

Introduction

Due to the energy bill reductions, marketing success, and customer satisfaction generated at Premier Garden's Near ZEHs, in 2004 and 2005 Premier Homes has again partnered with the Building Industry Research Alliance (BIRA) on the Roseville, CA area community, Premier Oaks. The Premier Oaks community of 45 homes range in size from 1,787 up to 3,322 square feet. These homes incorporate energy efficient features, Energy Star appliances, and building integrated 2.4kW DC photovoltaic (PV) systems. As modeled, the Premier Oak's homes exceed 60% whole house energy savings employing the BAP benchmark.

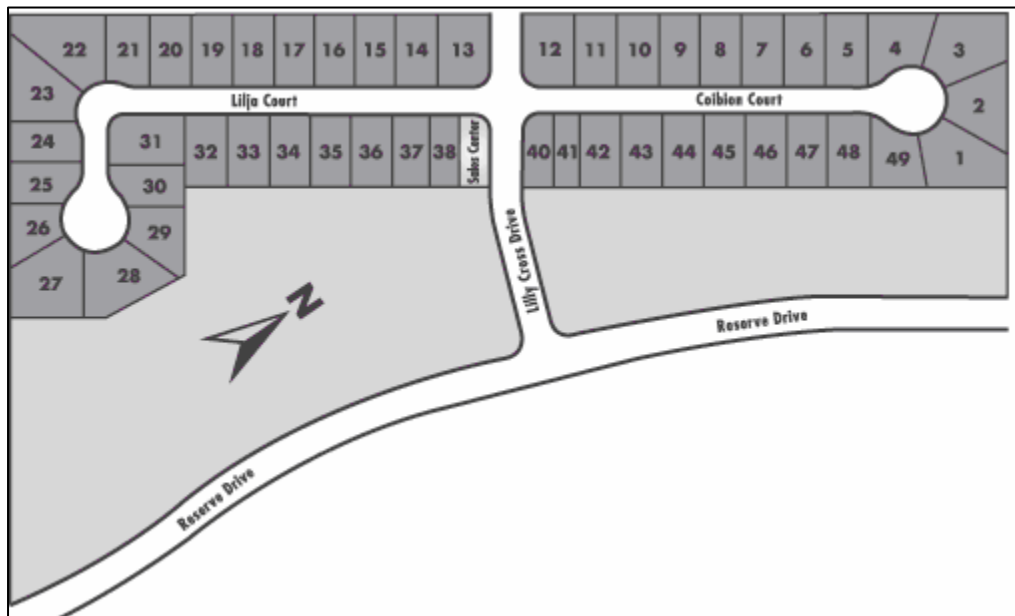


Figure 1- Premier Oaks Plot Map

Purpose

BIRA evaluated the results of the Premier Oaks community in order to learn as much as possible from this Near ZEH community and to accelerate the adoption of future Near ZEH community scale projects. Comparisons of the energy performance in these production homes are analyzed. The two models #1 & 5A are compared to base cases (referred to as the Base Case House) utilizing the BAP benchmark. Additionally, BIRA investigates the costs and benefits of each alternative approach as compared to those of the Base Case Houses.



Figure 2- Premier Oaks Home October 2006

Premier Homes

Premier Homes is an innovative homebuilder leading the Sacramento area in Near ZEH communities. Premier's Near ZEH, branded as a Premier ProEnergy home, includes Near ZEH features standard, incorporated ComfortWise¹ design, earned the ENERGY STAR² seal, and is certified as a Sacramento Municipal Utility District (SMUD) Solar Advantage Home.³

The first Premier ProEnergy development built was Premier Gardens located in nearby Rancho Cordova, CA. Premier Gardens was built on the same piece of land as another more standard development built by Cresleigh Rosewood. Each community contains slightly less than 100 homes, and the homes are similar in size. Given the large sample of near Zero Energy Homes and control homes combined with the amount of data collected, Premier Gardens and Cresleigh Rosewood offer a unique opportunity to evaluate the large scale impacts of Near Zero Energy Homes. Sacramento Municipal Utility District (SMUD) became an important participant in this project advocating and supporting this project from its inception and by monitoring electric data from both developments. The Premier Gardens and Cresleigh Rosewood homes will be used for comparison to the Premier Oaks' homes.

¹ Designed by ConSol, ComfortWise homes are designed and built for comfort and energy efficiency. Inspected for quality, performance, and energy features

² Energy Star Homes, a national Environmental Protection Agency, works with individual home builders and partners to construct homes that are 15% more energy efficient than Title 24.

³ Solar Advantage homes exceed Title 24 cooling requirements by 50% and feature state-of-the-art solar electric PV systems.

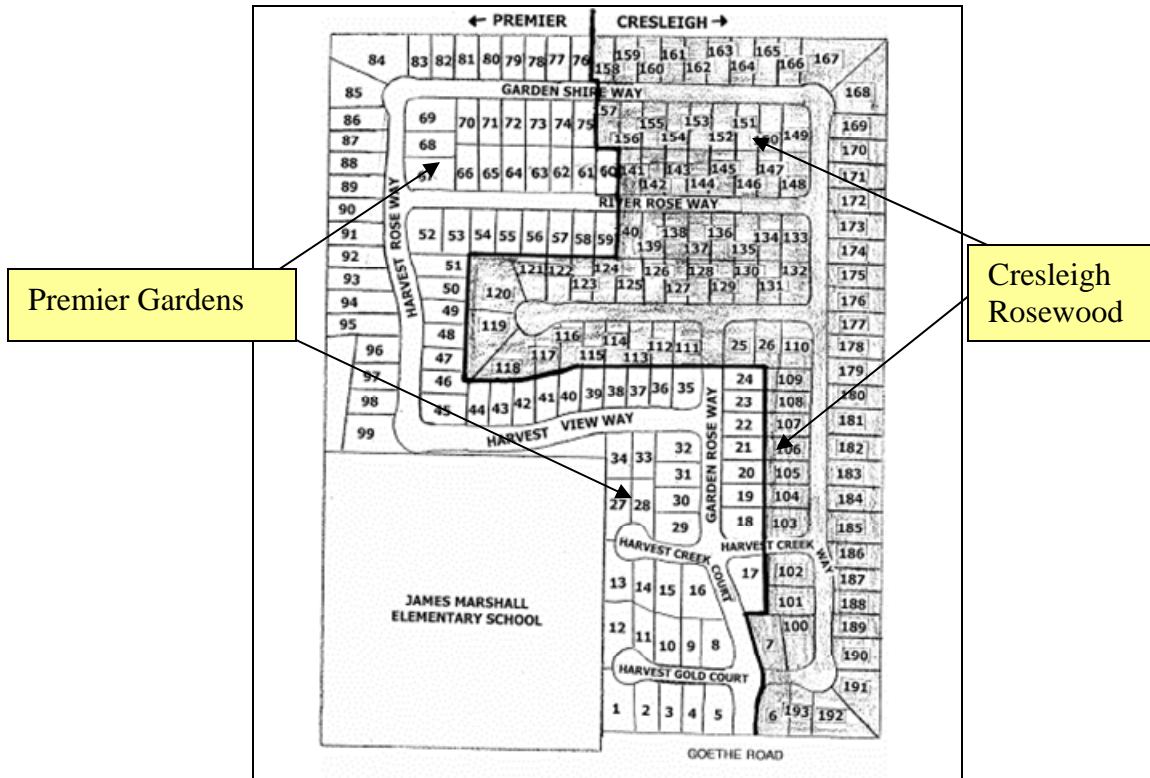


Figure 3- Premier Gardens and Cresleigh Rosewood Side-By-Side

Roseville Electric

Roseville Electric is a non-profit municipal utility providing its customers with the lowest rates in the region along with reliable energy and dependable service. Roseville Electric serves 41,883 residential and 5,410 commercial customers in the City of Roseville located in Placer County on the northeast side of Sacramento.

Roseville Electric is an advocate for energy efficiency aiming to reduce peak demand, maintain low rates, and maintain a high level of reliability. Currently Roseville Electric's residential new construction program includes two performance levels: Preferred Home and Preferred Home Diamond. These programs share the same energy efficient measures, but Diamond homes have electric solar generation, subsidized up to 2.5 kW.

Roseville is currently working to replace the Preferred Home label with the BEST Home program upon approval by the City Council in February 2007. This new program will include city wide participation.

The rebates for these programs include \$500 for energy efficient measures and a buy-down for PV generation of \$4 per watt, compared to \$3 for SMUD and \$2.60 for the California Energy Commission (CEC).

Roseville Electric is currently monitoring electric consumption for Premier Oaks, providing electric data for BIRA’s analysis.



Figure 4- Map of Sacramento, Rosewood, and Rancho Cordova

Mayor of Roseville

Rocky Rockholm, the Mayor of Roseville, is currently living in a Premier Oaks home.⁴ While shopping for a new home, he visited Premier Oaks’ model home, and the more he visited, the more he liked it. Rocky values the tankless water heater, the PV panels that generate power when he’s away, the comfort and quickness of the HVAC system, and the monthly energy bill savings. Rocky likes the Near ZEH concept saying, “The overall package was great.” When asked if he would recommend a Near ZEH to a new homebuyer Rocky replied, “Absolutely.”

⁴ Personal Interview by BIRA Associate Vicky Pang, November 21, 2006.

Analysis Tools

When performing energy analysis, energy use is broken down into different categories. The categories are:

- Heating
- Cooling
- Water Heating
- Lighting
- Other Uses/Appliances/Plug Loads

The heating, cooling, and water heating energy analyses was performed using CEC and BESTEST-certified Micropas⁵ energy analysis software for building code compliance. Lighting and other uses/appliances/plug loads are calculated using the BAP Benchmark assumptions.

To most simply display the varying sized homes in Premier Oaks, the smallest and largest plans were chosen for comparison. Plans 1 and 5A represent the smallest and largest homes in Premier Oaks and both are covered in detail below.



Figure 5- The Claret, Plan 1 (1,787 Sq. Ft.)



Figure 6- The Montelena, Plan 5A (3,322 Sq. Ft.)

⁵ Micropas is a product of Enercomp, Inc.

