

Building 

The Rebel Yell

NATION

Marketplace

thedailygreen

wednesday, december 5
the consumer's guide to the green revolution

news | tips & advice | green homes | new green cuisine | living green

HOME > NEWS > NEWS ARTICLES

news

10.19.2007 12:00 am

California Aims for Zero Energy Homes

All New Homes Built After 2020 Would Make as Much Energy as they Use

 e-mail  print  rss

share:  digg  reddit  more

By Dan Shapley

submit to  reddit  digg it

0 diggs
California energy regulators adopted an ambitious first-of-its-kind rule yesterday, making it a goal that all new homes built after 2020 produce as much energy as they consume, according to the Los Angeles Times.

With so-called "distributed energy" technology includes

related articles

- ▶ [Solar-Powered Homes Outselling Weak Market](#)
- ▶ [McCain's energy policy speech](#)
- ▶ [2008 Candidates: The Greenest and the Leanest](#)
- ▶ [Tankless Water Heater](#)
- ▶ [Fuel Rationing, Chemtrails and Bush-Cheney Oil Men: IPCC Ex-Chair Speaks Out](#)
- ▶ [Passive Solar Heating/Cooling](#)



said. "For years now, John Wesley Miller and his company

odes and Standards Committee, was honored with NAHB's

homes built in Austin this year

Model Homebuilders is building the showcase home to help demonstrate the variety of "Green" building practices and materials that

washingtonpo

Builder

Michelle Kaufm

Green solutions prepack

Source: BUILDER Online News
Publication date: September 1

By Nigel F. Maynard

Noted California architect M set to reveal a new entry in h prefabricated houses, only th budget analyst at the

International Monetary Fu Ages ago, when offices st

used mimeograph machines, he pushed for copiers. He brought in the first word processors. He won some battles but lost many more

< Back

comment

(2002)

gy home - a home that

g house to members of research Centre will

he ZEH concept into the range of green housing, r per day for heating and nies.

an of the US DOE. "Solar pined with off-the-shelf s, solar energy can make ly priced."

n energy-saving

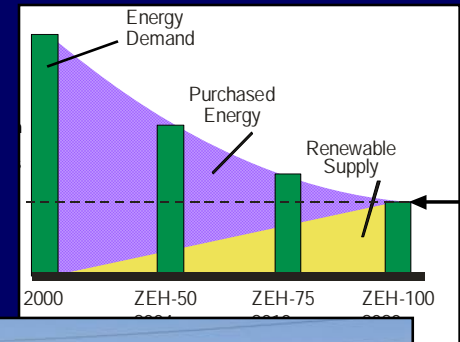
oved

 Digg This

Homes initiative
new single-family home



Zero Energy Homes: What, Why, and How?



Paul Norton
Center for Buildings and Thermal System



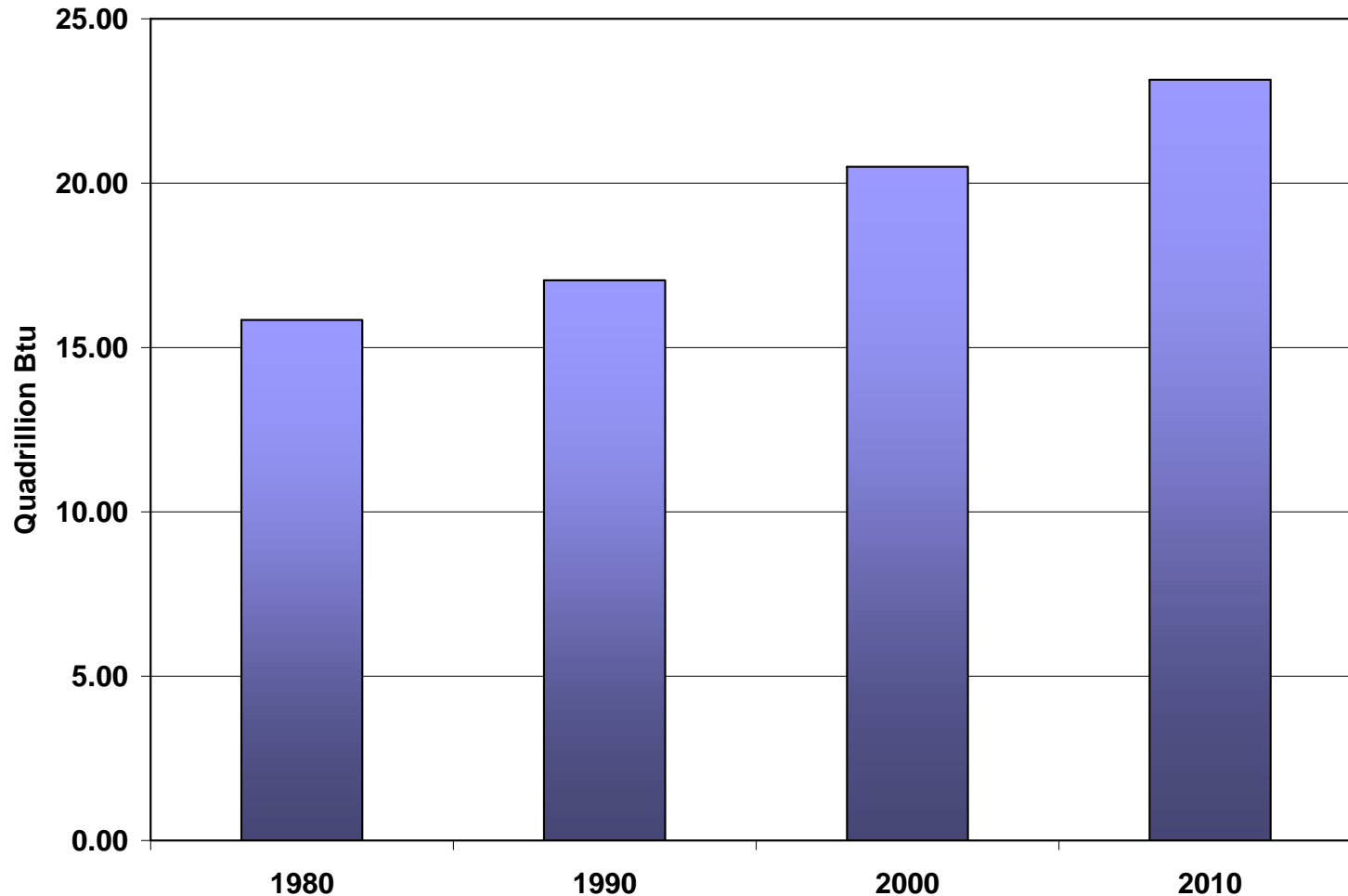
Why?

Homes account for **20%** of all
US primary energy use

Homes account for **37%** of all
US electricity use



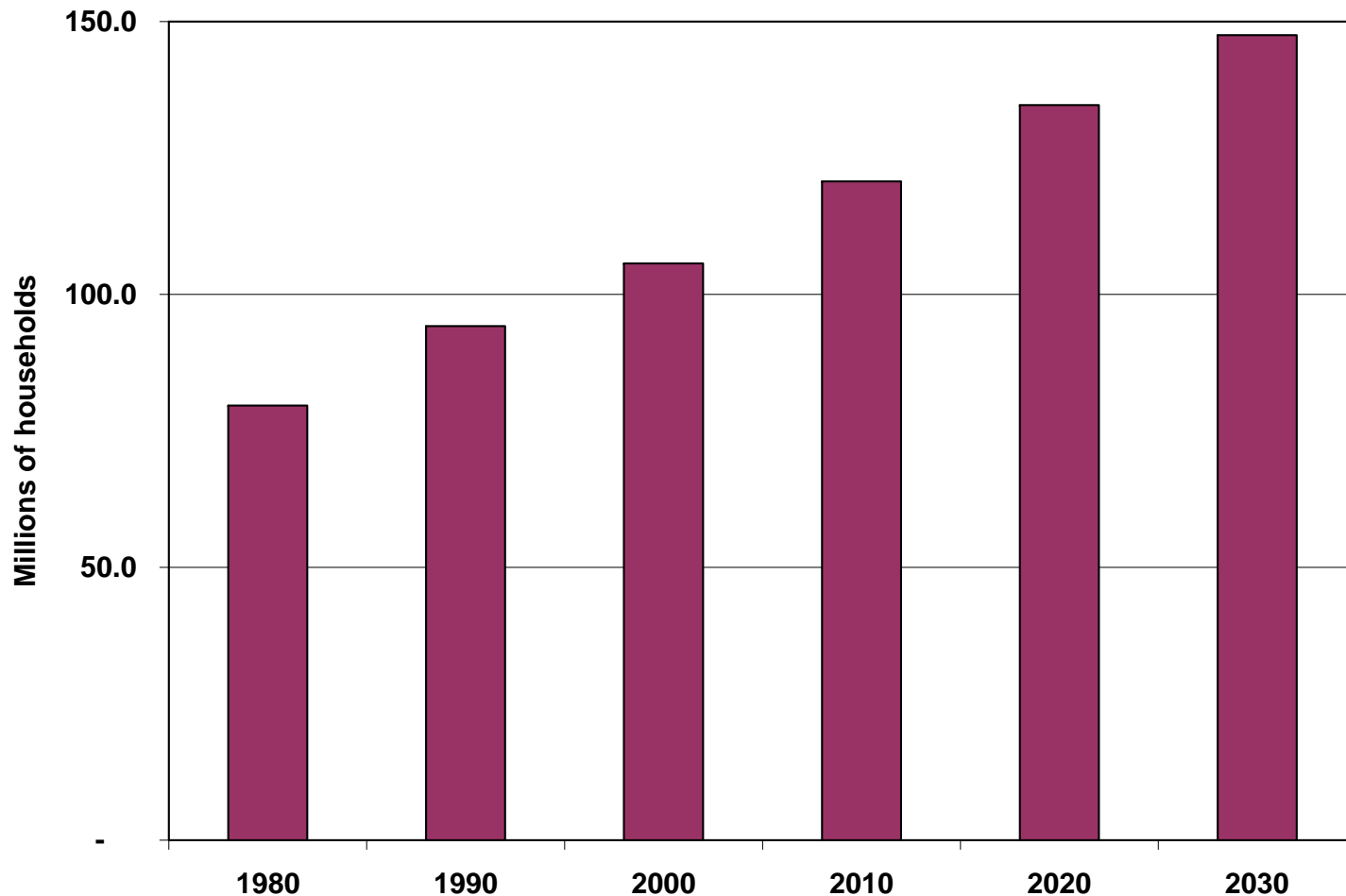
Residential energy use is growing



Residential
primary energy
consumption
Source: DOE 2007



Number of Households is Growing



Number of Households
Source: DOE 2007



McKinsey&Company

THE CONFERENCE BOARD



Reducing U.S. Greenhouse Gas Emissions: *How Much at What Cost?*



U.S. Greenhouse Gas Abatement Mapping Initiative
Executive Report
December 2007



What is a
Zero Energy Home?

~~Zero Energy Homes
consume NO energy!~~



What is a
Zero Energy Home?

