DOE's Zero Energy Home: From Concept to Realization

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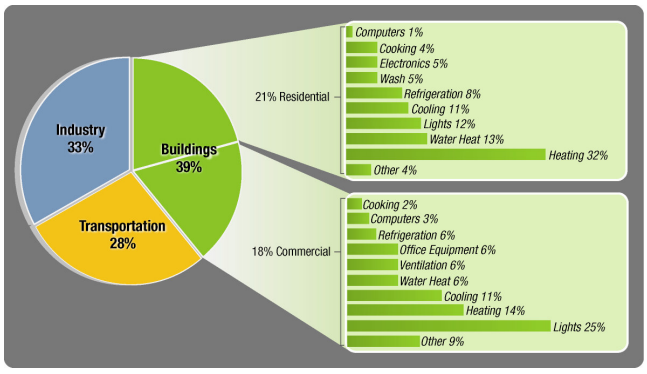
Why Are We Interested in Zero Energy Homes?

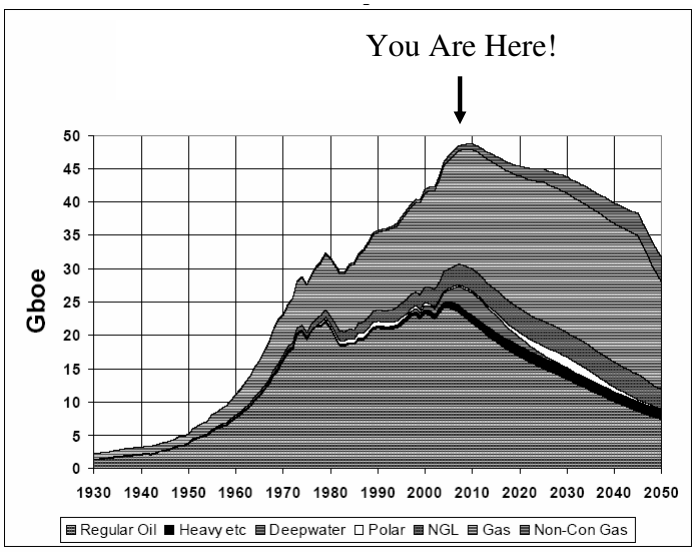
Buildings consume 39% of total U.S. energy

- **71% of electricity**
- **53% of natural gas** (primary consumption)



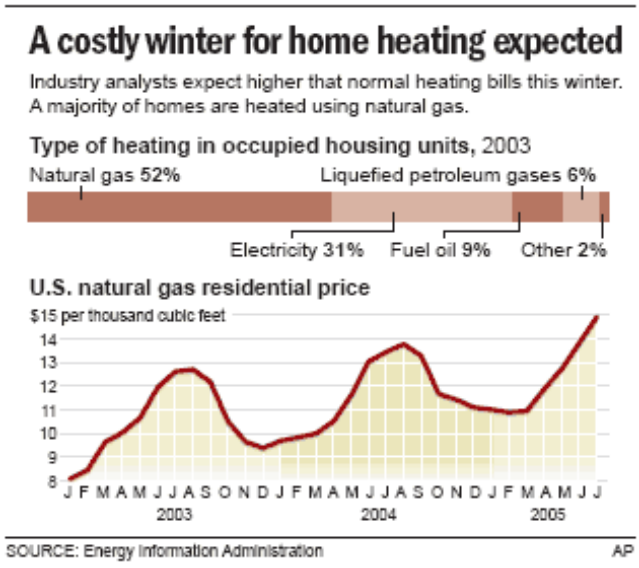
Development of cost neutral Zero Energy Homes (ZEH) is a critical part of ongoing DOE efforts to increase the efficiency of US energy use.

How Long Will Fossil Fuels Last?

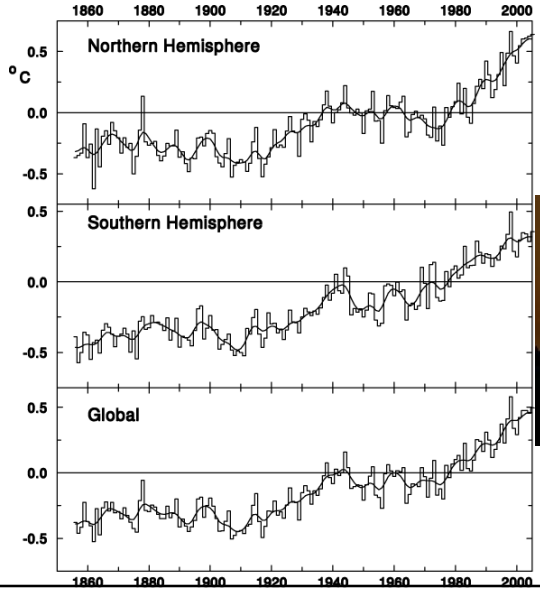


The Association for the Study of Peak Oil and Gas, October 2005 Newsletter, www.peakoil.ie

How High Will Utility Bills Go?