House Specifications

Plan 1 Base Case House Characteristics

The base case house utilizes the latest BAP Benchmark and has the following characteristics:

1. Ceiling R-30 insulation with U-value = 0.036
2. 2x4 construction frame wall R-13 with U-value = 0.076
3. R-4 Slab Edge Insulation
4. Specific Leakage Area (SLA) = 5.7
5. Fenestration and opaque door U-value = 0.62 and SHGC = 0.65
6. HVAC: 78% AFUE heating and 10.0 SEER cooling
7. Duct Insulation = R-3.3
8. One 40 gallon gas water heater with Energy Factor (EF) = 0.54, Recovery Factor = 0.82, and 36,000 Btu/hr
9. Annual Lighting is calculated using the formula based on Navigant 2002 used in Building America's benchmark.

Hard-Wired Lighting:

$$\text{TotalAnnualLightingUse(HardWired)} = 0.8 * (\text{FinishFloorArea} * 0.8 + 455) \text{kWh} / \text{yr} \\ + \text{GarageLighting} = 100 \text{kWh} / \text{yr} + \text{ExteriorLighting} = 250 \text{kWh} / \text{yr}$$

$$0.8 * [1,787 \text{sq. ft.} * 0.8 + 455] \text{kWh} / \text{yr} + 100 \text{kWh} / \text{yr} + 250 \text{kWh} / \text{yr} = 1,858 \text{kWh} / \text{yr}$$

Plug-In Lighting:

$$\text{TotalAnnualLightingUse(PlugInLighting)} = 0.2 * (\text{FinishFloorArea} * 0.8 + 455) \text{kWh} / \text{yr}$$

$$0.2 * [1,787 \text{sq. ft.} * 0.8 + 455] \text{kWh} / \text{yr} = 377 \text{kWh} / \text{yr}$$

Total Yearly Lighting:

$$\text{TotalAnnualLightingUse} = \text{HardWiredLighting} + \text{PlugInLighting}$$

$$1,858 \text{kWh} / \text{yr} + 377 \text{kWh} / \text{yr} = 2,235 \text{kWh} / \text{yr}$$

Plan 1, Prototype House Characteristics (1,787 Sq Ft)

The Prototype House has the following advanced systems:

1. R-38 attic insulation with U-value = 0.031
2. R-13 fiberglass batts + 1" Expanded Polystyrene (EPS) foam with U-value = 0.068
3. Low air infiltration rate, 3.1 SLA (ComfortWise inspection/ testing by ConSol HERS raters)
4. Dual Pane non-metal frame windows with spectrally selective glass, U-value = 0.36 and Solar Heat Gain Coefficient (SHGC) = 0.30
5. Engineered System with Heating Ventilating and Air Conditioning (HVAC) efficiencies of: 91% AFUE for furnace/ 14 SEER for AC with thermal expansion valve (TXV)
6. R-4.2 buried in insulation with tight ducts
7. Radiant Barrier in attic
8. Tankless water heater with a Energy Factor (EF) = 0.82
9. All Fluorescent Lighting
10. 2.4 kW Photovoltaic System (PV)



Figure 7- Integrated 2.4 kW PV at Premier Oaks

Plan 5A Base Case House Characteristics

The base case house represents the latest BAP Benchmark and has the following characteristics:

1. Ceiling R-30 insulation with U-value = 0.036
2. 2x4 construction frame wall R-13 with U-value = 0.076
3. R-4 Slab Edge Insulation
4. Specific Leakage Area (SLA) = 5.7
5. Fenestration and opaque door U-value = 0.62 and SHGC = 0.65
6. HVAC: 78% AFUE heating and 10.0 SEER cooling
7. Duct Insulation = R-3.3
8. One 40 gallon gas water heater with Energy Factor (EF) = 0.54, Recovery Factor = 0.82, and 36,000 Btu/hr
9. Annual Lighting is calculated using the formula based on Navigant 2002 used in Building America's benchmark.

Hard-Wired Lighting:

$$\boxed{\text{TotalAnnualLightingUse(HardWired)} = 0.8 * (\text{FinishFloorArea} * 0.8 + 455)\text{kWh} / \text{yr} \\ + \text{GarageLighting} = 100\text{kWh} / \text{yr} + \text{ExteriorLighting} = 250\text{kWh} / \text{yr}}$$

$$0.8 * [3,322\text{sq.ft.} * 0.8 + 455]\text{kwh} / \text{yr} + 100\text{kWh} / \text{yr} + 250\text{kWh} / \text{yr} = 2,840\text{kWh} / \text{yr}$$

Plug-In Lighting:

$$\boxed{\text{TotalAnnualLightingUse(PlugInLighting)} = 0.2 * (\text{FinishFloorArea} * 0.8 + 455)\text{kWh} / \text{yr}}$$

$$0.2 * [3,322\text{sq.ft.} * 0.8 + 455]\text{kwh} / \text{yr} = 623\text{kWh} / \text{yr}$$

Total Yearly Lighting:

$$\boxed{\text{TotalAnnualLightingUse} = \text{HardWiredLighting} + \text{PlugInLighting}}$$

$$2,840\text{kwh} / \text{yr} + 623\text{kWh} / \text{yr} = 3,463\text{kWh} / \text{yr}$$

Plan 5A, Prototype House Characteristics (3,322 Sq Ft)

The Prototype House has the following advanced systems:

1. R-38 attic insulation with U-value = 0.031
2. R-13 fiberglass batts + 1" Expanded Polystyrene (EPS) foam with U-value = 0.068
3. Low air infiltration rate, 3.1 SLA (ComfortWise inspection/ testing by ConSol HERS raters)
4. Dual Pane non-metal frame windows with spectrally selective glass, U-value = 0.36 and Solar Heat Gain Coefficient (SHGC) = 0.30
5. Engineered System with Heating Ventilating and Air Conditioning (HVAC) efficiencies of: 91% AFUE for furnace/ 14 SEER for AC with thermal expansion valve (TXV)
6. R-4.2 buried in insulation with tight ducts
7. Radiant Barrier in attic
8. Tankless water heater with a Energy Factor (EF) = 0.82
9. All Fluorescent Lighting
10. 2.4 kW Photovoltaic System (PV)

Evaluation of Advanced Systems

There are several reasons why Premier Homes has been able to successfully integrate advanced systems and features into the Premier Oaks' homes. First, Premier Homes had the previous experience of building and marketing 95 Near ZEHs at Premier Gardens in nearby Rancho Cordova. Many of the features across these communities are similar and Premier was able to leverage their experience with better and faster installations. Second, Premier Homes again used ConSol's ComfortWise program which includes an engineered HVAC system, and 3rd party inspections. Third, all the features included are available in the marketplace and have been used on previous projects. And fourth, Premier Homes owns a solar installation company that installed the PV systems.

Although the homes at Premier Oaks are built to Building America's high standards, given their experience, the ComfortWise program, the California marketplace, and Premier's solar installers the project moved along similar to a standard development.

1. **R-38 attic insulation with U-value = 0.031**

Higher insulation levels reduce heat gain in summer and reduce heat loss in winter.

2. **R-13 fiberglass batts + 1" Expanded Polystyrene (EPS) foam with U-value = 0.068**

This U-value reflects 23% framing factor.

3. **A low air infiltration rate, 3.1 SLA**

The 3.1 SLA compared to the 5.7 SLA in the Base Case House provides a lower infiltration of unconditioned air. It also provides lower exfiltration of the conditioned air which makes the home more efficient because less conditioning of the home is necessary.

4. **Dual Pane non-metal frame windows with spectrally selective glass, U-value = 0.36 and Solar Heat Gain Coefficient (SHGC) = 0.30**

Spectrally selective glass allows visible sunlight in while blocking out both infrared and ultraviolet solar energy in the summer. In the winter the spectrally selective glass reflects room-side radiant heat back into the room, which reduces heating cost. This type of glazing generally will enable builders to decrease the size of air conditioners and decrease other building energy related features.

5. **Radiant Barrier in Attic**

A radiant barrier helps to reduce heating and cooling loads by reducing summer heat gain and winter heat loss. Located in the attic, on the underside of the roof decking, the radiant barrier consists of highly reflective material that reflects radiant heat rather than absorbing it. With ducts and the air handler in the attic, it is important to keep the attic as cool as possible in the summer. A radiant barrier can reduce attic temperatures by as much as 35%.

6. **Engineered System with Heating Ventilating and Air Conditioning (HVAC) efficiencies of: 91% AFUE for furnace/ 14 SEER for AC with thermal expansion valve (TXV)**

HVAC systems are sized and selected by licensed mechanical engineers. This ensures properly sized HVAC systems with correct duct size and placement of registers. This also assures that the conditioned air will be distributed evenly throughout the house. Not only will it provide improved efficiency, but also improved comfort. The TXV is a metering device for refrigerant flow into the evaporator of an air conditioner, the TXV improves efficiency.

7. **R-4.2 insulated tight ducts buried in insulation**

A tight duct system does not leak more than 6% of the fan airflow. Excessive air leakages in duct systems make HVAC systems work harder, using more time and energy to cool or heat the home due to insufficient air delivery. This results in higher energy bills and less comfort for homeowners/occupants, which often triggers callbacks. Duct leakage typically occurs at:

- Poorly fitted and improperly sealed joints and seams in the ductwork
- Disconnected and partially disconnected boot connections
- Holes in the ducts
- Use of improperly sealed building cavities for supply and return ducts
- Poor connections between room registers and register boots
- Poorly fitted air handler doors, filter doors and air handler cabinets

Tight duct systems increase forced air distribution efficiency, resulting in improved comfort and lower utility bills for homeowners. Duct leakage is tested by licensed inspectors.

8. **Tankless water heater with an Energy Factor (EF) = 0.82**

The tankless water heater provides heated water upon demand and saves room by eliminating the storage tank. A tankless water heater is highly efficient with an 82% Energy Factor compared to the standard water heater in the base case, which is assumed to have an Energy Factor of 54%.