**Zero Energy Homes
produce as much energy
as they consume
on an annual basis.**



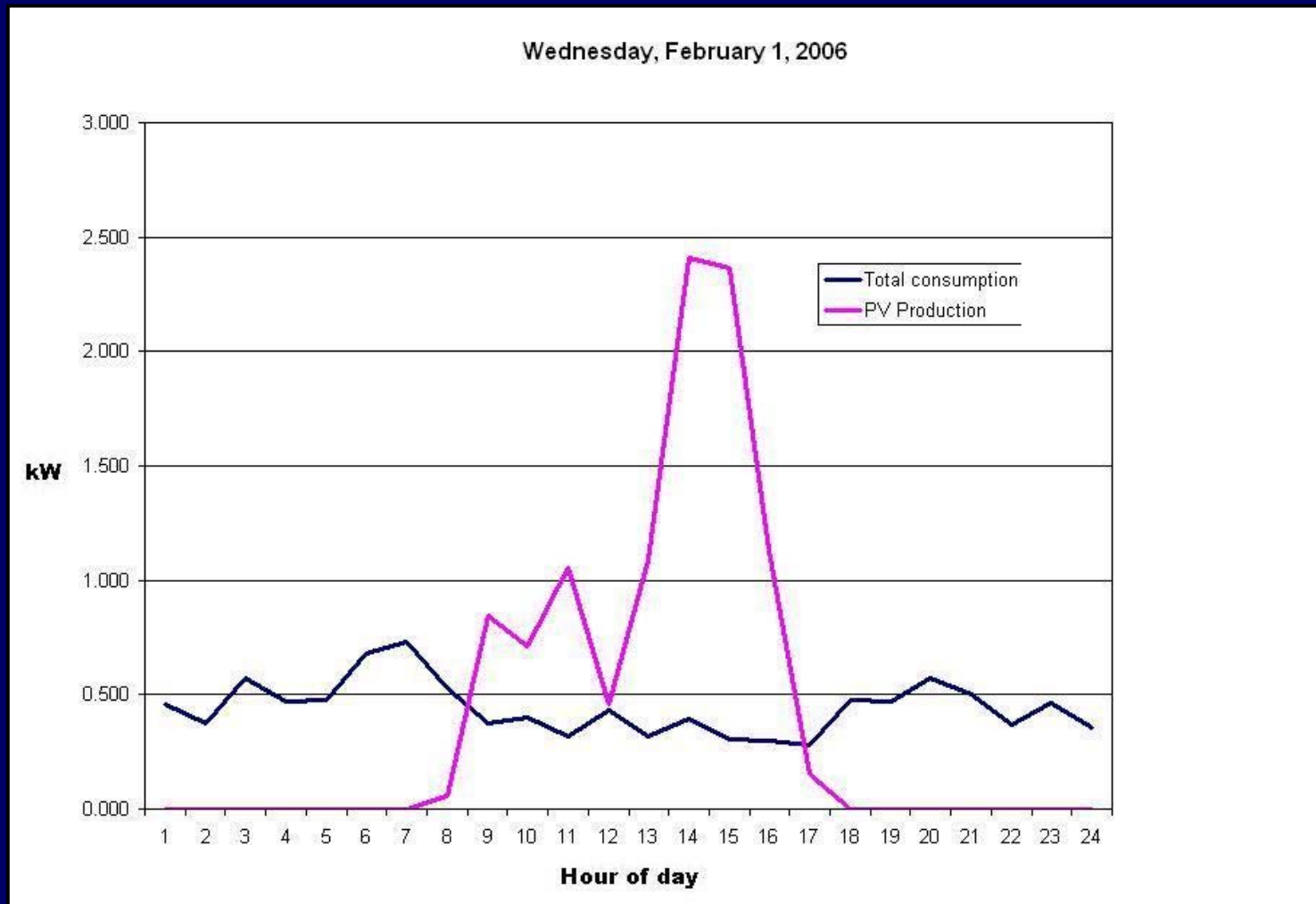
What is a Zero Energy Home?

Zero Energy Homes produce as much energy as they consume on an annual basis.

- NET zero energy
- Zero energy \neq zero utility bills
- The path to zero in new homes
- How to make a zero energy home
- Examples of zero energy homes
- What about my existing home?