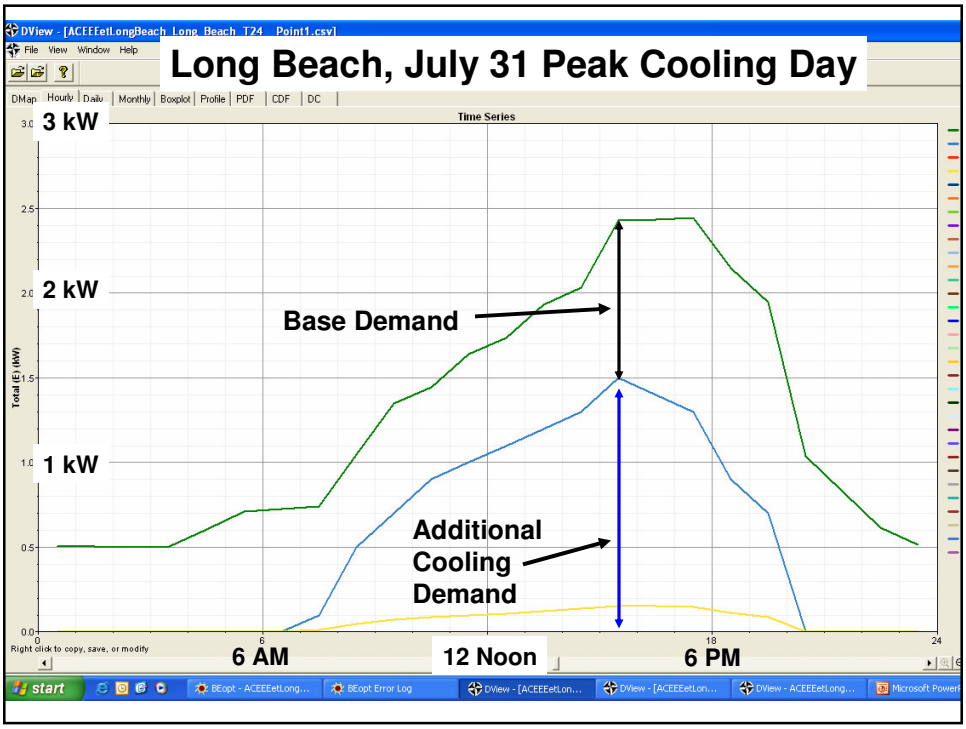


How Hot Will It Get?



"World temperatures keep rising. Climate data show 2006 on track to be hottest on record."

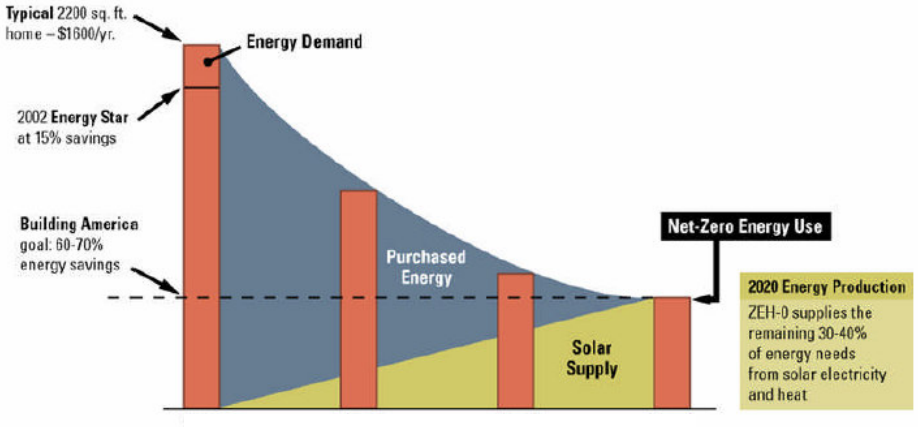
Long Beach, July 31 Peak Cooling Day



What is a Zero Energy Home?

- Zero (Net) Energy
- Zero Peak Load
- Zero Emissions
- Zero Complaints (from homebuyers)
- Zero Cost (83% in Nat. Survey of 1700 indicated that positive cash-flow with mortgage & utility bills is fine)

How Far Can We Go?