9. All Fluorescent Lighting

The wide varieties of improved quality, more efficient lighting that are market ready today warrant more careful lighting design. Lighting plans are recommended and fluorescent lamps used wherever possible. Where possible, use bayonet-mounted fluorescent in compact-fluorescent fixtures. Where this is not possible, medium-base CFLs are permitted. Minimum recommended downlight specifications of fluorescent lamps should be 2700K in cooler temperature, 23-26 watts, and 1300 lumens (used 26 watts). Vanity lighting requirements may vary.

10. 2.4 kW Photovoltaic System

2.4 kW DC system produces on average 3,420 kWh/year as estimated by PVWATTS⁶. The building integrated PV (BIPV) system not only produces electricity, but is aesthetically pleasing by blending in with the roof tiles.



Figure 8- Solar Roofs at Premier Oaks

⁶ Developed by researchers at the National Renewable Energy Laboratory to permit quick performance estimates for grid-connected PV systems by location. Can be found at http://rredc.nrel.gov/solar/codes_algs/PVWATTS/version1/

Results of Energy Performance

The following tables provide a summary comparison of the home specifications, energy use, and energy savings for each Prototype House as compared to the Base Case House. These values are all estimated using the models and assumptions discussed earlier.

Summary Comparison of House Specifications and Energy Savings, Plan 1

	Features	Base Case – Plan 1	Prototype House - Plan 1
	Degree of Energy Savings	BAP Benchmark	64% Energy Savings
1	Attic Insulation	R-30	R-38
2	Wall Insulation	0.076 U-value	R-13+EPS (U-value = 0.068)
3	Low Air Infiltration	5.7 SLA	3.1 SLA
4	Glazing	0.62 U-value / 0.65 SHGC	U- value = 0.36 SHGC = 0.33
5	HVAC Efficiencies	78% AFUE// 10.0 SEER	91% AFUE / 14.0 TXV SEER
6	Duct Insulation / Location	R-3.3 in Attic	R-4.2 in attic buried in insulation
7	Water Heater	40 Gal/36,000 Btu/hr w/ EF=0.54, R-12 external wrap	1 Tankless w/ an EF = 0.82 and R-4 pipe insulation on all major trunks
8	Lighting Usage	2,235 kWh/yr	1,148 kWh/yr
9	Dryer	Electric	Gas
10	Slab Edge Insulation	R-4	None
11	Radiant Barrier	None	Yes
	Total Energy Use Estimates	175,596 kBtu/yr	63,505 kBtu/yr

Table 1- Comparison of Energy Use, Plan 1

For Plan 1, the Prototype House consumes 63,505 kBtu/yr compared to 175,596 kBtu/yr for the Base Case House. The total overall energy savings are:

$$[(175,596 \text{ kBtu} / \text{ yr} - 63,505 \text{ kBtu} / \text{ yr}) / 175,596 \text{ kBtu} / \text{ yr}] * 100 = 64\% \text{ Energy Savings}$$

Summary Comparison of House Specifications and Energy Savings, Plan 5A

	Features	Base Case – Plan 5A	Prototype House – Plan 5A
	Degree of Energy Savings	BAP Benchmark	61% Energy Savings
1	Attic Insulation	R-30	R-38
2	Wall Insulation	0.076 U-value	R-13+EPS (U-value = 0.068)
3	Low Air Infiltration	5.7 SLA	3.1 SLA
4	Glazing	0.62 U-value / 0.65 SHGC	U- value = 0.36 SHGC = 0.33
5	HVAC Efficiencies	78% AFUE// 10.0 SEER	91% AFUE / 14.0 TXV SEER
6	Duct Insulation / Location	R-3.3 in Attic	R-4.2 in attic buried in insulation
7	Water Heater	40 Gal/36,000 Btu/hr w/ EF=0.54, R-12 external wrap	1 Tankless w/ an EF = 0.82 and R-4 pipe insulation on all major trunks
8	Lighting Usage	3,463 kWh/yr	1,668 kWh/yr
9	Dryer	Electric	Gas
10	Slab Edge Insulation	R-4	None
11	Radiant Barrier	None	Yes
	Total Energy Use Estimates	341,355 kBtu/yr	134,426 kBtu/yr

Table 2- Comparison of Energy Use, Plan 5A

For Plan 5A, the Prototype House consumes 134,426 kBtu/yr compared to 341,355 kBtu/yr for the Base Case House. The total overall energy savings are:

$$[(341,355 \text{ kBtu} / \text{yr} - 134,426 \text{ kBtu} / \text{yr}) / 341,355 \text{ kBtu} / \text{yr}] * 100 = 61\% \text{ Energy Savings}$$

Plan 1 Energy Usage	Base Case House	Prototype House
	kBtu/yr	kBtu/yr
Heating (from Micropas simulation)	31,755	16,851
Cooling (from Micropas simulation)	49,375	11,705
Water Heating (from Micropas simulation)	25,411	15,814
Lighting	22,884	11,754
Other Uses/Appliances/Plug Loads	<u>46,171</u>	42,398
Site Generation (2.4 kW DC PV System)		<u>-35,017</u>
Total	175,596	63,505

Table 3- Energy Use of Plan 1

Plan 5A Energy Usage	Base Case House	Prototype House
	kBtu/yr	kBtu/yr
Heating (from Micropas simulation)	97,102	50,494
Cooling (from Micropas simulation)	108,563	17,573
Water Heating (from Micropas simulation)	29,034	18,404
Lighting	35,458	17,079
Other Uses/Appliances/Plug Loads	<u>71,198</u>	65,893
Site Generation (2.4 kW DC PV System)		<u>-35,017</u>
Total	341,355	134,426

Table 4- Energy Use of Plan 5A

The percentage energy savings are greater for the smaller home because the PV energy offsets a larger percentage of the electricity consumption. Therefore, the overall energy savings are greater on a percentage basis.

Incremental Builder Cost

The following tables provide summary comparisons of the house specifications and incremental costs for the Prototype House as compared to the Base Case House.

Incremental Builder Cost of Plan 1

	Features / Source Used	Base Case – Plan 1	Prototype House - Plan 1	Incremental Cost
	Degree of Energy Savings	BAP Benchmark	64% Energy Savings	Plan 1 – Prototype House
1	Attic Insulation (Insulation Contractor)	R-30	R-38	\$286.00
2	Wall Insulation (Insulation Contractor)	0.076 U-value (R-13) 3-Coat Stucco System	R-13+EPS (R-4.2), 1-Coat Stucco System (U-value = 0.068)	\$300/home per Premier Homes
3	Furnace (Mechanical Contractor)	78% AFUE (Efficiency)	91% AFUE	\$500/unit
4	A/C (Mechanical Contractor)	10.0 SEER (Efficiency)	14.0 TXV SEER	\$600 (A/C) + \$95 (TXV) Total = \$695.00
5	Water Heater (Rinnai Corporation)	40 Gal/36,000 Btu/hr w/ EF=0.54, R-12 external wrap	1 Tankless w/ an EF = 0. 82 and R-4 pipe insulation on all major trunks	\$750.00 (Tankless WH) + \$75 (Pipe Insulation) Total = \$825.00
6	Lighting Usage (Lighting Contractor)	Incandescent	Fluorescent	\$350.00
7	PV System with Roseville \$4.00/Watt rebate (GE Energy) \$600/house Roseville EE rebate	None	2.4 kW DC System	\$7,515.00
8	PV Installation (GE Energy)	None	2.4 kW DC System	\$3,000.00
9	ComfortWise Inspections / Testing (ConSol)	None	Yes (rough and final inspections, air flow test & blower door test)	\$440.00
10	Gas Dryer Stub (Mechanical Contractor)	None	Yes	\$75.00
11	Radiant Barrier	None	Yes (Attic)	\$504
	Total			\$13,890.00

Table 5 – Incremental Cost, Plan 1

Enhancing the home's features to reach 64% energy savings costs an additional \$13,890.

In Roseville the price of gas is approximately \$1.15/therm and the price of electricity is approximately \$0.085/kWh. Gas is provided through Pacific Gas & Electric (PG&E), and the price per therm changes each month. The rate of \$1.15/therm is the non-weighted average monthly price for 2006. This rate is conservative as it weighs each month's rate equally, but in high use months, such as January, the rates are higher. The electric rate is conservative as well. Roseville Electric has a tiered-rate, penalizing high use. \$.085/kWh is close to the price for tier-one use.

The projected annual energy bill for this Base Case House is \$1,657.52. The Prototype House's expected annual bill is \$643.19, for an annual savings of \$1,014.33.

The below table displays a cash flow analysis comparing the mortgaged incremental cost to build Near ZEH versus the monthly energy bill savings derived from Near ZEH features.

Plan 1 Cash Flow Analysis	
	Monthly Impact
\$13,890 mortgaged for 30 years @ 6%	(\$83.28)
Energy Bill savings from ZEH features	<u>\$84.53</u>
Cash Flow	\$1.25
The monthly incremental cost for ZEH features are off set by the energy bill savings, creating a positive monthly cash flow	

Table 6 – Cash Flow, Plan 1

As seen, when the incremental cost of \$13,890 is mortgaged for 30 years at 6%, the monthly payment of \$83.28 is less than the monthly energy bill savings. This creates a positive cash flow of \$1.25 every month.

