

# The Ultimate Family Home

Las Vegas, Nevada



## Moving Toward Zero Energy Homes

### Zero Energy Home Shows Off

**F**ifty percent of new U.S. homes are going up in the Sunbelt, where air conditioning use is ubiquitous. The ever-growing demand for electricity – both from new home construction and increases in average electricity use per home – is putting a strain on homeowners' wallets and the electrical utility system.

Enter the Ultimate Family Home, built by Pardee Homes in partnership with BUILDER magazine, HOME magazine, and Bassenian/Lagoni Architects to serve as a show home for the 2004 International Builders' Show sponsored by the National Association of Home Builders in Las Vegas, Nevada.

Pardee Homes already constructs all its new homes to ENERGY STAR® standards through ComfortWiseSM. By participating in the U.S. Department of Energy's Zero Energy Homes initiative, Pardee

is among a small group of homebuilders across the nation that are building homes to the highest standards of efficiency. Then, by adding solar energy technologies, these homes are capable of using zero net energy over the course of a year. Some homes even generate excess electricity, rolling their utility meters backward.

Pardee Homes worked with energy consultant ConSol, researchers from the National Renewable Energy Laboratory, and a team of subcontractors and suppliers to make the Ultimate Family Home a Zero Energy Home.

***"Pardee Homes' commitment to homebuyers is to deliver comfort and value with attention to energy efficiencies, environmental sensitivities, and real, measurable savings that homeowners can appreciate."***  
– Rob Hammon, ConSol

The home is 5,300 square feet on three levels, and includes air conditioning



**The Ultimate Family Home showcases efficient design and solar technologies during the 2004 International Builders' Show.**

– even in the garage – and it is expected to generate all the electricity it uses. The home is expected to use about 90% less energy than a home built to code.

The home features an 8.6-kilowatt photovoltaic system that supplies most of its electricity. A solar hot water system, boosted by tankless water heaters, provides hot water. A highly efficient gas furnace heats the home, and a 16-SEER conditioning system with a thermostatic expansion valve (TXV) cools the home.

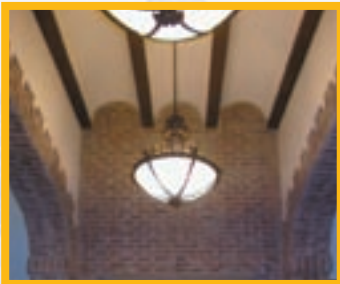


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**A radiant barrier prevents the sun's heat from seeping into the attic. Ducts are sealed and insulated.**



**Left: The home was designed for fluorescent light-bulbs, which are more efficient and don't give off heat like incandescents. Right: High levels of insulation are key to keeping the home's occupants comfortable.**