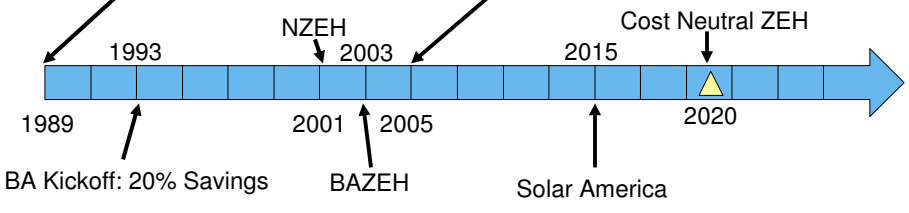
Progression to Full ZEH

Long Term Goal: Homes that Produce as Much Energy as they Use on an Annual Basis.

How Far Have We Come?

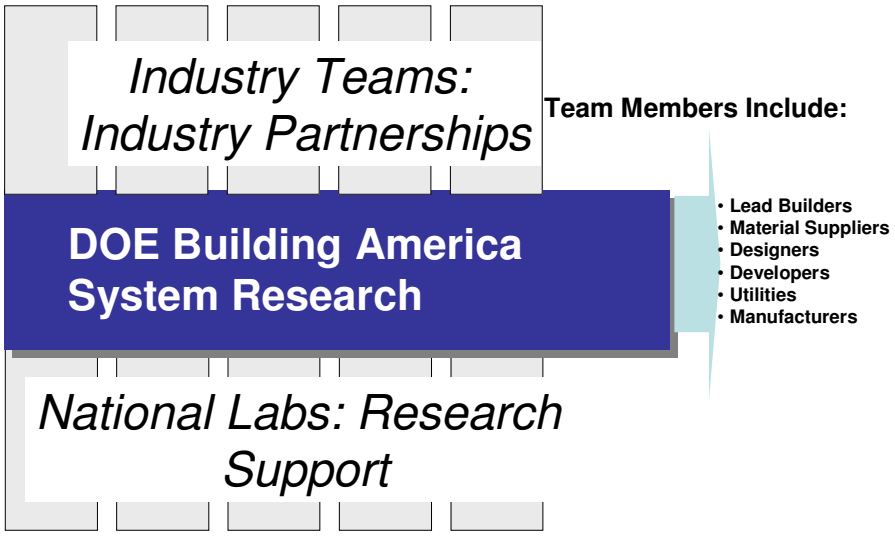
Over 40,000 BA Research Homes Completed

Brief History of BA Residential Innovation



Over 30,000 BA Homes Completed

Cost Shared R&D Approach



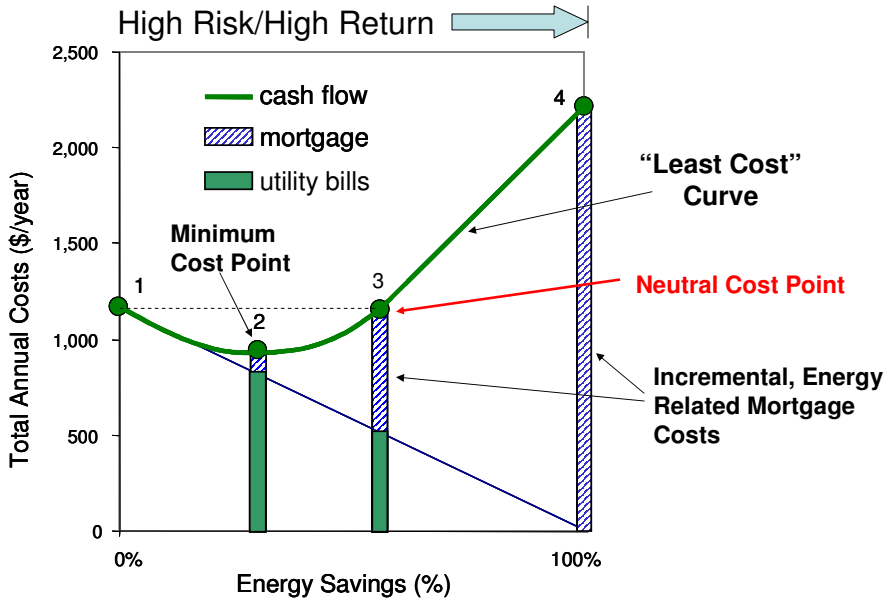
EEBA, Energy Star, Engineered for Life, ComfortWise, CEC, CEE Lighting for Tomorrow, RESNET, and Others are Deployment Partners

How Much Does it Cost?