Incremental Builder Cost of Plan 5A

	Features / Source Used	Base Case – Plan 5	Prototype House - Plan 5A	Incremental Cost
	Degree of Energy Savings	BAP Benchmark	61% Energy Savings	Plan 5A – Prototype House
1	Attic Insulation (Insulation Contractor)	R-30	R-38	\$359.00
2	Wall Insulation (Insulation Contractor)	0.076 U-value (R-13) 3-Coat Stucco System	R-13+EPS (R-4.2), 1-Coat Stucco System (U-value = 0.068)	\$300/home per Premier Homes
3	Floor Above Garage Insulation (Insulation Contractor)	R-19	R-30	\$136.00
4	Furnace (Mechanical Contractor)	78% AFUE (Efficiency)	91% AFUE	\$500/unit
5	A/C (Mechanical Contractor)	10.0 SEER (Efficiency)	14.0 TXV SEER	\$600 (A/C) + \$95 (TXV) Total = \$695.00
6	Water Heater (Rinnai Corporation)	40 Gal/36,000 Btu/hr w/ EF=0.54, R-12 external wrap	1 Tankless w/ an EF = 0. 82 and R-4 pipe insulation on all major trunks	\$750.00 (Tankless WH) + \$75 (Pipe Insulation) Total = \$825.00
7	Lighting Usage (Lighting Contractor)	Incandescent	Fluorescent	\$350.00
8	PV System with Roseville \$4.00/watt rebate (GE Energy) \$600/house Roseville EE rebate	None None	2.4 kW DC System Yes	\$7,515.00 -\$600.00
9	PV Installation (GE Energy)	None	2.4 kW DC System	\$3,000.00
10	ComfortWise Inspections / Testing (ConSol)	None	Yes (rough and final inspections, air flow test & blower door test)	\$440.00
11	Gas Dryer Stub (Mechanical Contractor)	None	Yes	\$75.00
12	Radiant Barrier	None	Yes (Attic)	\$760
	Total			\$14,355.00

Table 7– Incremental Cost, Plan 5A

Enhancing the building features to make the home reach 61% energy savings cost \$14,355.

In Roseville, the price of gas/therm is approximately \$1.15 and the price of electricity/kWh is approximately \$0.085. The projected utility bill per year for the Base Case House is \$3,262.49. For the Prototype House, the annual bill is estimated to be \$1,353.59, a savings of \$1,908.90 annually.

The below table contains a cash flow analysis comparing the mortgaged incremental cost to build Near ZEH versus the monthly energy bill savings derived from Near ZEH features.

Plan 5a Cash Flow Analysis	
	Monthly Impact
\$14,355 mortgaged for 30 years @ 6%	(\$86.07)
Energy Bill savings from ZEH features	<u>\$159.08</u>
Cash Flow	\$73.01
The monthly incremental cost for ZEH features are off set by the energy bill savings, creating a positive monthly cash flow	

Table 8 – Cash Flow, Plan 5A

As seen, when the incremental cost of \$14,355 is mortgaged for 30 years at 6%, the monthly payment of \$86.07 is less than the monthly energy bill savings. This creates a positive cash flow of \$73.01 each month.

Analysis of Cash Flows

Although interesting and important for Building America, this analysis is not something that many home owners care to calculate, nor do they have the information need to conduct this cash flow analysis. Premier Homes along with the majority of other builders constructing Near ZEHs integrate the cost for Near ZEH features into the home. Instead of offering Near ZEH features as an option Premier sells their homes at competitive prices per square foot including all of the energy efficiency features and PV systems. Instead of profiting on Near ZEH as an option, Premier uses it as a marketing tool for the entire home and development. Therefore, the homeowner does not know or directly pay for the features. However, for BA and BIRA the monthly cash flow is an important metric to understand what level of energy savings above the benchmark is logical and cost effective.

An interesting conclusion from the cash flow analysis is the level of savings achieved by Plan 5A homes. Their monthly cash flows were much higher, where Plan 1 homes saw a positive \$1.25 each month, Plan 5A owners saw a more substantial \$73.01 a month. This makes the home more affordable. The explanation for this is that many of the Near ZEH

features had similar costs across both plans, regardless of square footage, therefore the cost per square foot is higher for the smaller homes for those energy features. Other features that are based on square footage, such as the radiant barrier, had little impact on the overall cost of the Near ZEH system. Therefore, in some ways it is more affordable to build a large Near ZEH, rather than a small one. This is somewhat counter intuitive because the overall energy use is greater in the larger home. As the absolute dollar monthly savings are greater for larger homes, perhaps that money could go toward further EE and solar energy generation bringing the energy use of the larger homes closer to the smaller homes.

It is also important to consider the non-financial impacts of Near ZEH features such as indoor air quality, comfort, piece-of-mind, durability, and environmental stewardship. These benefits are more difficult to quantify, thus were not included in the economic monthly cash flow analysis. However, these are marketable benefits for builders and have value for many homeowners.

Actual Data Analysis

This is the first opportunity that BIRA has to compare the analytical data for Premier Oaks with actual data provided by various utilities. Roseville Electric provided electric data for Premier Oaks. SMUD and PG&E provided data for Premier Gardens and Cresleigh Rosewood. The use of data from Premier Gardens and Cresleigh Rosewood provides a means of comparison.

The data received from Roseville Electric provides electric energy consumption from January 2005 to August 2006 for each of the 45 homes. The data is not complete as homeowners moved into the homes at different times. This posed a problem for BIRA. BIRA decided to use only the homes with 50% or more months of occupied electric use data, which amounted to 38 homes. The floor plans are distributed as follows:

- Plan 1 (1,787 sq. ft.), three homes
- Plan 1A (1,990 sq. ft.), five homes
- Plan 2 (2,258 sq. ft.), eleven homes
- Plan 3 (2,549 sq. ft.), seven homes
- Plan 4 (2,817 sq. ft.), eleven homes
- Plan 5 (3,049 sq. ft.), three homes
- Plan 5A (3,322 sq. ft.), five homes

The following analysis uses electric data from September 2005 to August 2006 (12 months).

The following chart contains actual electric data for four homes. This chart represents the variation of the current electric data between homes. Two-sets of two homes with the same square footage consumed vastly different amounts of electricity. For example, for the 2,549 sq. ft. plan, Home 1 uses -247 kWh in July whereas Home 2 uses 1,579 kWh, 639% higher than Home 1.

	Home 1 (2,549 sq. ft.)	Home 2 (2,549 sq. ft.)	Home 3 (2,817 sq. ft.)	Home 4 (2,817 sq. ft.)
January	270	1,241	273	686
February	117	723	229	414
March	140	923	173	293
April	409	262	188	436
May	(144)	925	120	999
June	(251)	1,195	92	1,643
July	(247)	1,579	288	2,192
August	(47)	1,421	359	2,010
September	(153)	1,425	34	1,624
October	(184)	952	113	792
November	28	949	203	568
December	218	1,153	465	918
Total	156	12,748	2,537	12,575

Table 9–Varied Electric Data of Premier Oaks Development

The following analysis uses electric data from January 2005 to August 2006 (20 months).

The figure below compares the electric energy consumption of Plan 1 homes, Plan 5A homes, and the whole Premier Oaks development by month. There are a total of three Plan 1 homes, five Plan 5A homes, and forty-two Premier Oaks’ homes. For this analysis BIRA used averaged electric data from two of the Plan 1 homes, three of the Plan 5A homes, and forty-two Premier Oaks’ homes as each had 50% or more data. These results show that larger homes will typically use more electricity. However, it also shows that smaller homes, with the help of PV, can create negative electric bills.

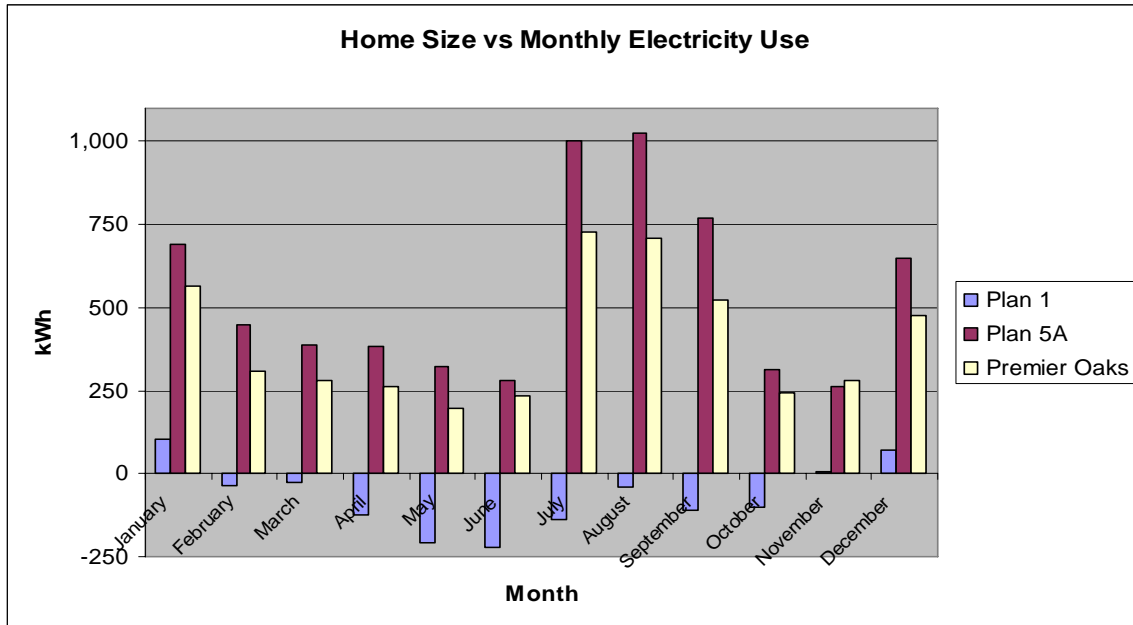


Figure 9- Home Size VS Monthly Electricity Consumption

The following analysis uses electric data from January 2006 to August 2006 (8 months).

The below figure displays electricity use for each plan. The electric data is varied, where the 2,817 sq. ft. homes use more than 5,000 kWh and the 1,787 sq. ft. homes generate more kWh than they use. As the electric data shows inconsistency, BIRA believes the reason is due to the homeowner’s varied electricity consumption. For example, one of the 2,817 sq. ft. homes uses 2,264 kWh whereas another 2,817 sq. ft. home used up to 8,160 kWh, 360% higher. With the small sample of homes from each plan, individual homeowner behavior can greatly influence the averages across plans.