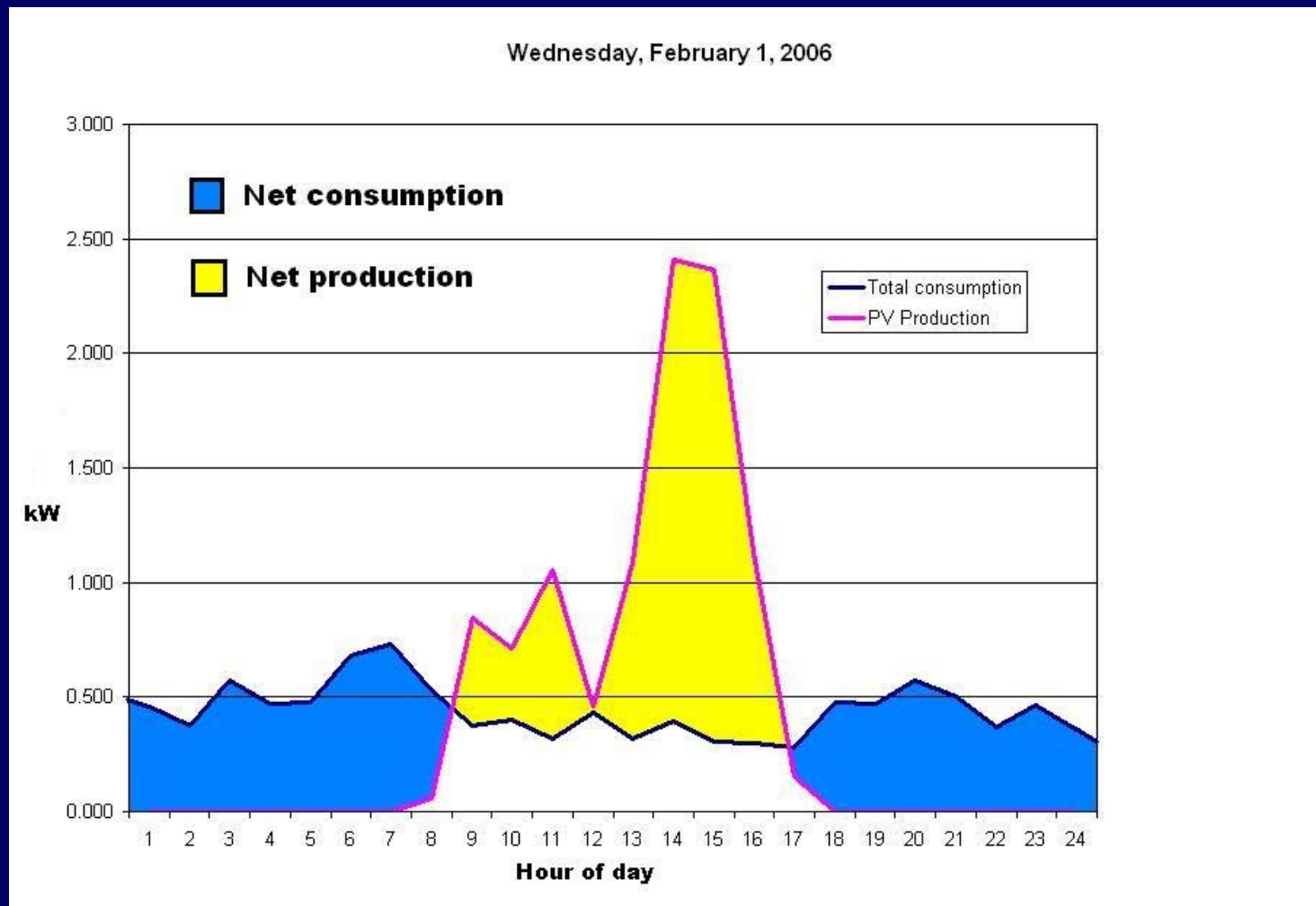


NET Zero Energy: Daily Energy Flow



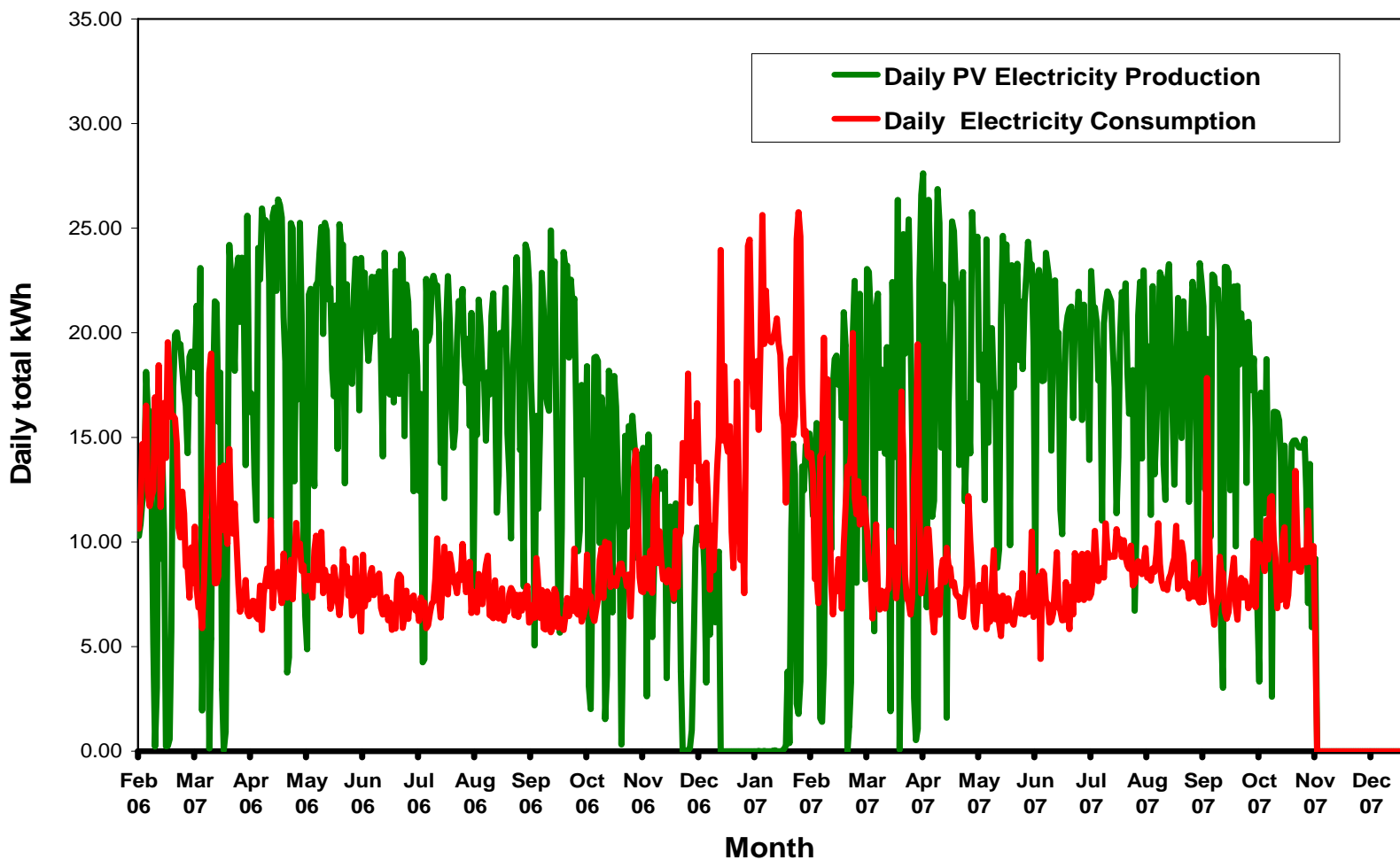


NET Zero Energy: Daily Energy Flow





NET Zero Energy: Seasonal Energy Flow







Zero energy \neq zero
utility bills

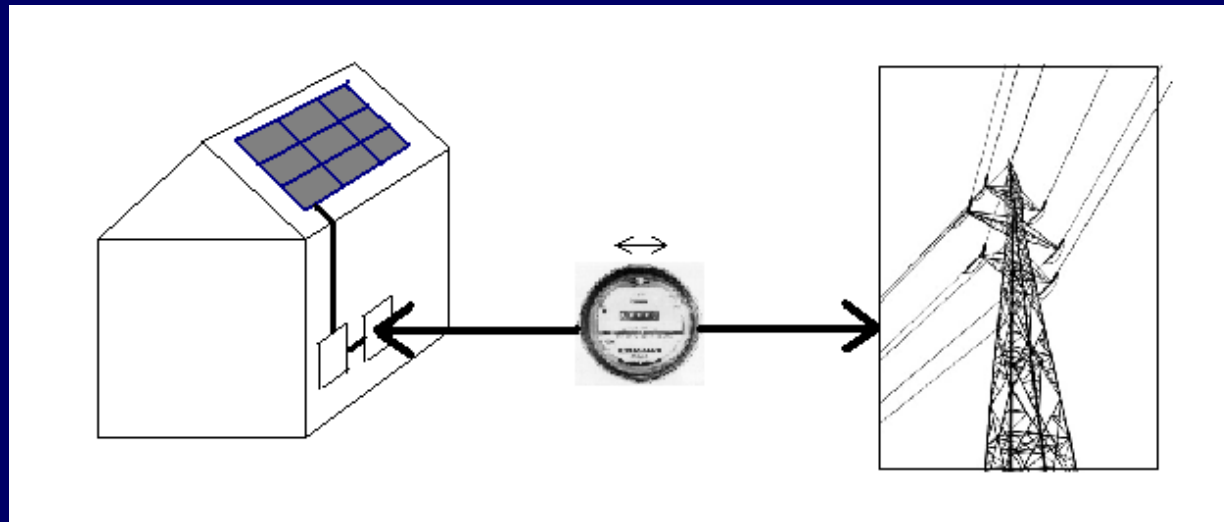
Net metering

Net billing

Feed-in tariffs



Net Metering

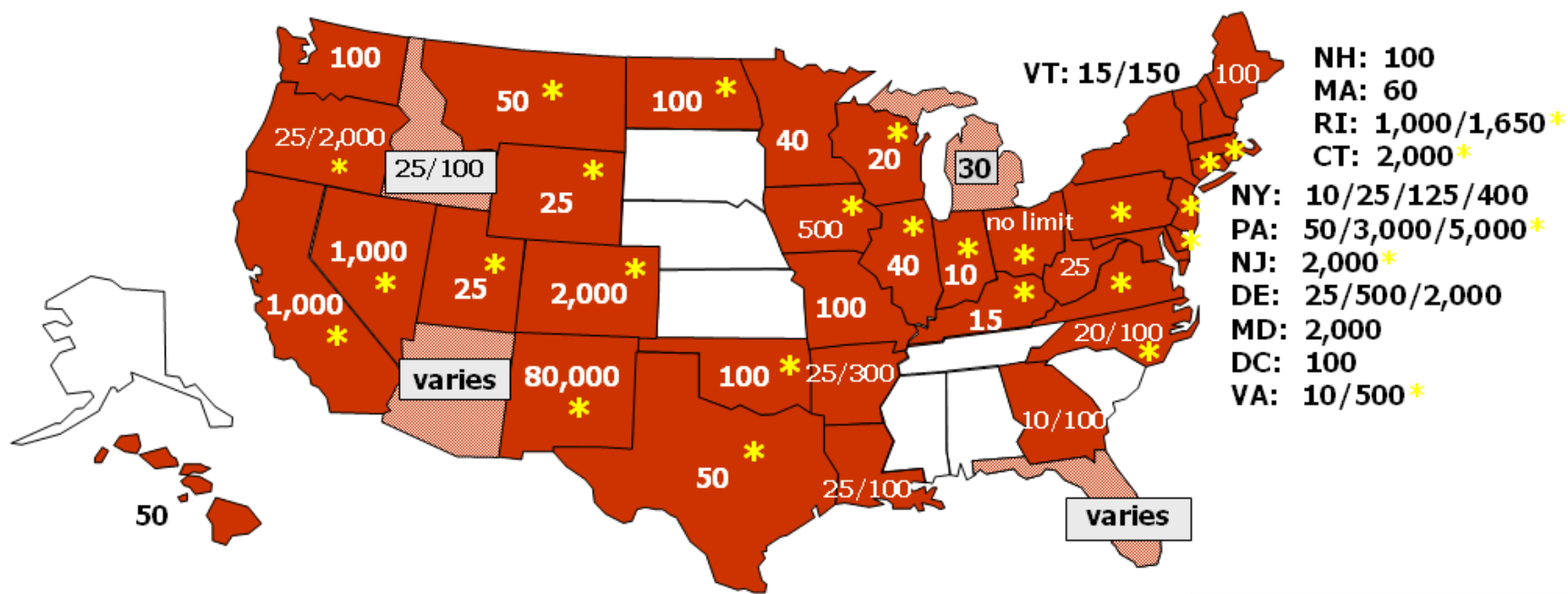


42 States now have net metering laws

In most states, the net metering requirement only applies to investor owned utilities

Colorado Xcel customers have net metering

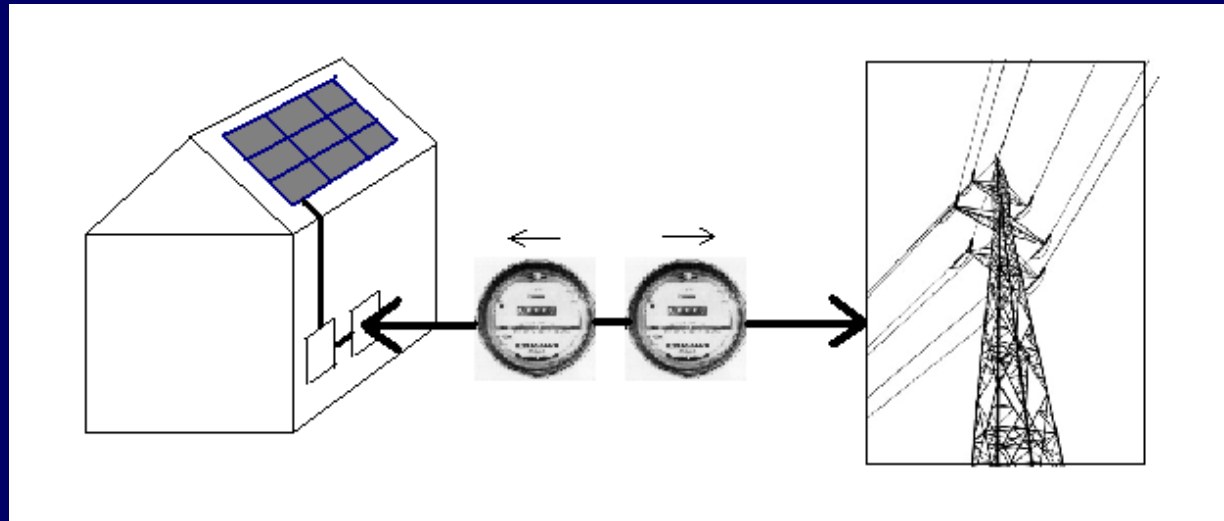
Net Metering



Net metering is available in 42 states + D.C.



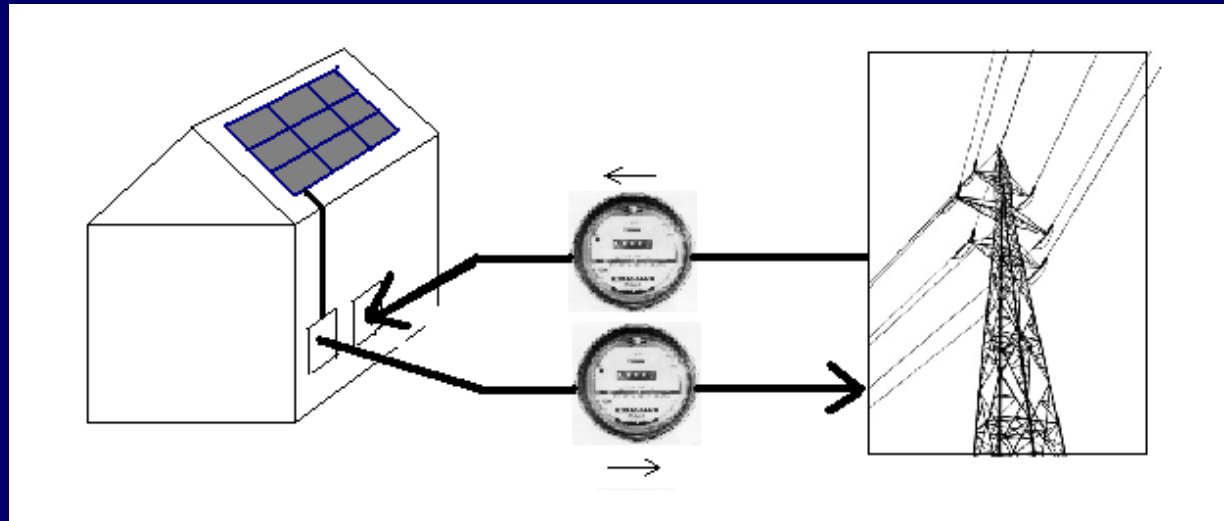
Net Billing



More common in rural coops



Feed-in Tariff



Some current feed in tariffs:

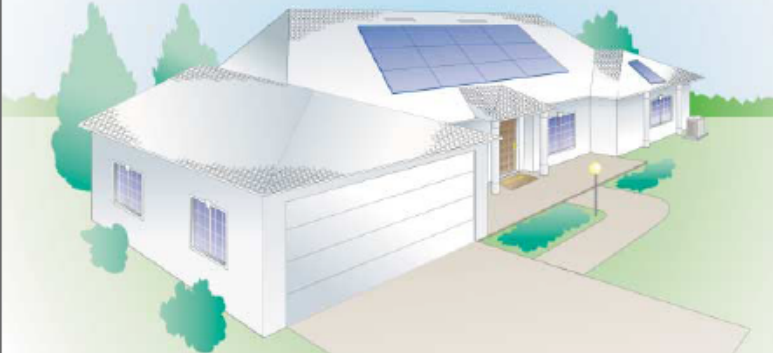
Germany
TVA

~ \$0.65/kWh
\$0.15/kWh



The path to Zero Energy

On The Path To
ZERO
Energy Homes

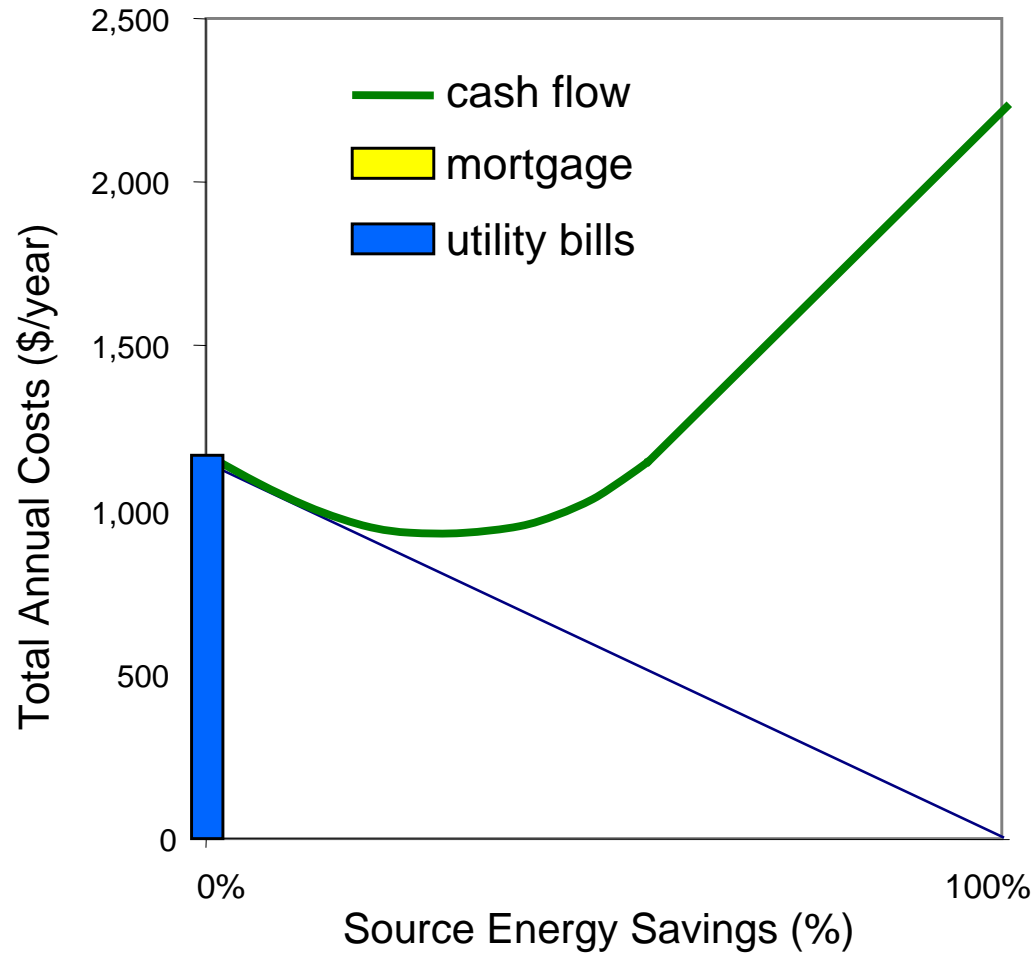
An illustration of a modern, single-story house with a white exterior and a grey roof. A large array of solar panels is mounted on the roof. The house is surrounded by green trees and a lawn. A driveway leads to a garage on the left side of the house.