## Energy Efficient Features

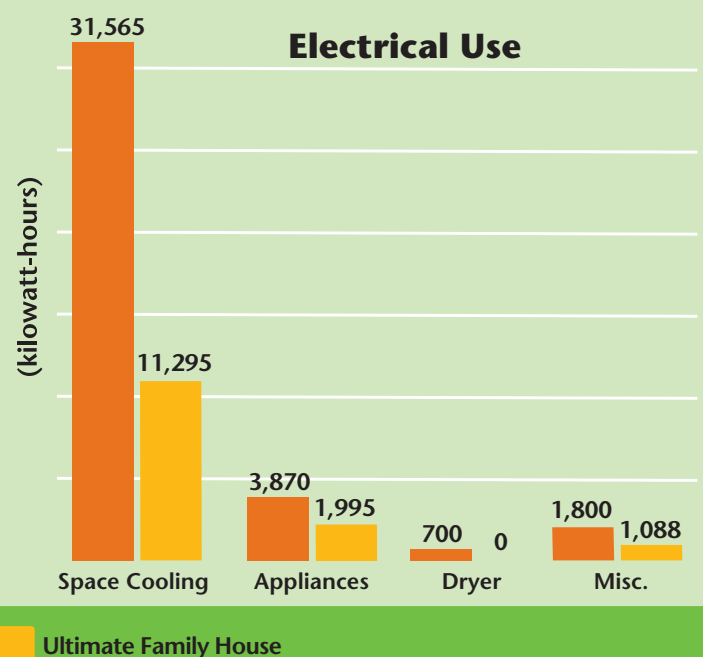
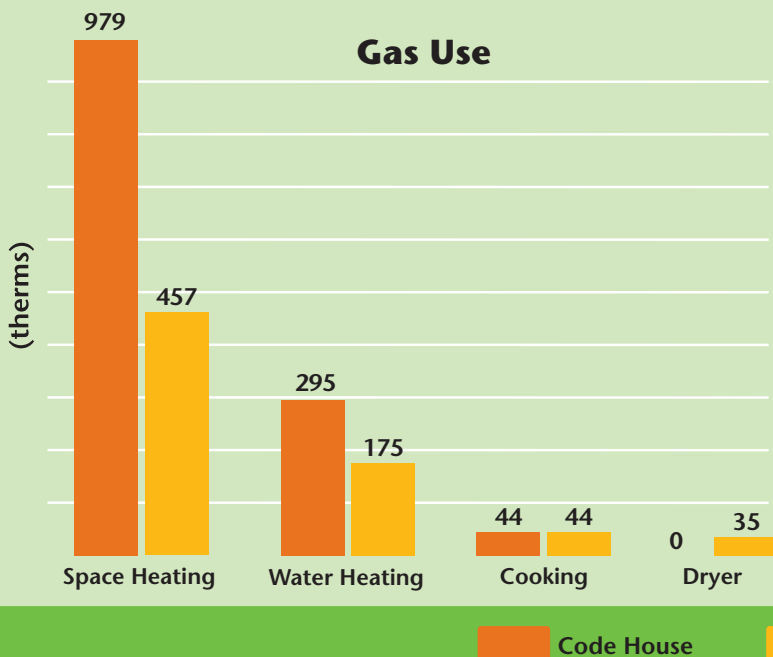
Today, about 10% of new homes in the United States are built to exceed minimum efficiency standards. Home energy use is increasing, which is attributed to larger homes and more electronics in use. Homes devour 35% of the electricity and 20% of overall energy used in the United States.

The well-designed home, including energy efficient products which are readily available on the market today, can dramatically cut energy use. The Ultimate Family Home was designed to include many efficiency features:

- Energy efficient building envelope with R-21 walls
- Radiant barrier roof sheathing
- Low air infiltration
- Spectrally selective windows
- Advanced HVAC systems including ACCA manual designs
- 16 SEER air conditioning with TXV
- 0.95 AFUE furnace
- Sealed, insulated, and tested ductwork
- Insulated polyethylene (PEX) for hot water distribution
- Fluorescent lighting
- ENERGY STAR<sup>®</sup> appliances

Sustainable features of the home include:

- Certified and engineered wood framing and renewable resource, lyptus molding
- Artificial turf and drought tolerant plants
- Low VOC paints
- Carpet with recycled materials
- Low formaldehyde insulation



Code House Ultimate Family House

## Renewable Energy Features

The owners of this Zero Energy Home won't need to worry about increases in electricity and natural gas rates. The home is designed to cut its energy use with efficiency, and then meet the remaining needs with renewable energy sources. At times, the home might even generate more electricity than it uses.

The home features an 8.6-kilowatt solar electric system with panels mounted on the roof. Inverters convert the DC power into AC power. Hot water is provided by solar collectors on the roof, boosted when needed by efficient, tankless water heaters.