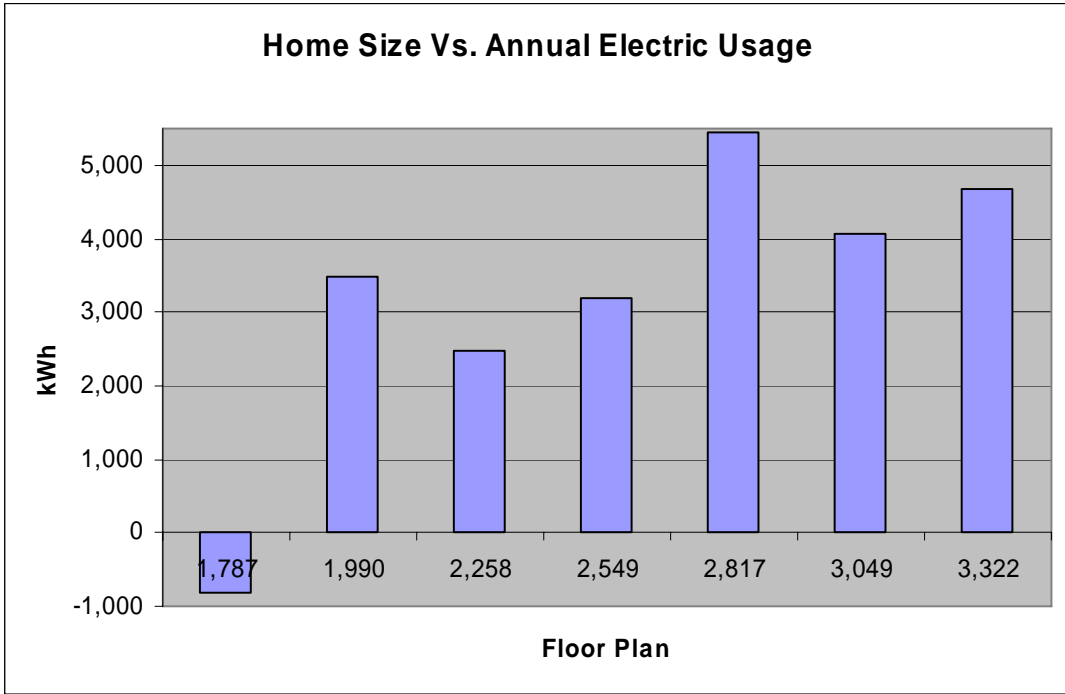


Figure 10- Home Size VS Annual Electric Usage

The following chart show annual electric usage for kWh/sq. ft.

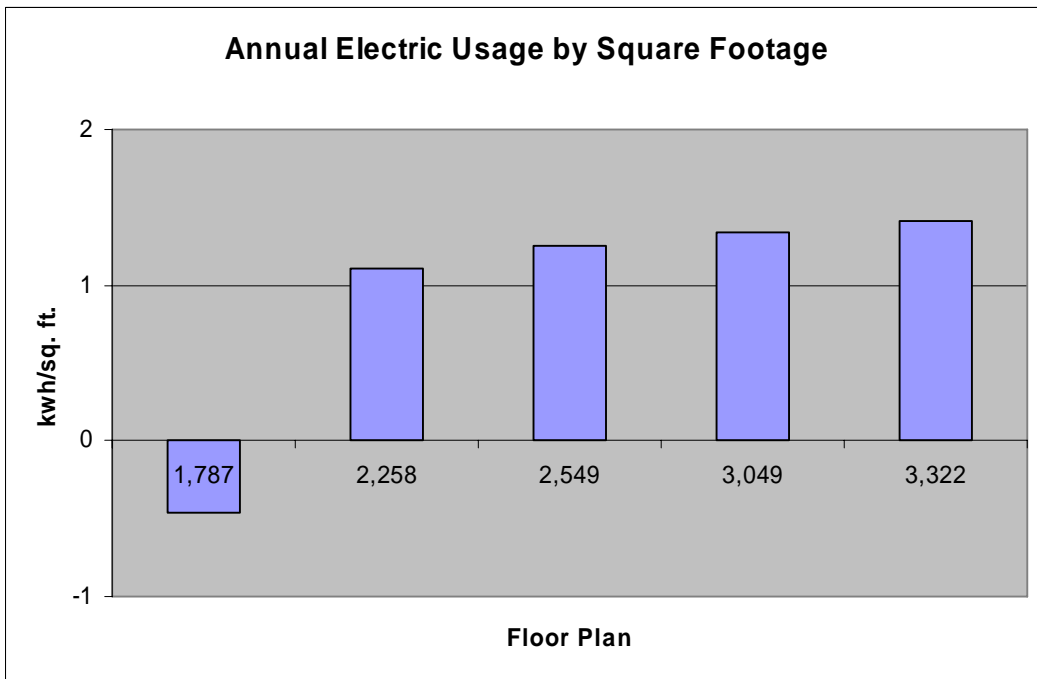


Figure 11- Annual Energy Electric by Square Footage

Comparison between Premier Oaks, Premier Gardens, and Cresleigh Rosewood

As Premier Oaks followed Premier Gardens, and there is electricity use data for each development, BIRA is able compare communities. Cresleigh Rosewood is used as the control for Premier Gardens, the same will be done with Premier Oaks. Premier Gardens contains ninety-five single-family homes and Cresleigh Rosewood contains ninety-eight single-family homes. Given the large sample size, Premier Gardens and Cresleigh Rosewood offers a more accurate representation of typical electric usage.

These comparisons are based on averaged electric data from January 2006 though August 2006 (8 months).

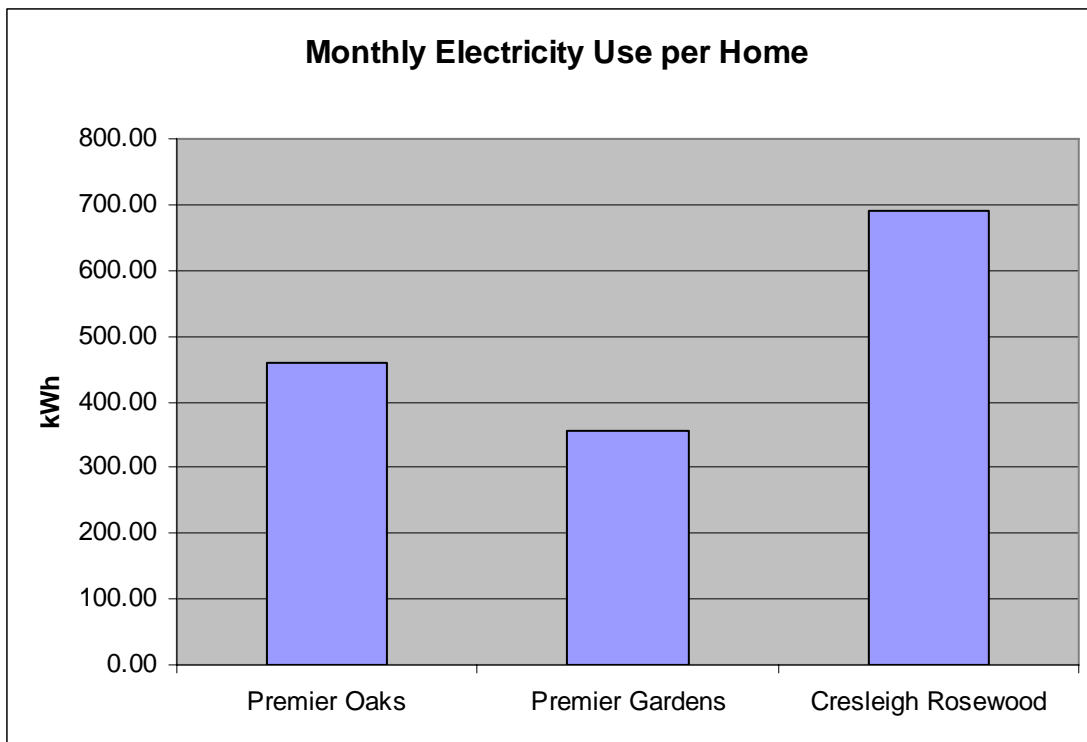


Figure 12- Home Development VS Electric Usage per home

On average, a Premier Oaks' home will use 22% more electricity than a Premier Gardens' home and 34% less electricity than Cresleigh Rosewood. These results seem to show that Premier Gardens' homes perform better than Premier Oaks' homes. However, when square footage is considered, Premier Oaks' homes perform better than Premier Gardens' homes.

A Premier Oaks' home uses .18 kWh/sq. ft./month compared to .20 kWh/sq. ft./month for a Premier Gardens' home. That is 10% more than a Premier Oaks' home. A Cresleigh Rosewood home uses .35 kWh/sq. ft./month. That is 48.5% more than a Premier Oaks' home.

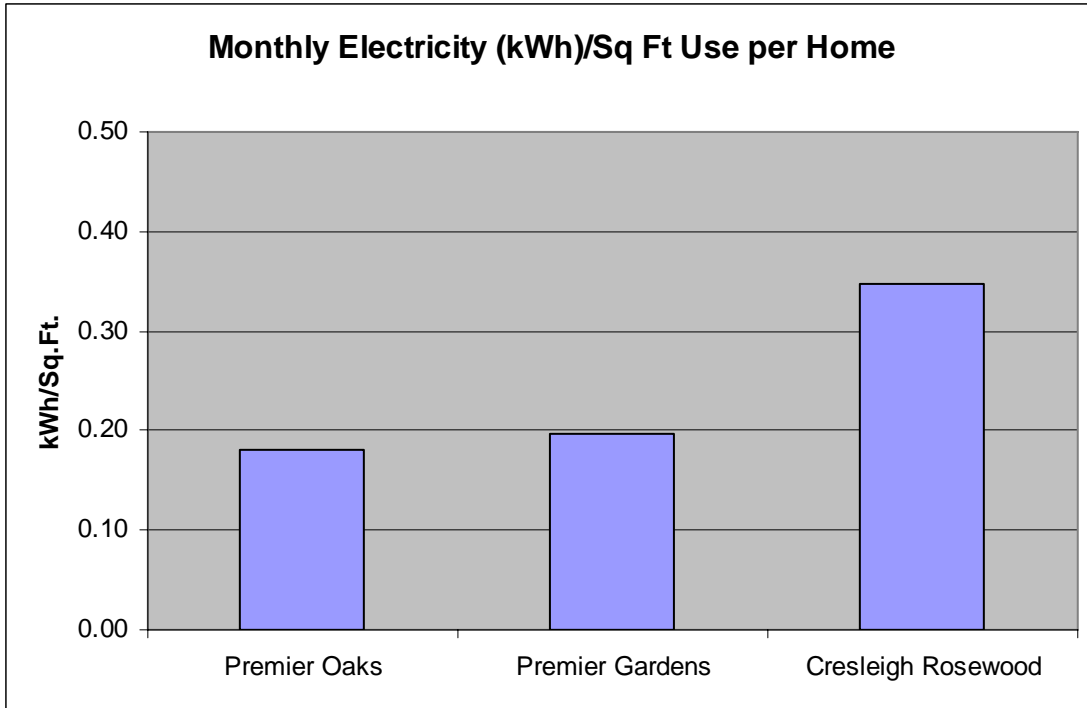


Figure 13- Electric Usage by Square Footage

PV Analysis

PV orientations installed at Premier Oaks include east, southeast, south, southwest, and West.