*Energy efficiency and solar energy technologies
can result in zero net energy consumption
from nonrenewable sources*

During times of peak demand, a Zero Energy Home generates more power than it uses, thereby reducing power demand on the utility provider. During times of power outage, the home generates its own power, allowing the homeowner essential energy security. In a Florida study, a prototype Zero Energy Home outperforms a conventional model by providing almost all of its own power needs throughout the year.

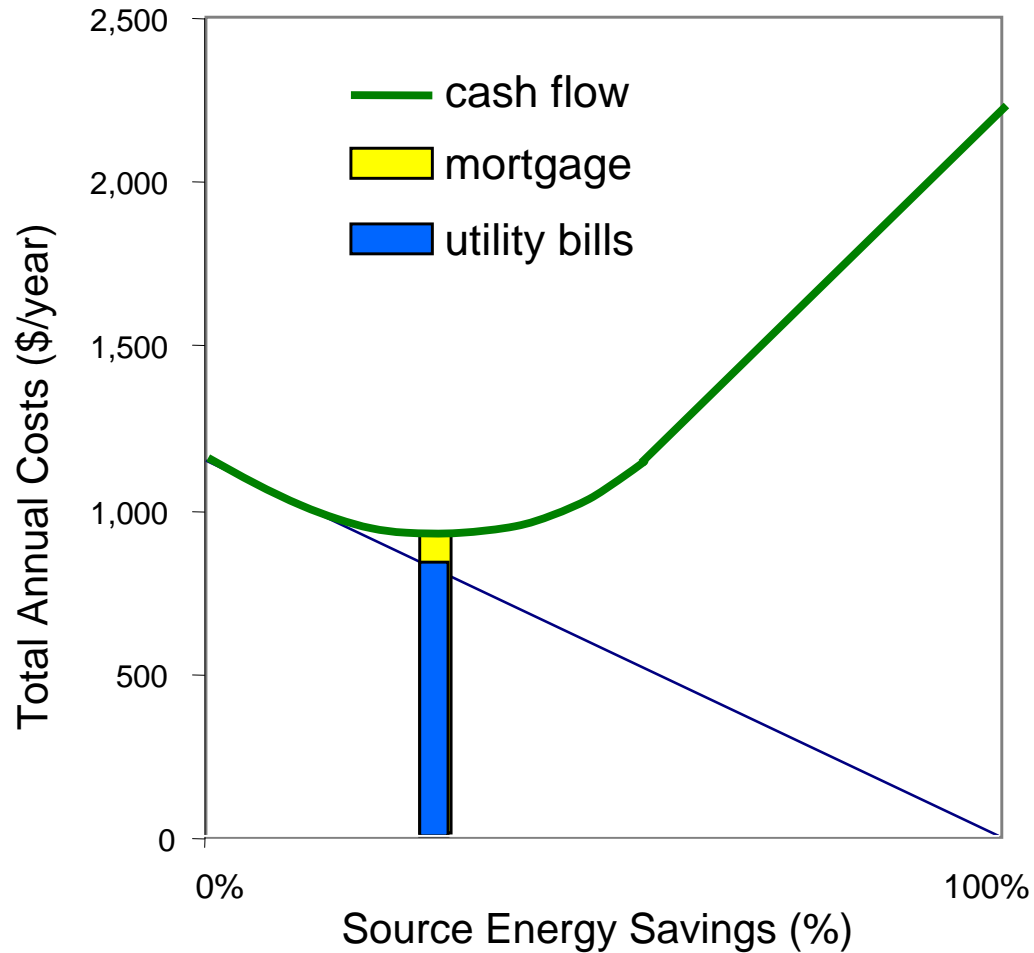


