



Zero Energy Homes

A Brief Primer

Short ZEH Description

A Zero Energy Home (ZEH) combines high levels of energy efficiency with renewable energy systems to annually return as much energy to the utility as it takes from the utility – resulting in a net-zero energy consumption for the home.

ZEH Disclaimer

A Zero Energy Home is **not**:

- Zero energy consumption
- Utility independent
- Energy rationed
- Energy Unlimited

ZEH defined by DOE

The U.S. DOE's Zero Energy Homes research initiative ...combines state-of-the-art, energy-efficient construction and appliances with commercially available renewable energy systems...[that] can result in net zero energy consumption. A ZEH, like most houses, is connected to the utility grid, but can be designed and constructed to produce as much energy as it consumes on an annual basis.

The Basics



*Hathaway
home,
Purcellville,
VA. NREL
photo archive*

1. Decrease demand for energy
2. Produce energy from renewable sources

An Energy Efficient Home

Plug & Small Appliances:
Individual homeowner's choice to decrease use

Water Heating:
Solar preheat, efficient delivery, low-flow fixtures

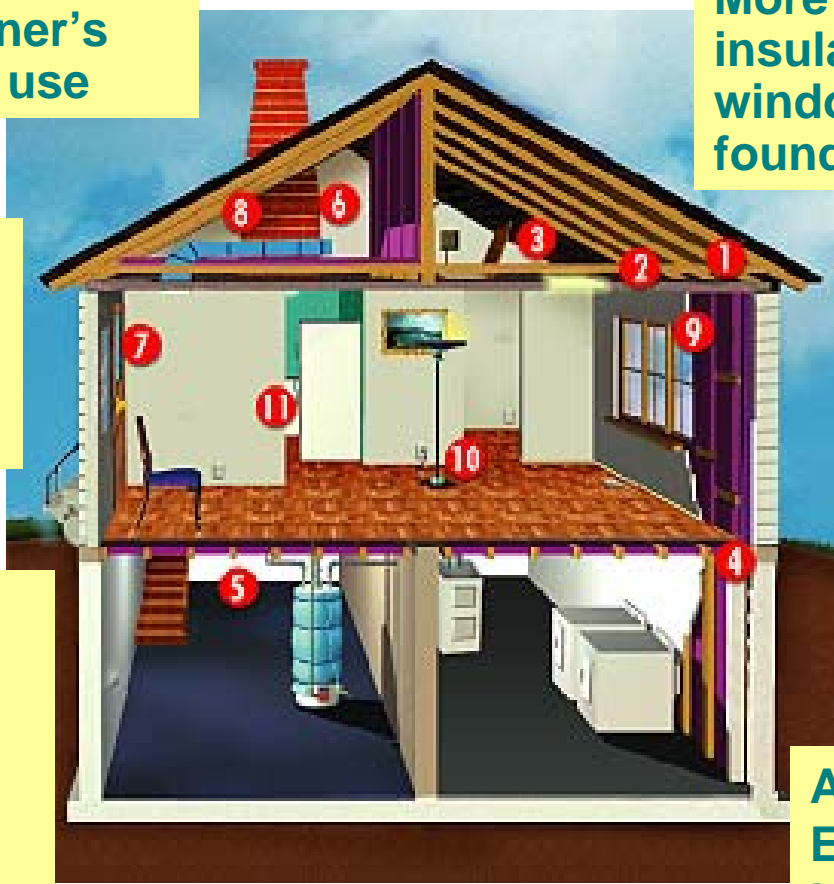
Heating & Cooling Equipment:
High Efficiency, programmable thermostat, sealed ducts

