

# The End-Game: Zero Energy Homes

Communities of Super-Efficient Homes  
With Integrated Solar Generation



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# What is ZEH?

- DOE Program
  - Element of Building America
  - Produce as much energy as consume
  - By 2020 Communities
- Today
  - Demonstration homes: Net-zero
  - Communities: 50% bill reduction
- ConSol
  - 60% bill reduction
  - Net-zero annual energy bill

# Why Build ZEH?

- ... Other than reduced dependence on foreign oil, reduced emissions, reduced peak-electricity demand...
- Market Differentiation
- Press Exposure
- Increased Profits

# Pardee Ultimate Family Home



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**ZERO**  
Energy Homes

**ConSol**

*Building*  
**AMERICA**   
U.S. Department of Energy



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# Pardee Homes -- Ultimate Family Home

## Floor Area 5300 sqft

### Zero Energy Home Features

#### **ENVELOPE:** (Insulation)

Roof (attic, rafter)

**R-38, R-30**

Wall (Exterior)

**R-21**

Floor (above garage)

**R-30**

#### **GLAZING:**

Windows & French Doors (U-factor, SHGC)

**U=0.33, SHGC=0.33**

#### **HVAC SYSTEM:**

Furnace AFUE, A/C SEER

**0.95 AFUE, 15 SEER**

Duct Insulation / Location

**R-6**

#### **WATER HEATING:**

Main

**Solar ICS**

Backup

**0.82 EF Tankless**

Distribution System

**PipeInsulation; short run; PEX**

#### **PHOTOVOLTAIC SYSTEM (PV)**

**8.6kW DC**

#### **FLUORESCENT LIGHTING**

**Mainly fluorescent/Halogen/IR accents**

#### **INSPECTIONS AND TESTS**

**All features, duct and envelope leakage, air flows**



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# Water Heating



# Photovoltaic System (PV)



# Fluorescent Lighting

- Typical Problems with Fluorescents
  - Typical replacement wattage is too low
  - Quality, hard-wired, IC-rated, air-tight cans not available
  - Color rendition
- Solutions
  - Good lighting design; Careful choice of fixtures
  - Proper wattages (about 25W for 75W replacement)
  - New down-light cans are coming soon
  - 2700 - 3000°K, 80 or greater CRI











# Energy and Cost Savings

Space Heating	58%
Space Cooling	71%
Water Heating	41%
Appliances	54%
Lighting	53%

reduce kWh by solar contribution 11,568 kWh

Total Reduction in Electricity Use	98%
Total Reduction in Energy Use	86%
Total Reduction in Energy Cost	88%

# Marketable/Affordable ZEH

- 50% or Greater Energy-Bill Reduction
  - Whole house
  - Integrated solar

# ZEH Subdivisions

- Pardee Homes, Orange Co CA
- Pardee Homes, Las Vegas
- Morrison Homes, Sacramento CA
- Clarum Homes, East PA & Watsonville CA
- Premier Homes, Sacramento

# Clarum Homes

- “Vista Montana”
  - 257 Homes, All ZEH
  - Mix: SF Attached & Detached
  - Affordable, Entry, Move-Up
- Over 60% Sold before Grand Opening
- No Marketing Used
  - Only Press from ZEH



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# Research Needed

- Energy-efficiency technologies
  - New, better, less expensive
  - Building America, Solar programs
- Integration of Solar
- Market Analysis
  - What will buyers buy? Why? How Market?
- Community Impacts of Distributed Generation

# Rating Issues and Opportunities

- “Normal” Inspections/Tests
  - All features inspected/tested
- Lighting
  - Maximize fluorescent
  - Quality/color
- Solar
  - Size
  - Operation