Roseville Electric is currently collecting 15 minute PV collection data on four homes with the following orientations:

- East
- Southeast
- Southwest
- West

To determine the PV production of south PV oriented homes BIRA used PVWATTS to help generate the annual PV production. To ensure the calculated PV production for the south orientation is consistent to the other orientations, BIRA used PVWATTS to generate the other PV orientations as well. BIRA then averaged the difference between the PV production data provided by Roseville Electric and the PV production data determined by PVWATTS. This difference was then subtracted from the estimated annual South PV production from PVWATTS to ensure that the numbers were consistent with the actual PV production data. These results are used to calculate the energy collected based on the PV orientation. The south annual kWh production as determined by the previous analysis will be applied to south facing homes. All the other annual kWh production figures represent actual field data.

PV Orientation	Annual kWh Production
East	3,557
Southeast	3,541
South	3,724
Southwest	3,413
West	3,184

Table 10- PV orientation and kWh production

The annual kWh production data is important for determining how best to orient PV, when given options. It is necessary to determine what orientation is optimal for greatest financial benefit. Clearly, when applied to a flat rate system south facing PV will benefit the homeowner most. But, if on a time-of-use plan the seemingly worst orientation shown, west, might make homeowners the most money if the utility values late afternoon production. As more PV is added to homes and businesses utilities will determine how to best incent the orientation that serves their needs best. Conceivably, this could be through a time-of-use rate system or through a rebate system.

The following chart shows the difference in actual energy use for three floor plans with PV. The 2,258 floor plan produces 71% energy savings, Plan 2,549 produce a 68% energy savings, and 2,817 produces a 48% energy savings. Again, the varied results are assumed to be a result of human behavior and not home or PV performance.

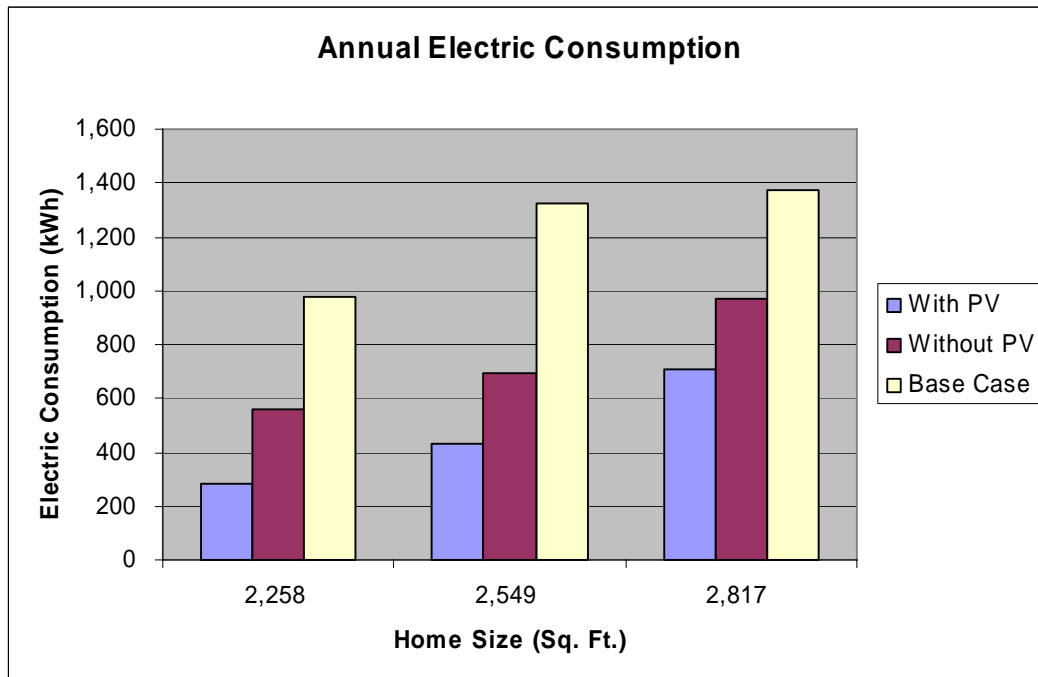


Figure 14- Home size comparisons with PV, without PV, and Base Case

The following table provides data that shows the affect of PV on energy use by home size. With the addition of PV, varied size homes are able to produce negative electricity bills, not only for a month, but for a whole year.

Homes	Home 1 1,787 sq. ft.	Home2 1,787 sq. ft.	Home 3 2,258 sq. ft.	Home 4 2,258 sq. ft.	Home 5 2,258 sq. ft.	Home 6 2,549 sq. ft.	Home 7 2,549 sq. ft.
January	(99)		341				
February	(189)		70		(32)		
March	(229)		(93)		48	(22)	(93)
April	(275)		(222)	(255)	152	409	(155)
May	(355)	(171)	(331)	(194)	51	(144)	(148)
June	(389)	(175)	(349)	(264)	(39)	(251)	(130)
July	(433)	(161)	(420)	(25)	210	(247)	189
August	(338)	(68)	(329)	522	(38)	(47)	408
September	(99)	89		270	159	(153)	360
October	(189)	(110)		47	(6)	(184)	76
November	(229)	(100)		122	99	28	124
December	(275)	6		262	219	218	256
Total	(2,307)	223	(1,333)	485	823	(393)	887

Table 11– Effect of PV on Electricity Use

Accuracy of BIRA Analysis

The following analysis uses electric data from January 2006 to August 2006 (8 months).

To achieve the most accurate results, only the homes with 85% or more electric data were used. This electric data is based on six 2,258 sq. ft. homes, four 2, 549 sq. ft. homes, and three 2, 817 sq. ft. homes. With this limited data, BIRA’s calculations were within a 14.4% margin of error.

Size of House (sq. ft.)	Analytical Electric Data (kWh)	Actual Electric Data (kWh)	Percent Difference
2,258	560	627	10.6%
2,549	704	769	8.5%
2,817	744	869	14.4%

Table 12– Analytical Data vs. Actual Data

In the analyzing and comparing utility data and modeled predictions of energy use for Premier Gardens it was determined that early assumptions that all the homes would employ gas dryers and gas ranges was not true. The homes in both developments were plumbed and wired for both and it was an option that homes owners had to decide on. Because many already own electric close dryers and because gas ranges costs more than electric ranges, it was found in a study by SMUD in Premier Gardens that most home owners opted for electric cloths dryers and ranges and that making changes in the originally assumptions seem to account for much of the difference seen in the above table between Analytical and Actual.

Conclusion

Premier Homes has built a second successful and energy saving community in the Sacramento area. Premier Oaks' is a second generation Near ZEH community realizing energy savings of 60% beyond the BAP benchmark. As the initial evaluation of electricity data, this report shows the preliminary electricity savings from these homes. As gas data becomes available, and more electricity data can be analyzed BIRA will better understand the way these homes perform.

It should also be noted that subsequent to Premier Gardens, Premier Homes offered PV as an option and in that very few PV systems were sold and the overall project did not to seem to be as successful as the two previous Near ZEH projects.

Premier has more recently not only decided to build and market energy efficient homes with PV as standard, they are participating in California's Zero Energy New Homes Program (ZENH). The requirements of this program are that homes must reduce electric energy consumption by 70% and reduce peak demand (as defined by the local utility) to no more than 1 kW.

For Premier's participation in this ZENH program BIRA has analyzed six different combinations of energy efficiency measures and PV. This project will most certainly meet BAP 40% goals for this hot-dry climate and will be worth following closely.



Figure 15- Premier Oaks Home (2) October 2006

Appendix A- Energy and Cost Analysis

Premier Homes

Premier Oaks Plan 1

Floor Area (SQ FT) =

1,787

Roseville, CA

Energy and Cost Analysis for Base Case and BA Prototype Houses

	Base Case / BA Benchmark House (kBtu/yr)	Prototype House	Reduction In Energy Use (kBtu/yr)	Estimated Incr. Cost: Base to Prototype House
Heating	31,755	16,851		
Cooling	49,375	11,705		
Water Heating	25,411	22,106		
Total	106,541	50,661	52.4%	
Lighting	22,880	22,915		
Total (Heat, Cool, WH and Lighting)	129,421	73,576	43%	
Other Uses	46,171	42,398		
Total (Heat, Cool, WH, Lighting & Other Uses)	175,592	115,975	34%	
Site Generation (2.4kW PV)			(35,017)	
Overall Total Energy Savings	175,592	80,957	54%	
ENVELOPE: (Insulation U-Values or R-Values)				
Roof (attic)	R-30	R-38 (U-value = 0.025)		\$265
Roof (at furnace)	R-30	R-19 (U-value = 0.047)		
Wall (Exterior)	U-value = 0.076	R-13 (U-value = 0.068)		\$300
Floor (above garage)	N/A	N/A		
Floor (cantilever)	N/A	N/A		
Attic Radiant Barrier	No	Yes		
Low Air Infiltration	SLA = 5.7	SLA = 3.1		
GLAZING:				
U-Factor Dual Pane Vinyl Frame Windows w/ Spectrally Selective Glass				
Slider (horz)'	0.620	0.36		
Slider (vert)'	0.620	0.33		
Fixed"	0.620	0.36		
Patio"	0.620	0.36		
SHGC				
Slider (horz)'	0.650	0.30		
Slider (vert)'	0.650	0.30		
Fixed"	0.650	0.30		
Patio"	0.650	0.30		
HVAC SYSTEM:				
Furnace: AFUE	0.78	0.91		\$500
A/C: SEER	10 SEER	14 SEER w/ TXV		\$695
Duct Insulation / Location	3.3/Attic	R-4.2 buried in attic insulation		
Duct Testing	No	Yes		
ACCA Manual D	No	Yes		
WATER HEATING:				
Water Heater Size	40 gal	Tankless System		\$750
Energy Factor	0.54	0.82		
Distribution Type	Standard	Pipe Insulation		\$75
External Wrap	R-12	None		
Solar Credit	None	Yes		
3rd Party Inspections and Testing (In ComfortWise Program)	No	Yes		\$440
Gas dryer stub	No	Yes		\$75
Fluorescent lighting (screw-in lamps)	No	All fluorescent		\$350
PV System (including buy down)	No	2.4 KW DC		\$7,515
PV Estimated Installation Cost	No	Yes		\$3,000
Total Estimated Incremental Cost				\$13,986