House Shell:
More wall and roof insulation, low-e windows, insulated foundation

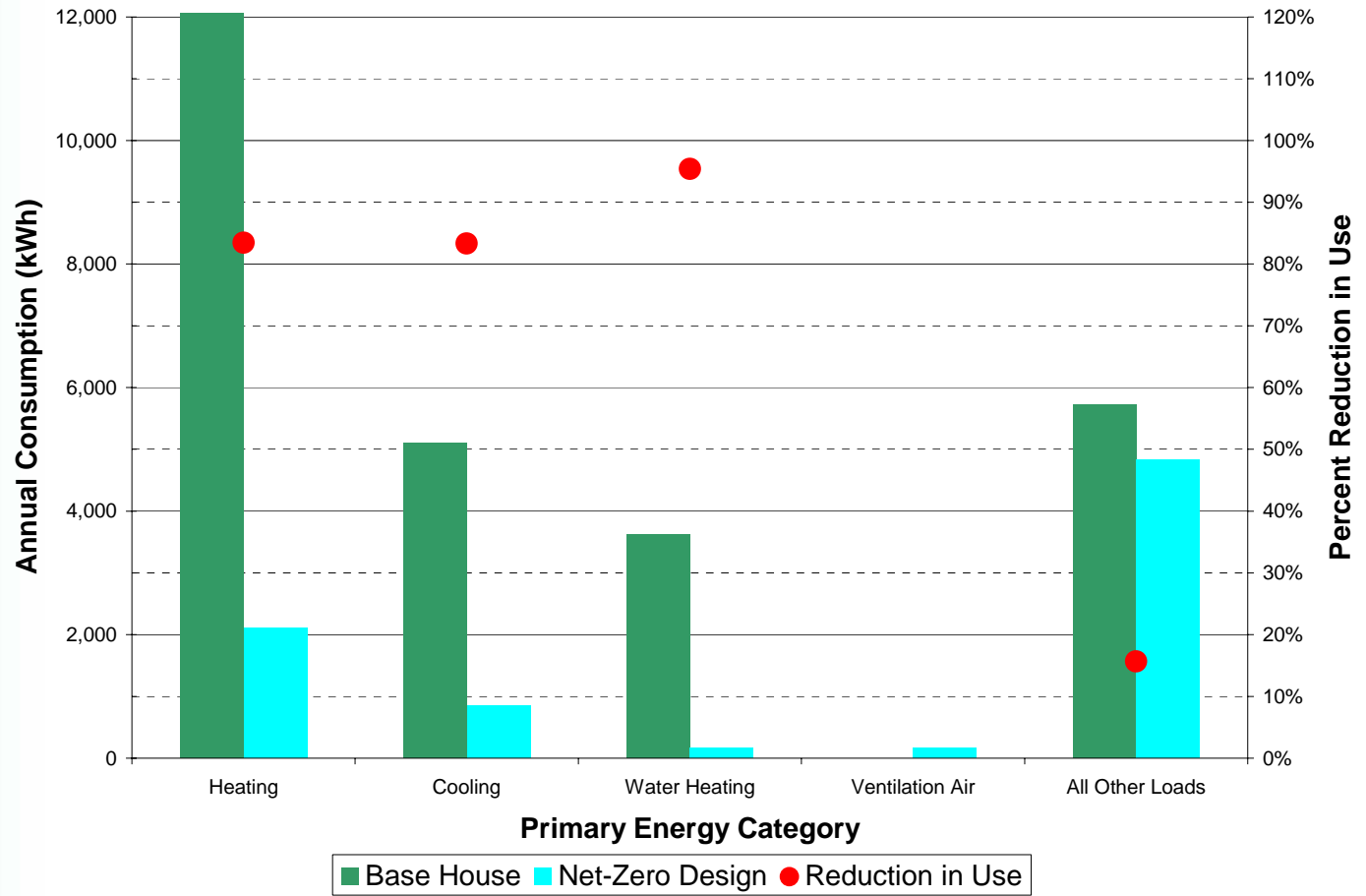
Air-sealing:
Seal vents, holes and gaps through walls and roof

Lighting:
Fluorescent

Appliances:
EnergyStar Label



Effect of Efficiency Upgrades



Example ZEH Energy Use

Energy End Use	Base House Annual Consumption (kWh)	Percent of Total (%)	Net-Zero Annual Consumption (kWh)	Percent of Total (%)
Heating	12,749	47	2,110	26
Cooling	5,100	19	850	11
Water Heating	3,627	13	167	2
Ventilation Air	0	0	175	2
All Other Loads	5,730	21	4,833	59
Annual Consumption	27,206	100	8,135	100

The PV system that meets the estimated annual use is 5,700 watts - requiring just over 500 square feet of south facing roof area. The PV system is estimated to produce about 8,266 kWh annually.