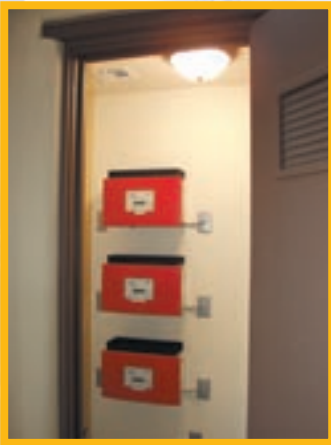
**Solar electric panels mounted unobtrusively on the roof on the back side of the house.**



**Solar hot water heater on the roof uses the desert sun to heat water for the home.**



**The home is designed for indoor/outdoor living. The courtyard is protected from the sun while the swimming pool deck (foreground) welcomes the rays.**



**The inverters, neatly tucked into the utility closet, convert the DC power generated by the solar electric panels into AC power used in the home.**

## Getting to Zero Energy

Measurement is key to meeting the goals of the Zero Energy Homes initiative. ConSol analyzed how much energy the Ultimate Family Home would use if simply built to meet the local building code. Engineering analysis was conducted to deliver a home that would use about 90% less energy than the code home. Air conditioning was one of the major targets for reducing electricity use. A building envelope that keeps out the heat and retains the cool air, along with a highly efficient TXV air conditioner, ENERGY STAR appliances, and fluorescent lighting contributed to meeting the electricity target. A highly efficient furnace and insulated ducts in conditioned space reduced gas use.

Key Energy Features		
Energy Efficiency	Code Home	Ultimate Family Home
Building Envelope	R-values	R-values
Roof (attic)	30	38
Roof (cathedral)	19	30
Exterior wall	13	21
Floor above garage	13	30
Attic radiant barrier	No	Yes
Low air infiltration	No	Yes
Fluorescent lighting	No	Yes
Glazing	U, SHGC	U, SHGC
Slider, Fixed, Patio	0.40, 0.40, 0.55	0.33, 0.33, 0.33
French Doors	0.65	0.33
Heating/Cooling		
Furnace AFUE	0.80	0.95
A/C	10 SEER	16 SEER with TXV
Duct insulation	4.2	R-6, buried in insulation
Ducts sealed and tested	No	Yes
ACCA Manual designs	No	Yes
Water Heating		
Water Heater Size	50 gallon	tankless
Energy Factor	0.53	0.82
Distribution	Copper	Pipe insulation, short run, PEX
Renewable Energy	Code Home	Ultimate Family Home
8.6-kilowatt photovoltaic system	No	Yes
1.5-kw solar water heater	No	Yes

## About Zero Energy Homes

To take U.S. home energy performance to a higher level, DOE created the Zero Energy Homes (ZEH) initiative, bringing the latest R&D out of the laboratory and into homes. Both energy efficiency and renewable energy technologies - like solar water heating and solar electricity - serve these homes. DOE's goal is to help builders create homes that produce as much energy as they use over the course of a year. ZEHs are connected to the utility grid, and some are even energy generators, rolling the utility meter backward when they produce more electricity than they consume.

DOE selected four teams that are working with researchers at the National Renewable Energy Laboratory to introduce the ZEH concept into the single-family, new-home construction industry. The four teams are ConSol, Stockton, California; Davis Energy Group, Davis, California; NAHB Research Center, Upper Marlboro, Maryland; and Steven Winter Associates, Norwalk, Connecticut.

**For more information:**  
**Building Technologies Program**  
[www.buildings.gov](http://www.buildings.gov)  
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## Research that Works

### A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.



**U.S. Department of Energy**  
**Energy Efficiency**  
**and Renewable Energy**



**Solar electric and solar hot water panels on the roof are barely visible on the back and side of the house.**

Other features include a highly insulated building envelope, advanced windows, and fluorescent lighting.

### Designed for Today's Family

How do you design the Ultimate Family Home? The builders wanted the home to be miserly on energy but generous with the features today's families want. To gain insight into what parents and children want in a home, the project team hired a marketing research firm, which convened focus groups to determine exactly which amenities to include.

Special home features include:

- Rotunda kitchen with a home management center, nook, family area, and a secondary, smaller kitchen
- Oversized mud room with storage lockers, seating, nearby laundry and half bath
- Oversized, three-car garage with an air-conditioned bay and a workshop
- Dedicated study and guest suite on the main level
- Secondary bedroom suites, one with a private hideaway area
- Observatory that converts from a game room to a sleeping porch
- Half-acre lot with a center courtyard, pool area, open-air pavilion, treehouse and kids' play area

### Project Information

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