Comparison of Total Energy Use

3 Bedrooms

Premier Oaks Plan 1

	Base Case / BA Benchmark House			BA Prototype House		
	\		Dollars	Energy Use		Dollars
	Therms	kWh	\$	Therms	kWh	\$
Energy Code Related						
Space Heating	318		\$ 184	169		\$ 98
Space Cooling		4,822	\$ 386		1,143	\$ 91
Water Heating	254		\$ 147	221		\$ 128
Other Uses						
cooking	NA	604	\$ 48	NA	536	\$ 43
clothes washer		105	\$ 8		66	\$ 5
dishwasher		206	\$ 16		107	\$ 9
electric or gas dryer	53	76	\$ 37	36	80	\$ 27
refrigerator		669	\$ 54		669	\$ 54
Miscellaneous (Appliances + Plug)		2,298	\$ 184		2,298	\$ 184
Lighting (Hard Wired)		1,858	\$ 149		1,861	\$ 149
Lighting (Plug In)		377			377	
reduce kWh by solar contribution		NA	NA		(3,420)	\$ (274)
Total use	625	11,015	\$ 1,213	426	3,717	\$ 514

Total Annual Energy Use

175,236 kBtu/yr

80,619 kBtu/yr

Reduction in Energy Use

32%

66%

58%

Total for Column in kBtu/yr

62,456 112,780

42,563 38,056

Total kBtu/yr for BA Benchmark House

175,236 kBtu/yr

Total kBtu/yr for Prototype House

80,619 kBtu/yr

Percent End Use Energy Savings

54%

	Base Case/Benchmark		BAP House	
	Gas	Electric	Gas	Electric
Estimated Monthly Energy Bill	\$ 30.19	\$ 73.43	\$ 20.57	\$ 24.78

price of gas/therm

\$0.58

price of electricity/kWh

\$0.08000

Premier Homes
Premier Oaks Plan 5A
Floor Area (SQ FT) =
Roseville, CA

3,322

Energy and Cost Analysis for Base Case and BA Prototype Houses

	Base Case / BA Benchmark House	Prototype House	Reduction in Energy Use (kBtu/yr)	Estimated Incr. Cost: Base to Prototype House
Heating	97,102	45,844		
Cooling	108,563	17,573		
Water Heating	29,034	24,251		
Total	234,699	87,668	62.6%	
Lighting	35,454	35,511		
Total (Heat, Cool, WH and Lighting)	270,153	123,179	54%	
Other Uses	71,198	65,863		
Total (Heat, Cool, WH, Lighting & Other Uses)	341,351	189,071	45%	
Site Generation (2.4kW PV)			(35,017)	
Overall Total Energy Savings	341,351	154,054	55%	
ENVELOPE: (Insulation U-Values or R-Values)				
Roof (attic)	R-30	R-38 (U-value = 0.025)		\$350
Roof (at furnace)	R-30	R-19 (U-value = 0.047)		
Wall (Exterior)	U-value = 0.076	R-13 (U-value = 0.067)		\$300
Floor (above garage)	R-19	R-30		\$136
Floor (cantilever)	N/A	N/A		
Attic Radiant Barrier	No	Yes		
Low Air Infiltration	SLA = 5.7	SLA = 3.1		
GLAZING:				
Dual Pane Vinyl Frame Windows w/ Spectrally Selective Glass				
U-Factor				
Slider (horz)*	0.620	0.36		
Slider (vert)*	0.620	0.36		
Fixed*	0.620	0.36		
Patio*	0.620	0.36		
SHGC				
Slider (horz)*	0.660	0.33		
Slider(vert)*	0.660	0.33		
Fixed*	0.660	0.33		
Patio*	0.660	0.33		
HVAC SYSTEM:				
Furnace: AFUE	0.78	0.91		\$500
A/C: SEER	10 SEER	14 SEER w/TXV		\$606
Duct Insulation / Location	3.3/Attic	R-4.2 buried in attic insulation		
Duct Testing	No	Yes		
ACCA Manual D	No	Yes		
WATER HEATING:				
Water Heater Size	40 gal	Tankless System		\$750
Energy Factor	0.54	0.82		
Distribution Type	Standard	Pipe Insulation		\$75
External Wrap	R-12	None		
Solar Credit	None	Yes		
3rd Party Inspections and Testing (In ComfortWise Program)	No	Yes		\$440
Gas dryer stub	No	Yes		\$75
Fluorescent lighting (screw-in lamps)	No	All fluorescent		\$350
PV System(including buy down)	No	2.4 kW DC		\$7,515
PV Estimated Installation Cost	No	Yes		\$3,000
Total Estimated Incremental Cost				\$14,195

Comparison of Total Energy Use

6 Bedrooms

Premier Oaks Plan 5A

	Base Case / BA Benchmark House			BA Prototype House		
	\		Dollars	Energy Use		Dollars
	Therms	kWh	\$	Therms	kWh	\$
Energy Code Related						
Space Heating	971		\$ 563	458		\$ 266
Space Cooling		10,603	\$ 848		1,716	\$ 137
Water Heating	290		\$ 168	243		\$ 141
Other Uses						
cooking	NA	604	\$ 48	NA	536	\$ 43
clothes washer		158	\$ 13		98	\$ 8
dishwasher		309	\$ 25		161	\$ 13
electric or gas dryer	79	114	\$ 55	54	119	\$ 41
refrigerator		669	\$ 54		669	\$ 54
Miscellaneous (Appliances + Plug)		4,272	\$ 342		4,272	\$ 342
Lighting (Hard Wired)		2,840	\$ 227		2,846	\$ 228
Lighting (Plug In)		623			623	
reduce kWh by solar contribution		NA	NA		(3,420)	\$ (274)
Total use	1,341	20,191	\$ 2,343	755	7,620	\$ 998

Total Annual Energy Use

340,799 kBtu/yr

153,527 kBtu/yr

Reduction in Energy Use

44%

62%

57%

Total for Column in kBtu/yr

134,066

206,733

75,504

78,023

Total kBtu/yr for BA Benchmark House

340,799 kBtu/yr

Total kBtu/yr for Prototype House

153,527 kBtu/yr

Percent End Use Energy Savings

55%

	Base Case/Benchmark		BAP House	
	Gas	Electric	Gas	Electric
Estimated Monthly Energy Bill	\$ 64.80	\$ 134.60	\$ 36.49	\$ 50.80