Example uses Baltimore, MD area climate

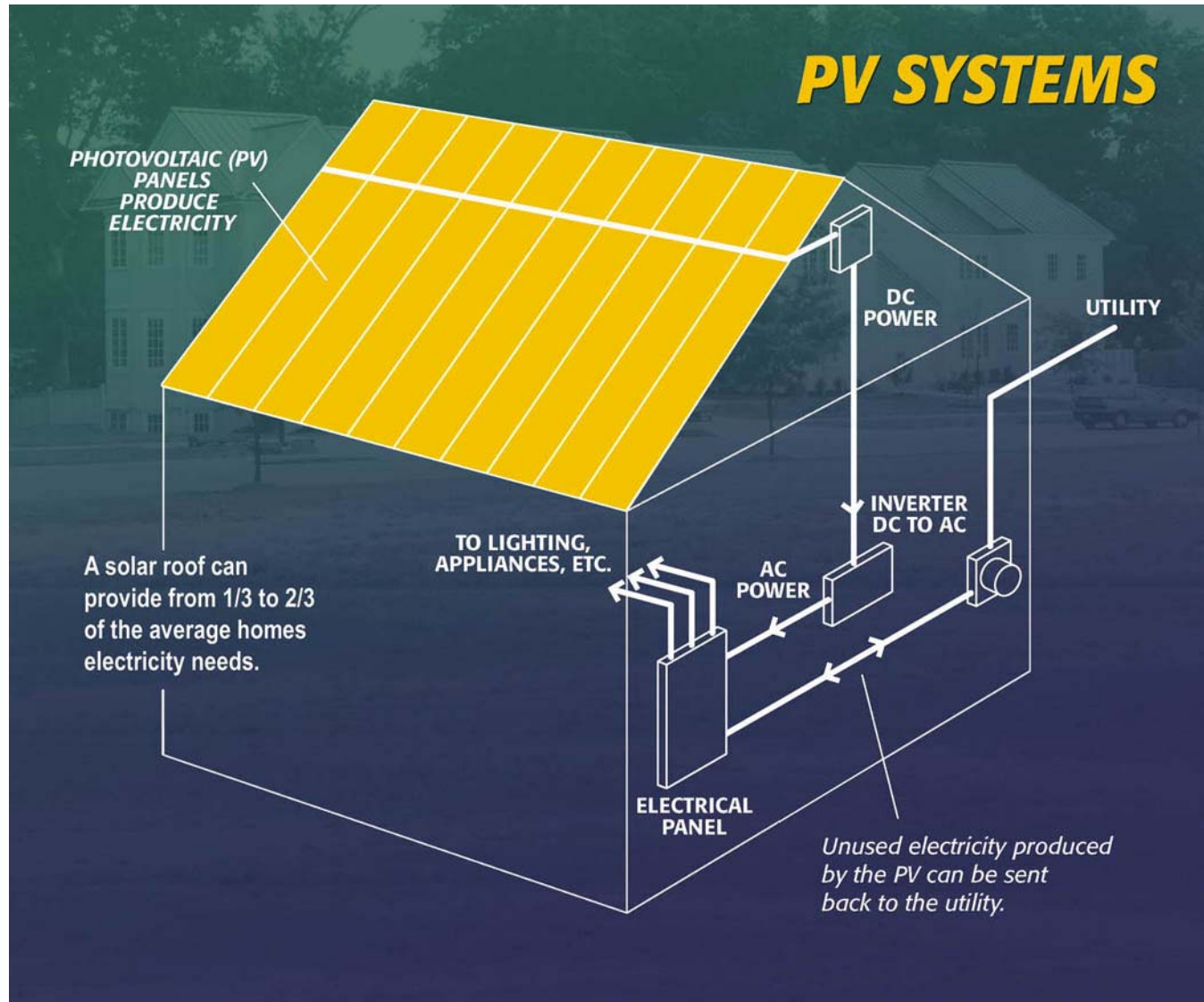
Solar Electric (PV) Systems

- Produce electricity directly from the sun's energy
- Operates daily but with variable output
- Available, reliable, low maintenance
- Quiet and non-polluting when on