The cost effective path to Zero Energy



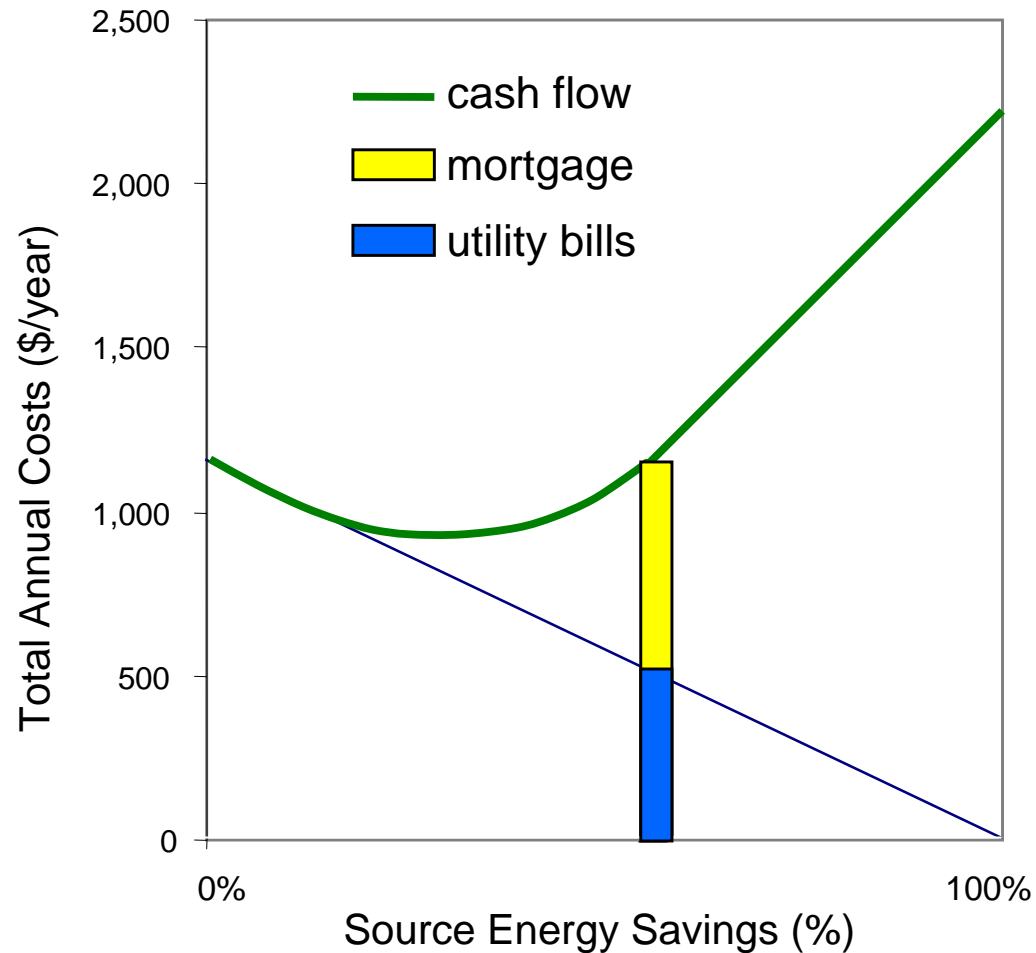


The cost effective path to Zero Energy



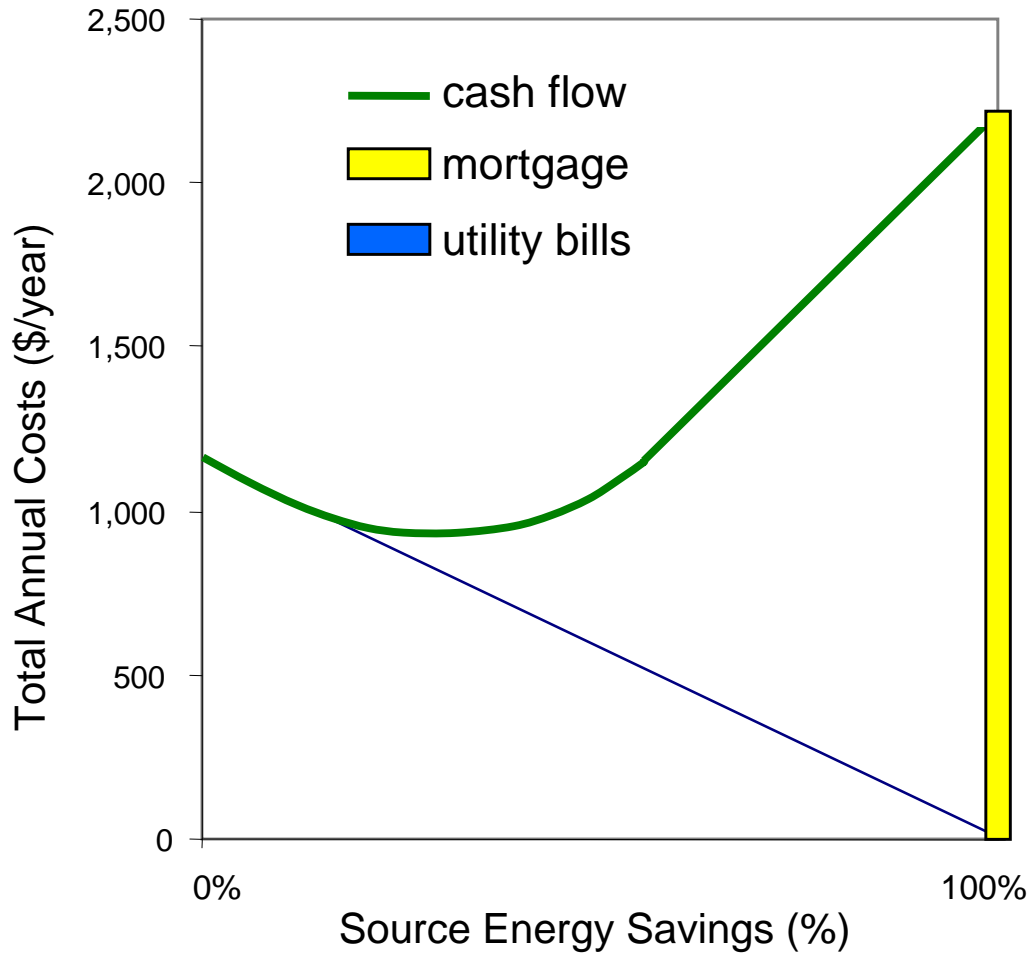


The cost effective path to Zero Energy



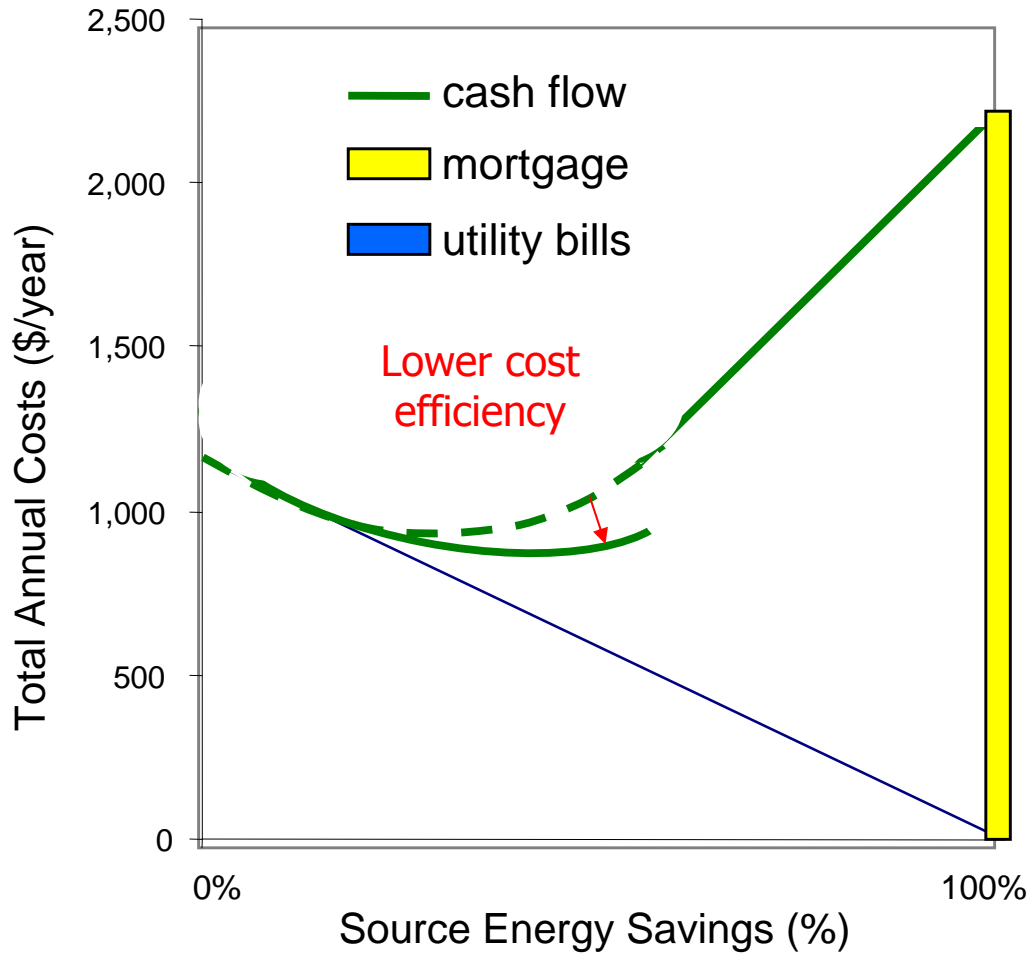


The cost effective path to Zero Energy



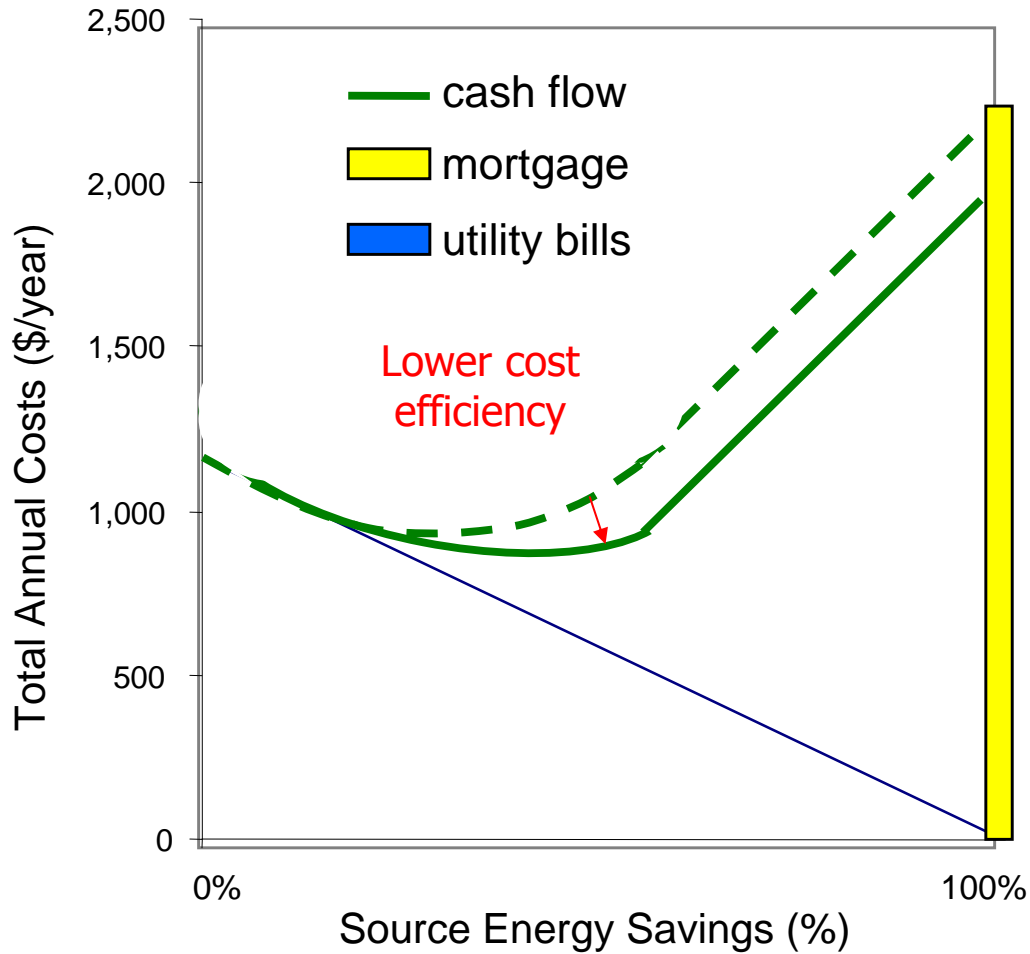


The cost effective path to Zero Energy



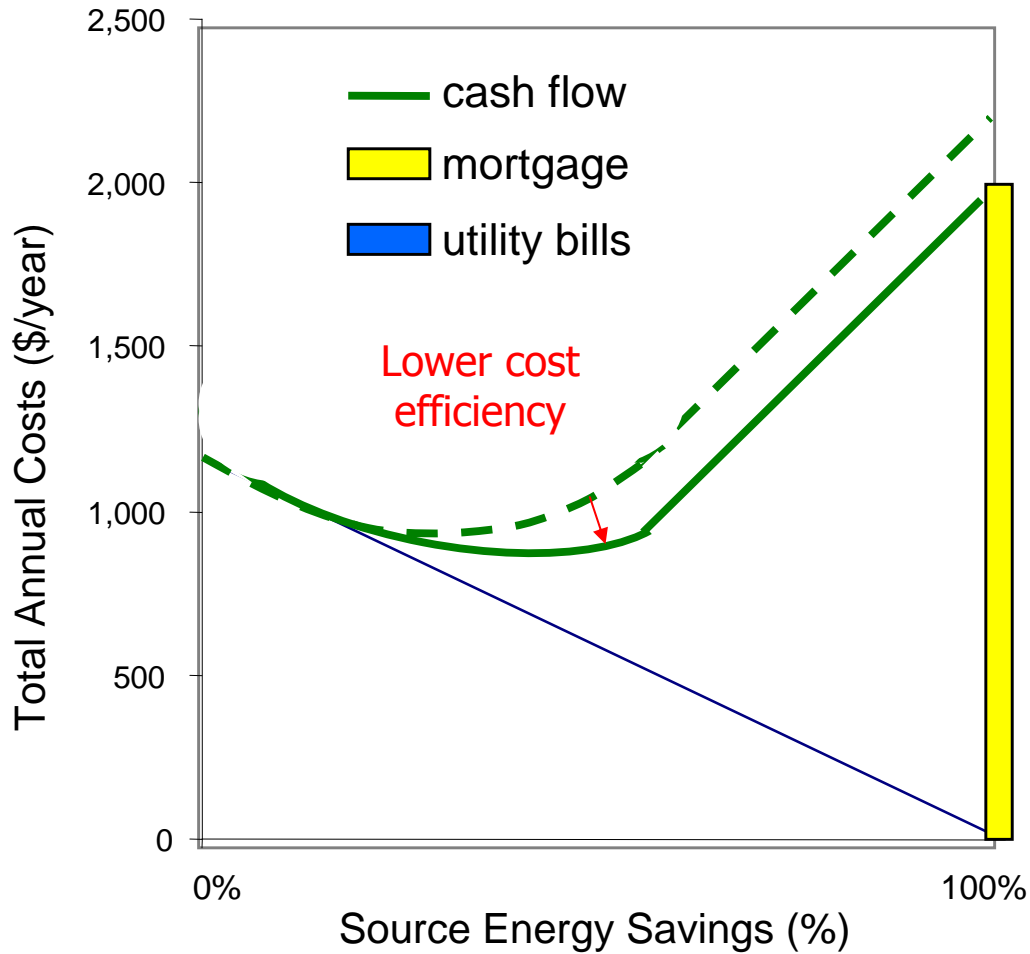


The cost effective path to Zero Energy



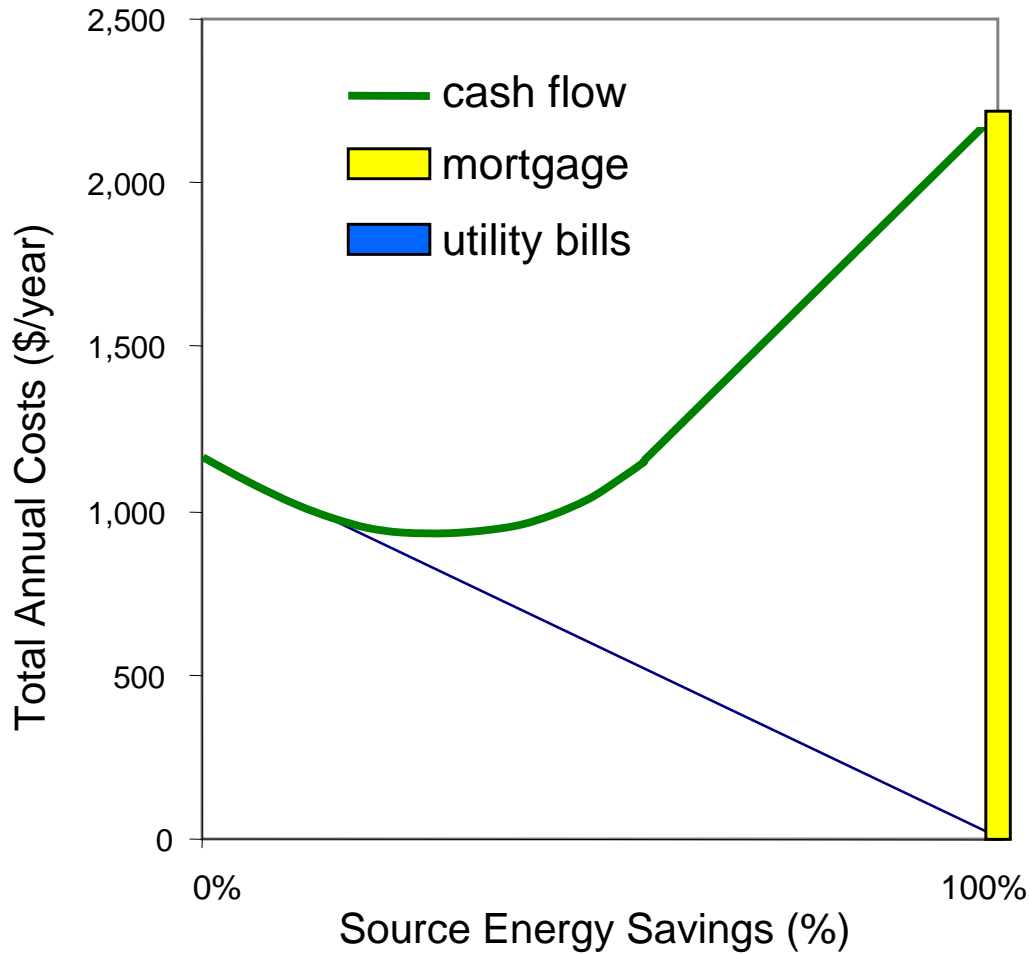