price of gas/therm

\$0.58

price of electricity/kWh

\$0.08000

Appendix B- Plans/ Elevation: Plan No. 1, 1,787 Square Feet

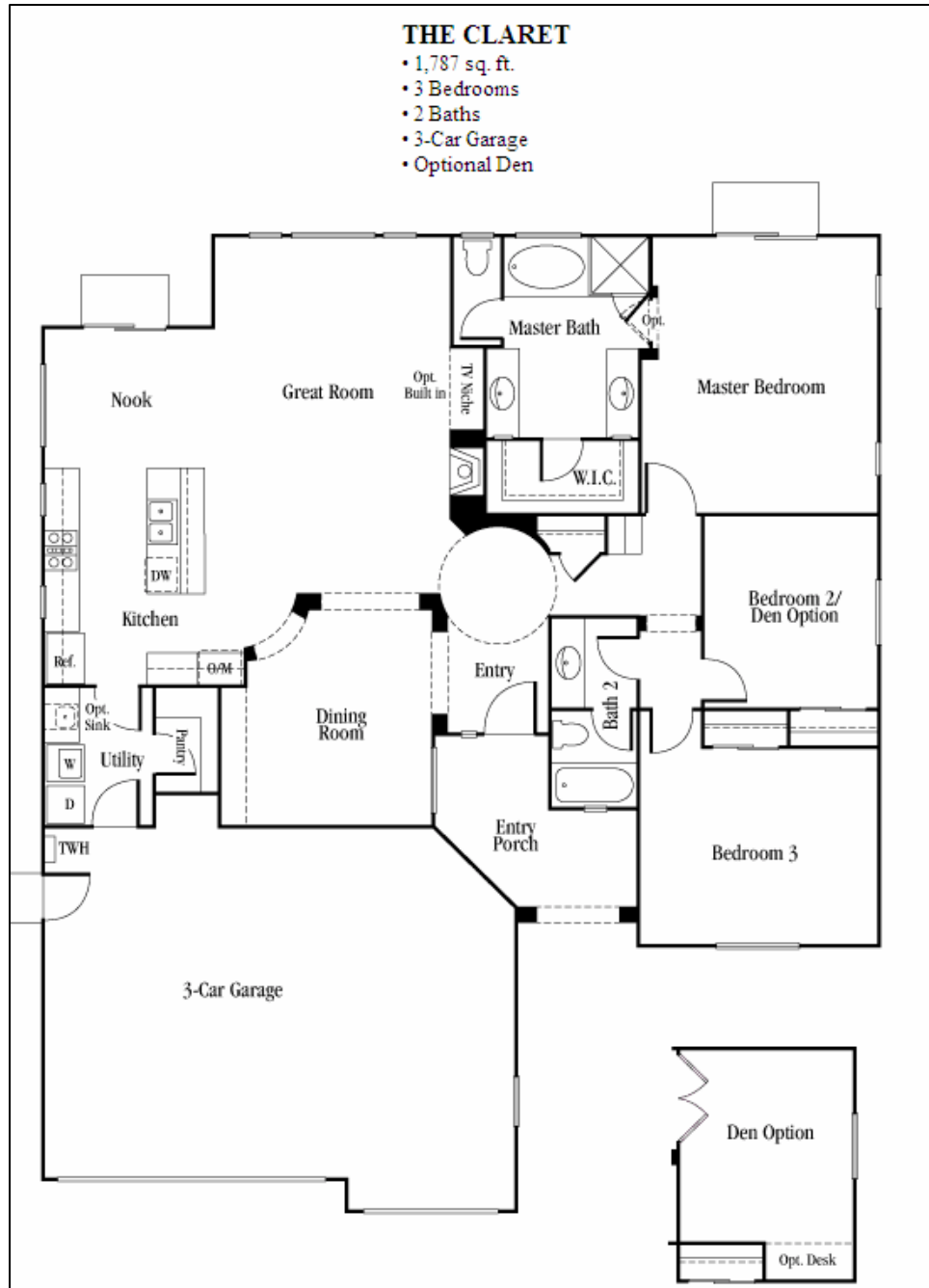


Figure 16- Plan 1 First Floor Plan, Optional Den

THE CLARET



Elevation A



Elevation B



Elevation C

Figure 17 – Plan 1 Elevations

Appendix C- Plans/Elevation: Plan No. 5A, 3,322 Square Feet

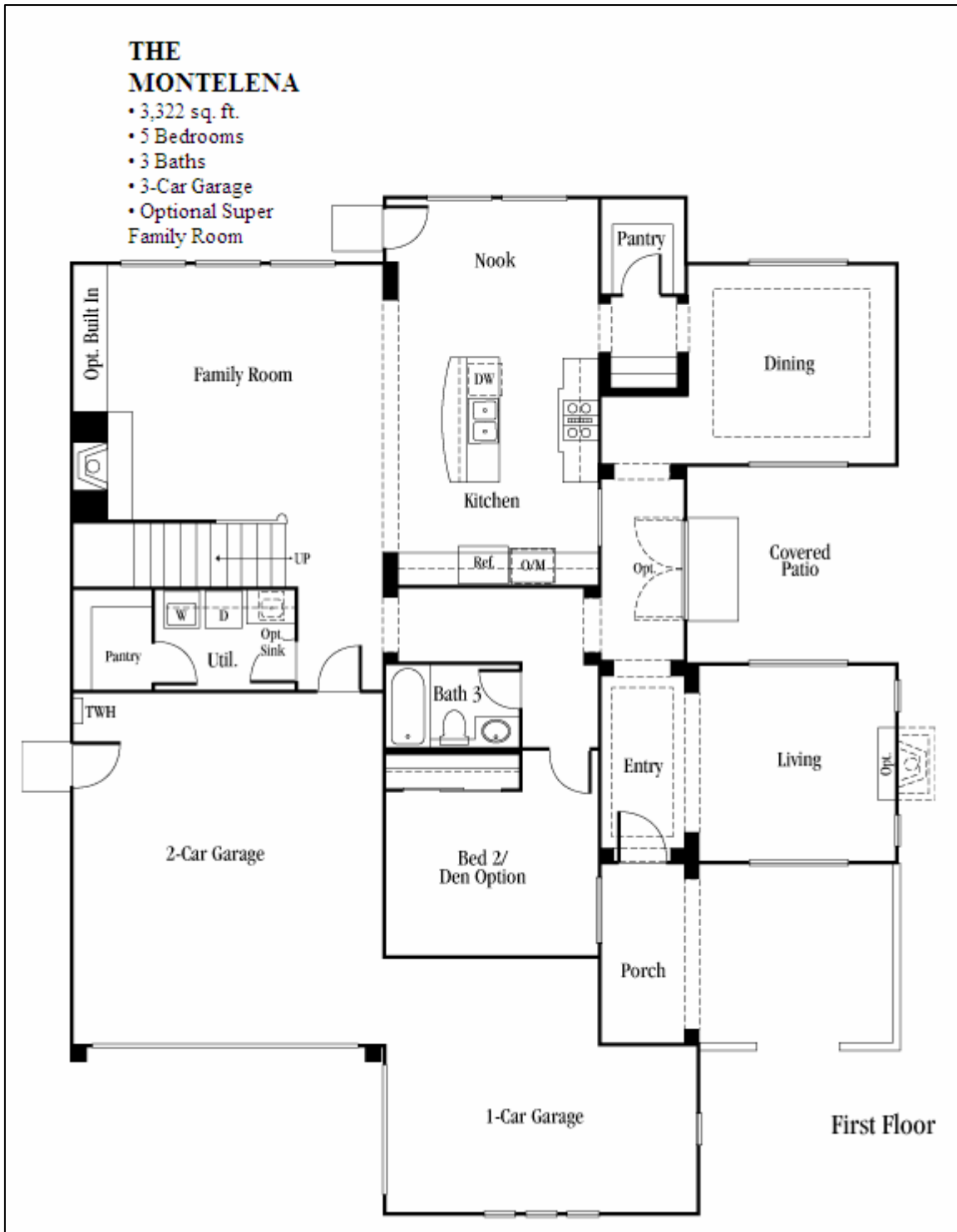


Figure 18- Plan 5A First Floor Plan

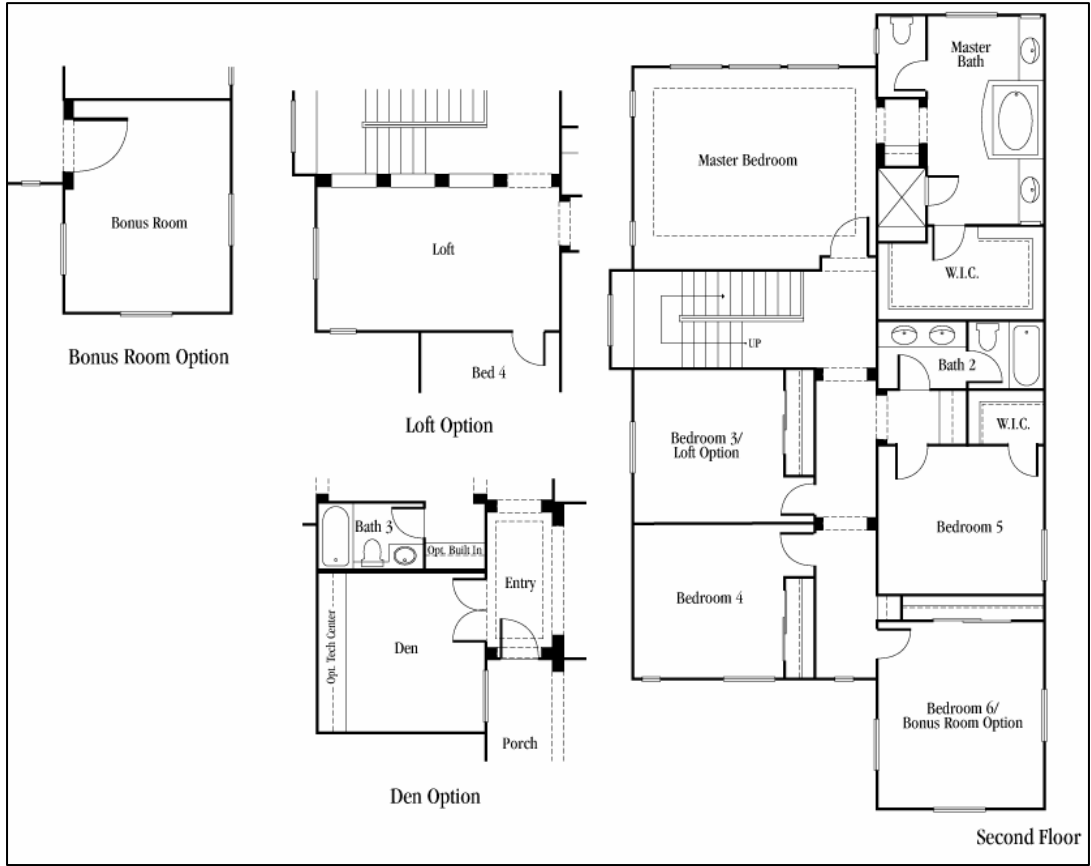


Figure 19 – Plan 5A Second Floor Plan, Optional Den, Loft, and Bonus Room

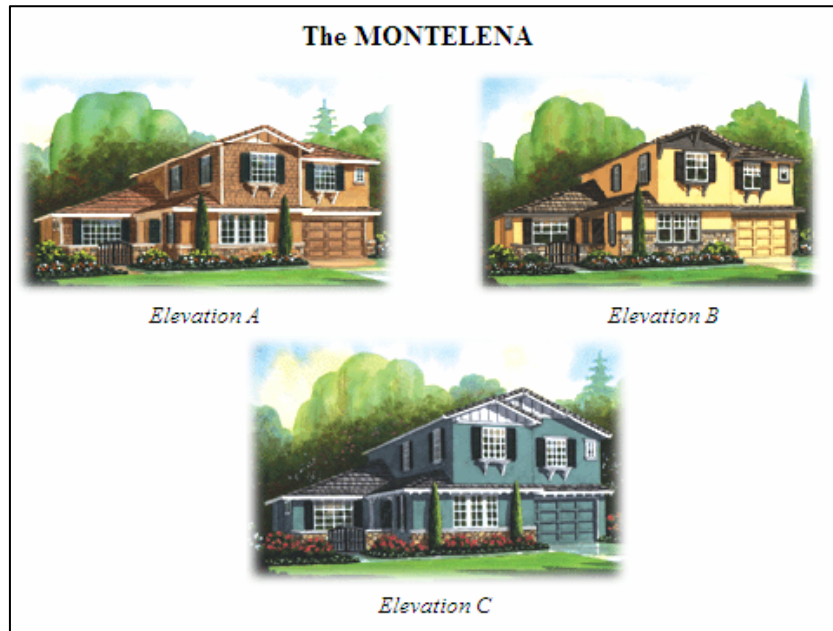


Figure 20– Plan 5A Elevations