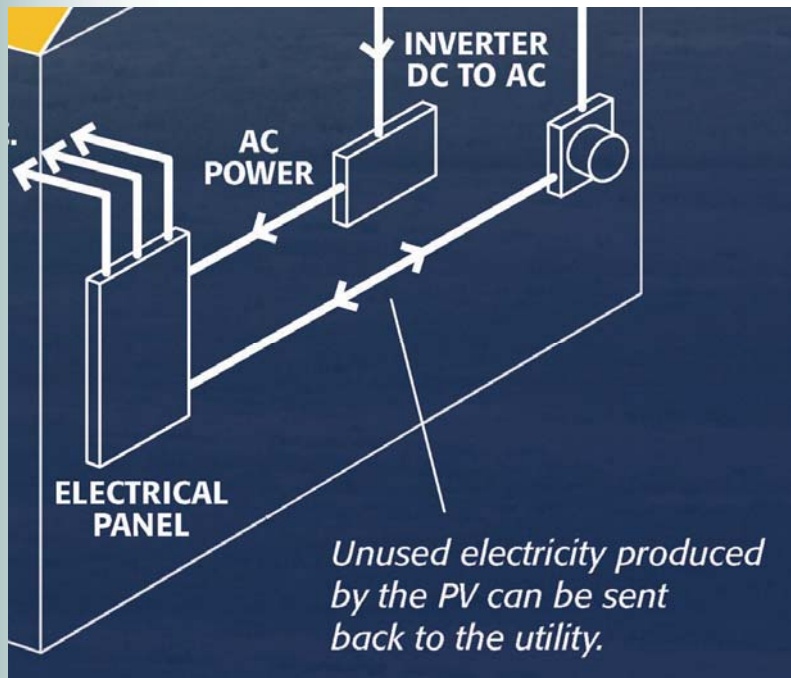


Top Photo: ZEH remodel in NJ, courtesy of Bill Asdal

Utility Connection



ZEH Utility Requirements

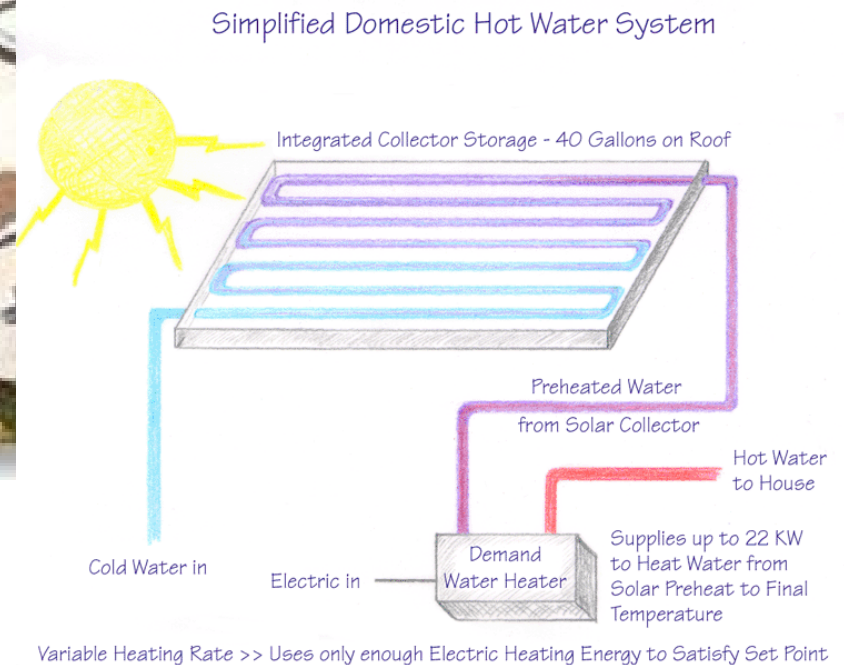


Utility must be ON to have PV power

**Utility must “net-meter”:
credit the home for
electricity fed back to
the utility**

**Utility must “settle” credit
not less than once a year**

Solar Water Heating System



Solar hot water systems provide a pre-heat for domestic hot water and space heating systems.

Current ZEH Experience

- Today's Opportunity => 50% minimum reduction in total energy from the utility
- Demonstrated Range => 50 – 70% of Total Energy
- First Breakthrough Anticipated => Net-zero electric bill
- Offset for Gas Appliances Unavailable Now
- Builder's testing concept ->

ZEH '02 and '03 Projects:

Shea Homes, San Diego (100 of 300 homes)

Centex Homes, Livermore, CA (1 home)

John Wesley Miller Companies, Tucson, AZ (99 homes)

Pardee Homes, Los Angeles (Optional in 4 subdiv.)

Pardee Homes, Las Vegas (NAHB Show home +optional)

Clarum Homes, East Palo Alto (20 Homes); Watsonville, CA (250 Homes)

Morrison Homes, Sacramento (12 Homes)

Bradley Builders, Long Island, NY (1 Home), Leesburg, VA (1 home)

Claretian Associates, Chicago (3 Homes)

Habitat for Humanity, Oak Ridge, TN (5 homes)

ZEH Projects in progress:

- Premier Homes, Sacramento (144 homes)
- Centex Homes, San Ramon, CA (2 models & optional)
- Northern Capital, Inc., San Diego (50 homes)
- Lennar/BVHP, San Francisco (1,600 homes)
- Ponderosa Homes (1 home)
- Clarum Homes, Menlo Park, CA (20 homes)
- Pardee Homes, San Diego (126 homes)
- Pinnacle Homes, Las Vegas (1 home)
- Western Massachusetts Electric Company (1 home)
- Clarum Homes, Borrego Springs, CA (4 homes)
- Habitat for Humanity, Sacramento, CA (1 home)
- Gensis Group, Atlantic City, NJ (6 homes)
- Austin Department of Housing + utility, Austin, TX (100 homes)
- Veridian Homes, Madison, WI (1 home)
- Grupe, Sacramento (1 home)
- Monley-Cronin, Sacramento (1 home)
- Bentwood Custom Homes, Dallas, TX (1 home)



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