The cost effective path to Zero Energy



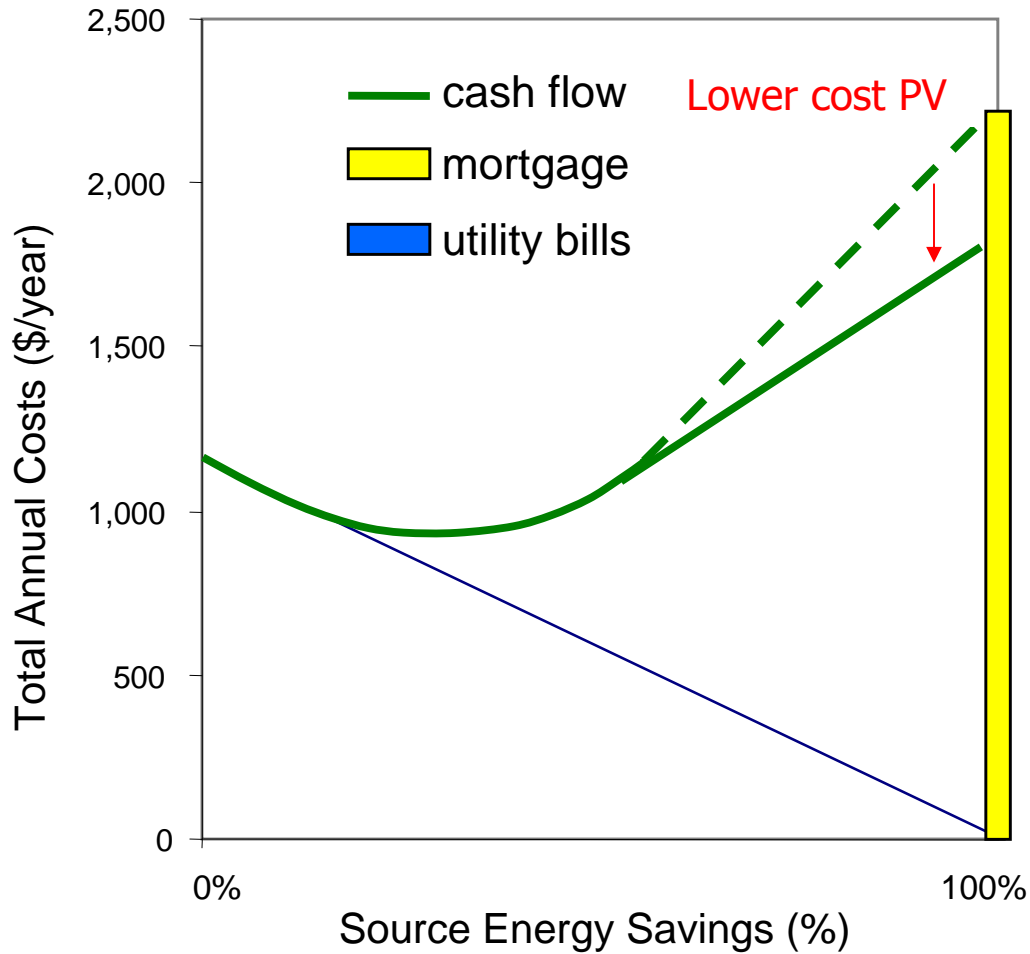


The cost effective path to Zero Energy



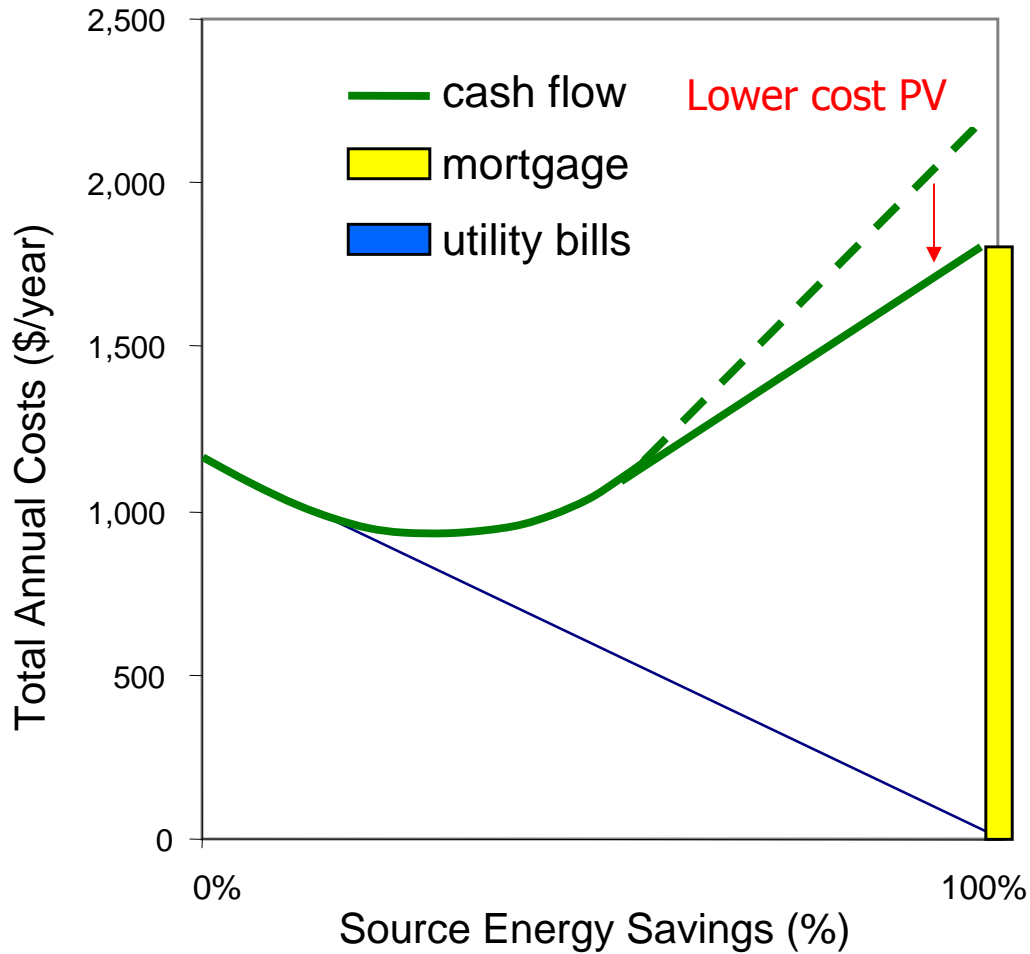


The cost effective path to Zero Energy



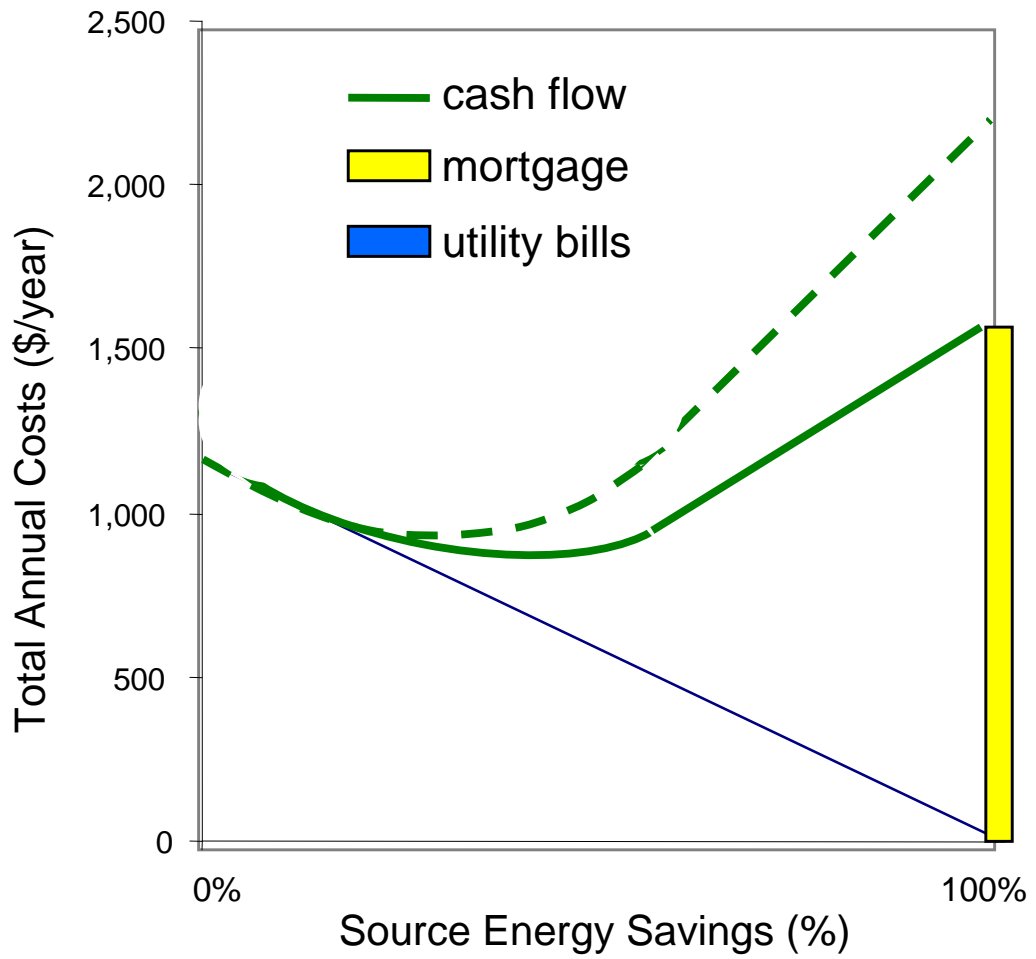


The cost effective path to Zero Energy





The cost effective path to Zero Energy





How to make a ZEH

Successful Zero Energy Homes:

1. Efficiency
2. Efficiency
3. Efficiency
4. Solar
5. Solar
6. Solar



How to make a ZEH

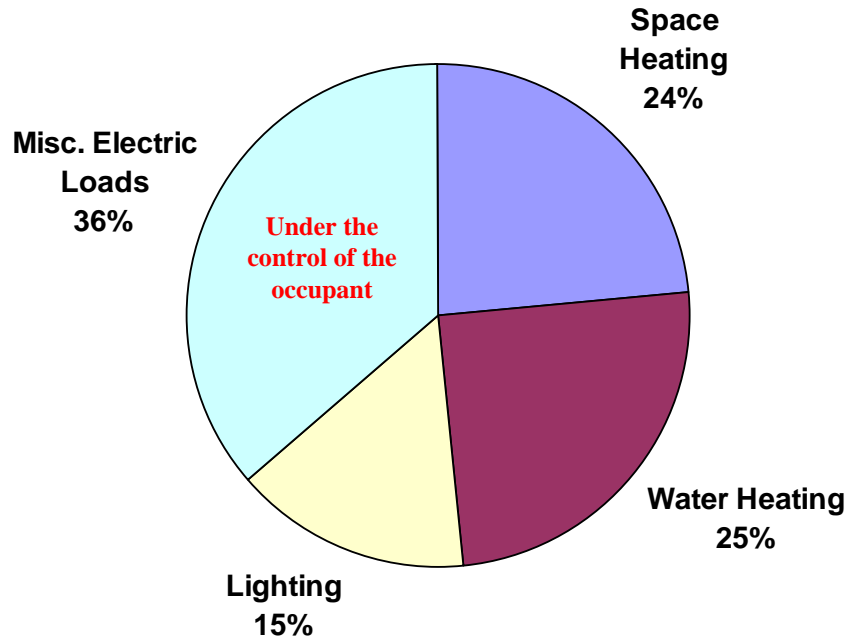
Successful Zero Energy Homes:

1. Efficiency - envelope: walls, roof, foundation
2. Efficiency - heating and cooling systems
3. Efficiency - lights and appliances
4. Solar - passive techniques
5. Solar - active thermal systems
6. Solar - electric systems (photovoltaics)

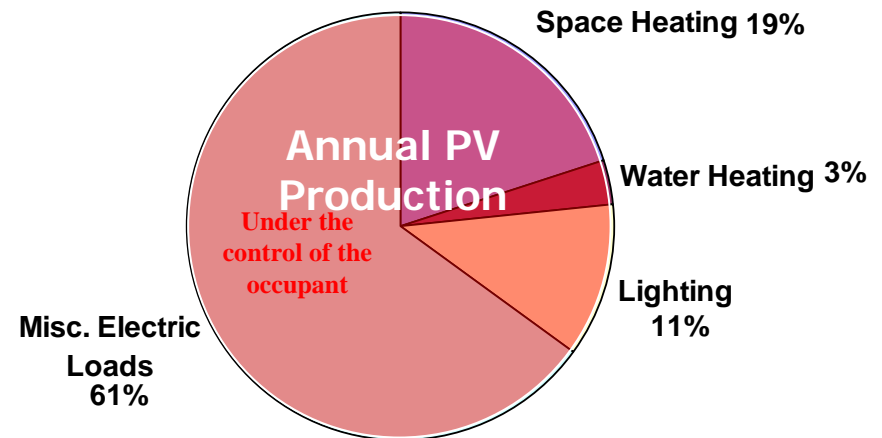


Zero Energy Guaranteed?

Energy Use in Habitat BA Benchmark House



Energy Use in the Habitat ZEH House





Will it *really* be ZERO??

In any given year, it depends on....

- **Plug loads**
(TVs, DVDs, Microwave, computers, stereo, toaster, electric blanket, hair dryer, the list goes on!)
- **Specific weather conditions**
- **Temperature set points**
- **Hot water use**

It could be!

The **house** AND the **occupants**
meet or miss the zero energy target ***TOGETHER***

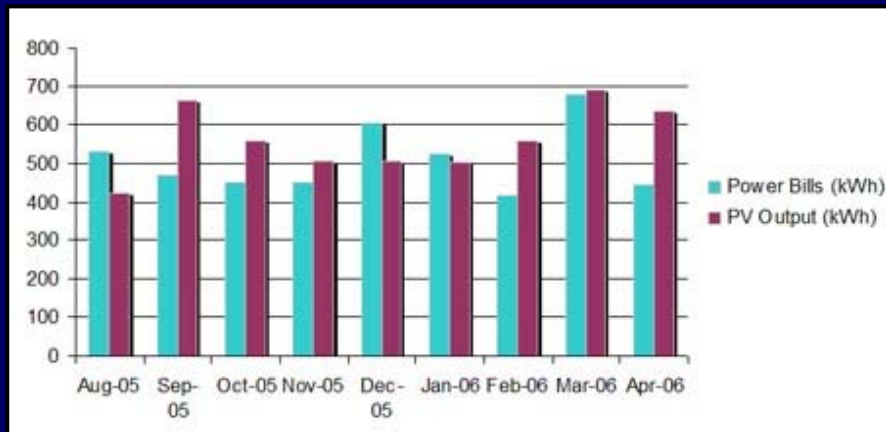
Ideal Homes ZEH

- Near Oklahoma City, OK
- 1584 ft², 3-bedrooms, 1-story
- 5.3 kW





Hickory, NC





Patterson, NJ



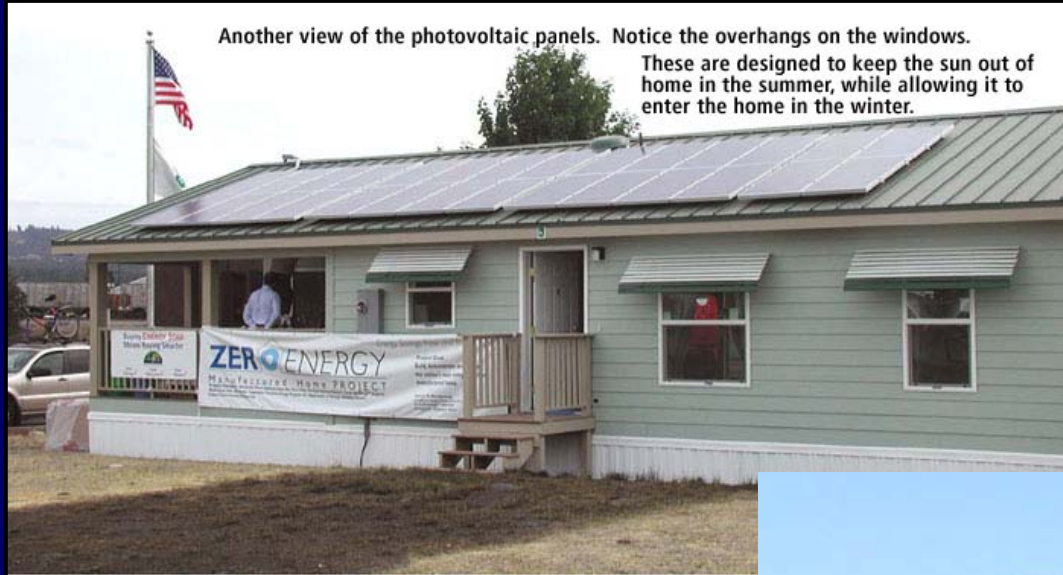


Frisco, TX 8kW PV





Washington State



Europe





Tucson, AZ





Solar Row Boulder, CO



\$529,000
2,300 sq. ft.





NREL/Habitat for Humanity Wheatridge, CO



- 1280 sq ft
- 4 kW PV



Home Features

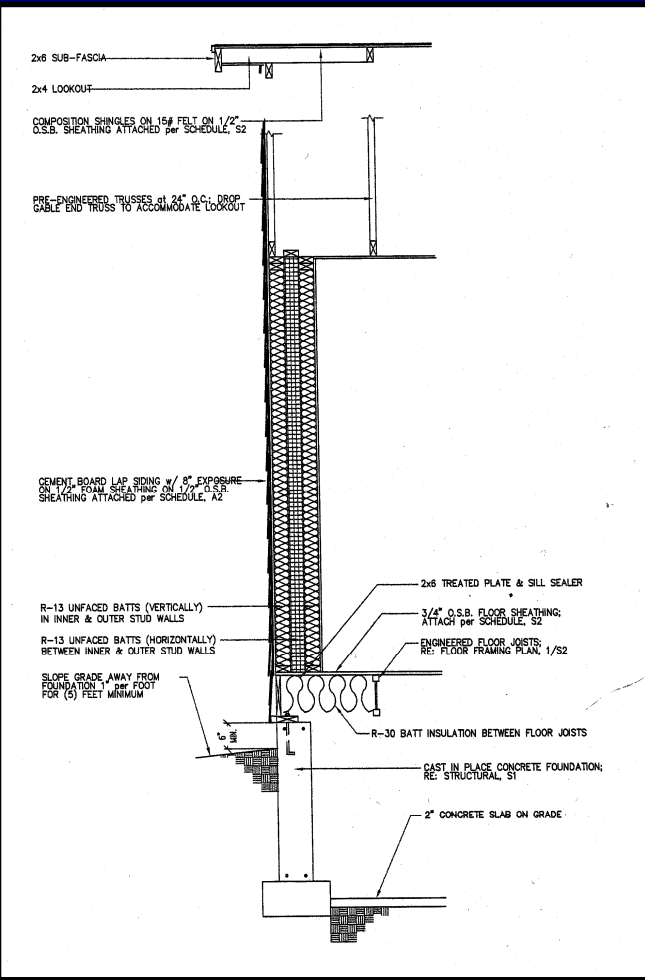
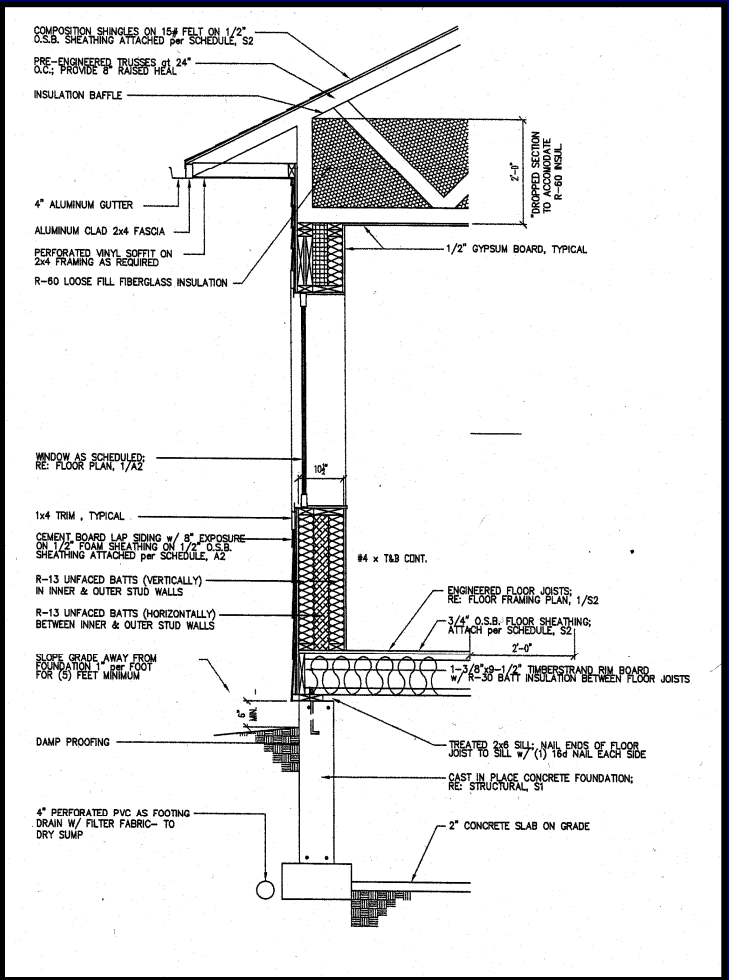
1. Make it HIGHLY Efficient!