Example BA Project Cost Summary:
Cold Climate

Advanced Framing	- $250
High performance windows	+ $250
Controlled ventilation system	+ $150
Power vented gas water heater	+ $300
Simplified duct distribution	- $250
Downsize air conditioner by 1 ton	- $350
Net Benefit	- $150

Homeowner Costs vs. Savings



ZEH Developments in California

Builder	Location	# ZEH	PV	Savings
SheaHomes	San Diego	16	2.4 kw	62%
Premier Homes	Sacramento	99	2.4 kw	56%
Premier Homes	Sacramento	50	2.4 kw	57%
Clarum Homes	Watsonville	257	Varied	47%
Centex Homes	San Ramon	32	3.5 kW	58%

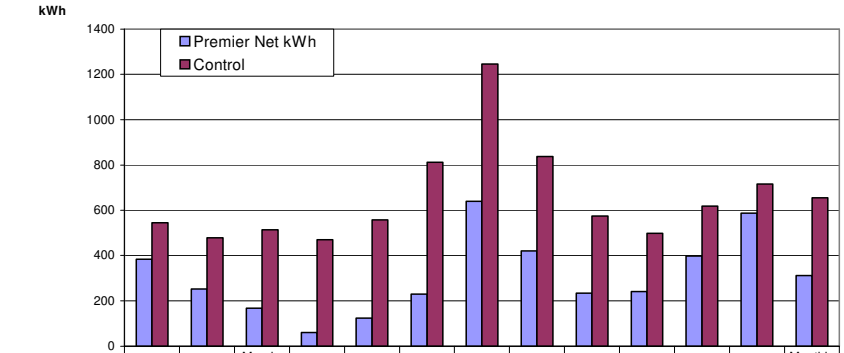
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT
The Power To Do More.

CONSOL

Energy Efficiency Features

	Non-ZEH	Premier
Walls	*R-13 + 1"Foam with Stucco*	
Ceiling Ins.	R-30	R-38
Windows	*Vinyl-Framed Low-E2*	
AFUE	80	92
SEER	10	14 w/TXV
Air Flows	Normal	ACCA - Tested
Ducts (attic)	R-4.2	Buried in ceiling Ins
Duct Sealing	Normal	Sealed
Air Infiltration	Normal	<3 SLA, tested
Water Heater	40gal 0.60EF	Tankless 0.82EF
Lights	Incandescent	Fluorescent
Solar	None	2.4kW BIPV

Impact of ZEH on Mo. kWh



	Jan,05	Feb, 05	March, 05	April, 05	May, 05	June, 05	July, 05	Aug, 05	Sept, 05	Oct, 05	Nov, 05	Dec, 05	Monthly Avg
Premier Net kWh	385	252	168	61	123	229	640	421	234	241	399	587	312
Control	545	478	514	471	558	812	1246	838	575	498	619	716	655

Example Program Design: CA New Solar Homes Partnership

- Incentives Based on PV Performance Calculator with TDV Place Priority on High production in sunnier climates
  - Higher incentives in high peak load, high growth, high T&D cost areas
  - Higher incentives for efficient PV modules and inverters
  - Lower incentives for partially shaded arrays, poor orientation or tilt
- Performance calculator used to determine expected performance of actual system/location and compare to the reference to determine the incentive

Example Program Design: CA New Solar Homes Partnership

- Tier I: minimum EE to qualify for program
- Tier II goal: positive cash-flow for consumer
  - Mortgage increase offset by utility savings
  - Energy efficiency crucial
  - Approximately 50% of savings benefit from energy efficiency at 10% of cost (before incentives)

Example Program Design: CA New Solar Homes Partnership

- Tier I: Mainly solar impact
- Tier II: Large combined benefits
  - 40% Cooling reduction
  - Coincident solar production (W – SE orientation)
  - Approx 60% reduction in peak from combination of efficiency and solar
  - Benefit to consumer with TOU electricity rates

Example Program Design: CA New Solar Homes Partnership

- Tier I: 15% over Title 24
  - $500 - $1,000 incr. cost
- Tier II: Building America
  - 35% improvement over Title 24
    - 40% improvement in Title 24 cooling
  - $2,500 - $3,000 incr. cost
- Both Tiers
  - Title 24 lighting
  - Field verification
    - Both efficiency and solar
    - 3rd Party inspections and tests

Example Program Design: CA New Solar Homes Partnership

- Tier I
  - $2.50/watt
  - 15% incentive (Utility programs: $500 typical)
  - Basic marketing support (logo)
- Tier II
  - $2.60/watt
  - Efficiency incentive (est. $2,000, new utility program)
  - Local jurisdictional support
  - Local marketing support

Example Program Design: CA New Solar Homes Partnership

Field Verification Process

- Same process used for field verification for energy efficiency for Title 24, New Construction programs, Energy Star, Federal Tax Credits
- Installer tests and certifies every system
- HERS raters verify and test a sample of systems

Other ZEH Initiatives:

Please see our website at:
www.buildingamerica.gov

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