- Superinsulated, tight building envelope, Wall R-40, Ceiling R-60
- Low-e windows
- Heat recovery ventilation
- Tankless back-up water heater
- Energy Star refrigerator and clothes washer
- Compact Fluorescent Lighting

2. Meet ALL of the Remaining Energy Needs with Solar

- Solar tempering with orientation specific windows
- 96 sq. ft. drainback solar water heating system
- 4 kW PV system

Superinsulated Construction



- Double Stud Wall
- Three layers of fiberglass batt insulation
- 24" Raised heel trusses
- Wall R-40
- Ceiling R-60
- Floor R-30
- Low-e windows



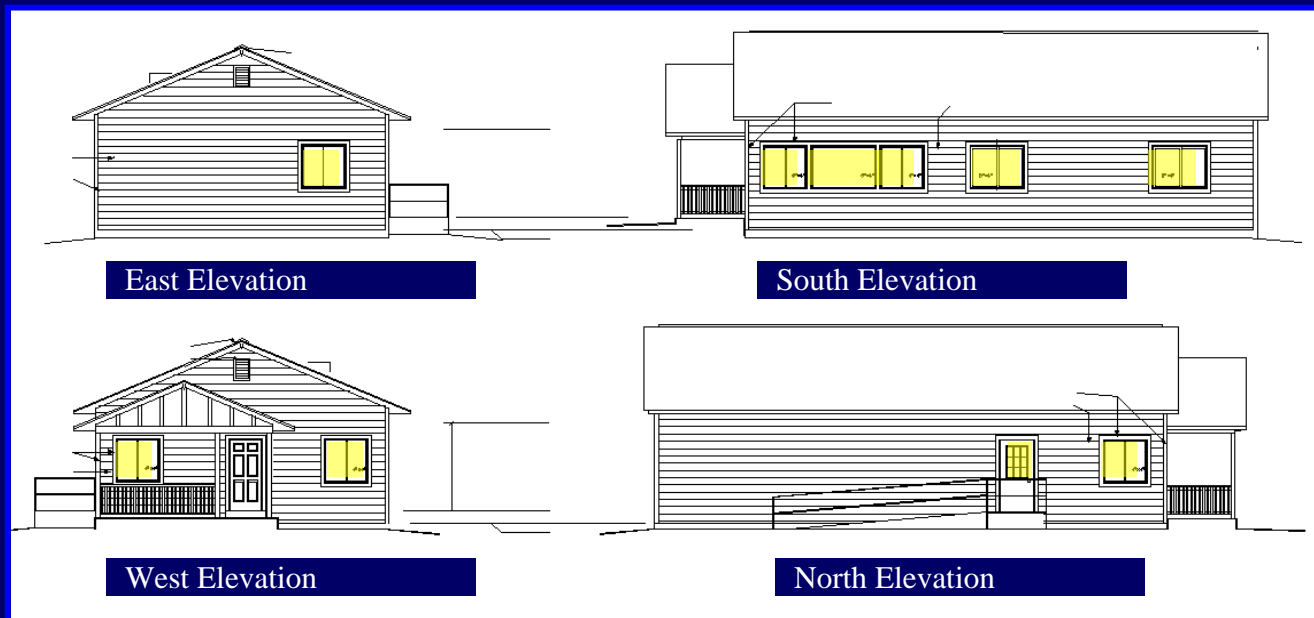








Solar Tempering



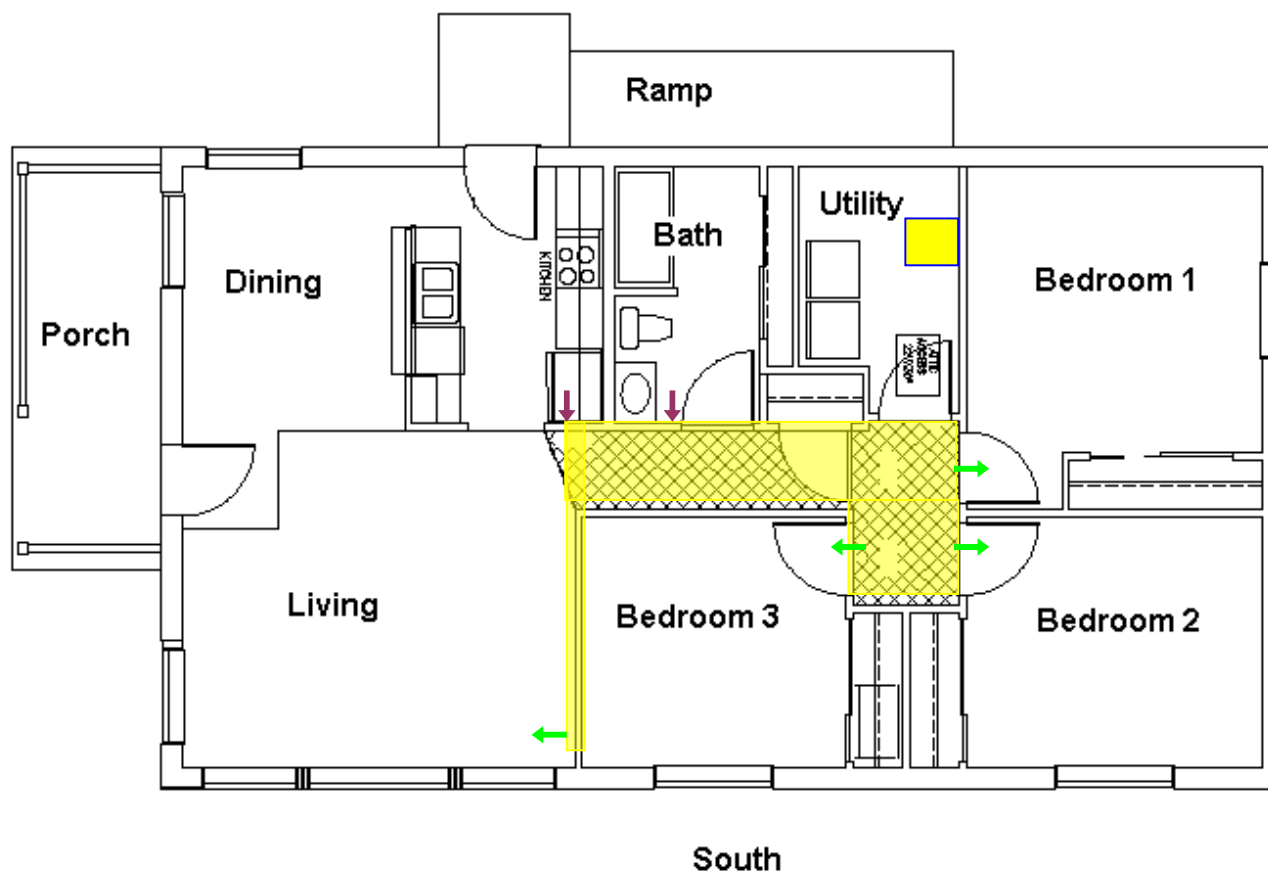
- **Window distribution**
- **Orientation specific glazing**
- **3' overhang**







Energy Recovery Ventilation



- Recovers heat from ventilation air
- 6" ducts in hallway drop ceiling





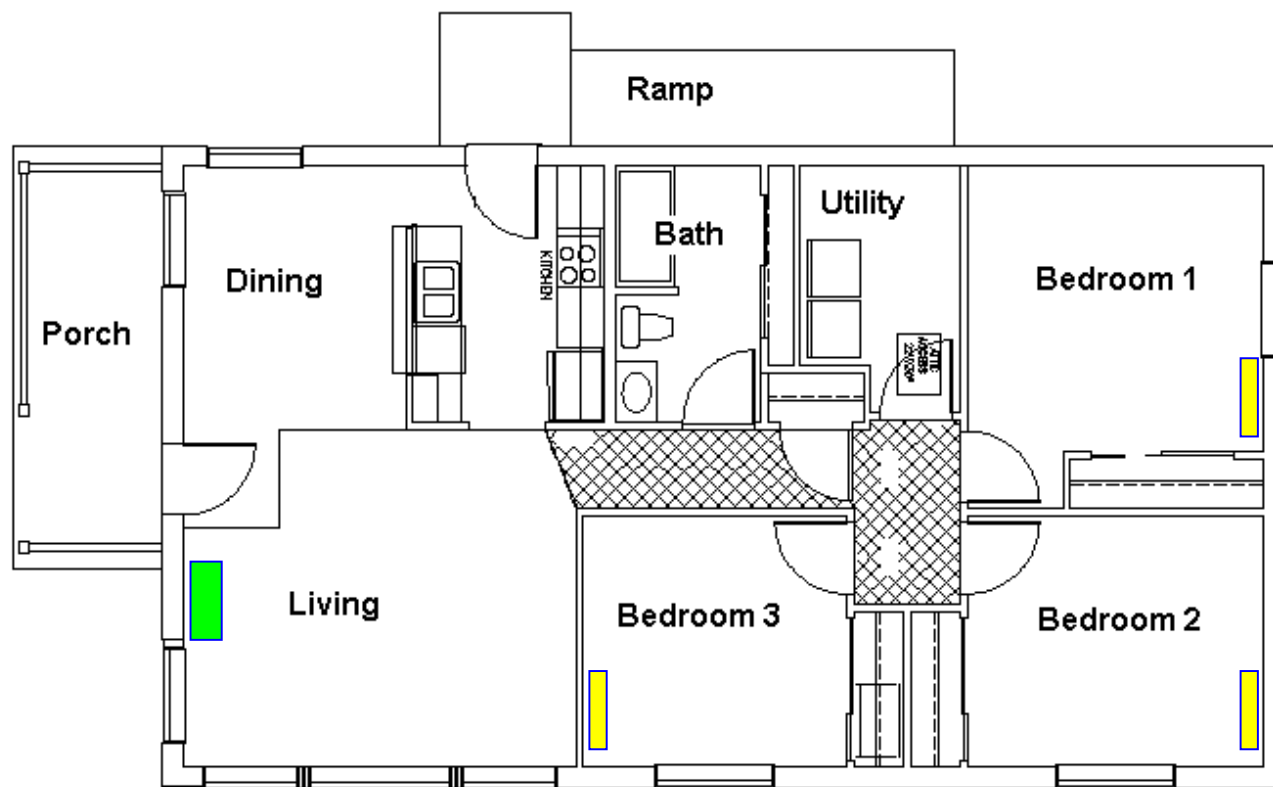








Hybrid NG/Electric Space Heating System



South

- Direct vent, single point NG heater
- Small electric baseboards in bedrooms



AIR FILTER
CLEAN THE AIR FILTER AT LEAST ONCE A WEEK
DO NOT USE THIS UNIT WITHOUT THIS FILTER
INSTALLER IS RESPONSIBLE FOR THE PROPER
INSTALLATION OF THE AIR FILTER.
REPLACE THE AIR FILTER AS SHOWN.

THIS APPLIANCE IS EQUIPPED
FOR NATURAL GAS.
THIS APPLIANCE IS NOT DESIGNED
WITH OPTIONALS OTHER THAN INSTALLATION
WITH NATURAL GAS.
FOR INFORMATION ON LP GAS USE
INSTALLATION, PLEASE SEE THE APPLIANCE
INSTALLATION MANUAL FOR LP CONVERSION
AND PREVENTION OF BACK-UP GAS.

LES APPAREILS SONT CONÇUS POUR
LE GAZ NATUREL.
CET APPAREIL N'EST PAS CONÇU POUR
ÊTRE ÉQUIPÉ D'OPTIONES AUTRES QUE L'INSTALLATION
AU GAZ NATUREL.
POUR OBTENIR PLUS D'INFORMATIONS SUR L'UTILISATION
DU GAZ LIQUIDE, VOUS DEVRIEZ CONSULTER LE MANUEL
D'INSTALLATION ET D'ENTRETIEN DE L'APPAREIL.
LE MANUEL D'INSTALLATION ET D'ENTRETIEN
DE L'APPAREIL EST DISPONIBLE EN FRANÇAIS.

NOTICE
PLEASE READ BEFORE USING THIS UNIT.
DO NOT USE THIS UNIT WITHOUT THE FILTER.
INSTALLER IS RESPONSIBLE FOR THE PROPER
INSTALLATION OF THE AIR FILTER.
REPLACE THE AIR FILTER AS SHOWN.
REPLACE THE AIR FILTER AS SHOWN.
REPLACE THE AIR FILTER AS SHOWN.

Rinnai ENERGYSAVER 556WT

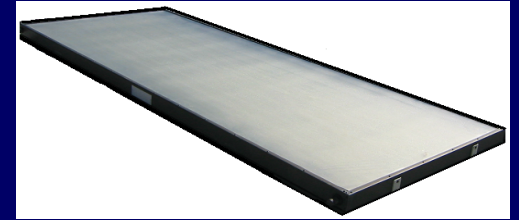
Price setting
Start Select Timer Power On/Off
[Down Arrow] [Up Arrow] [Enter] [On/Off]







Solar Water Heating System



- Drainback system
- 96 sq. ft. collector
- 200 gal storage tank
- Tankless backup heater







PV System

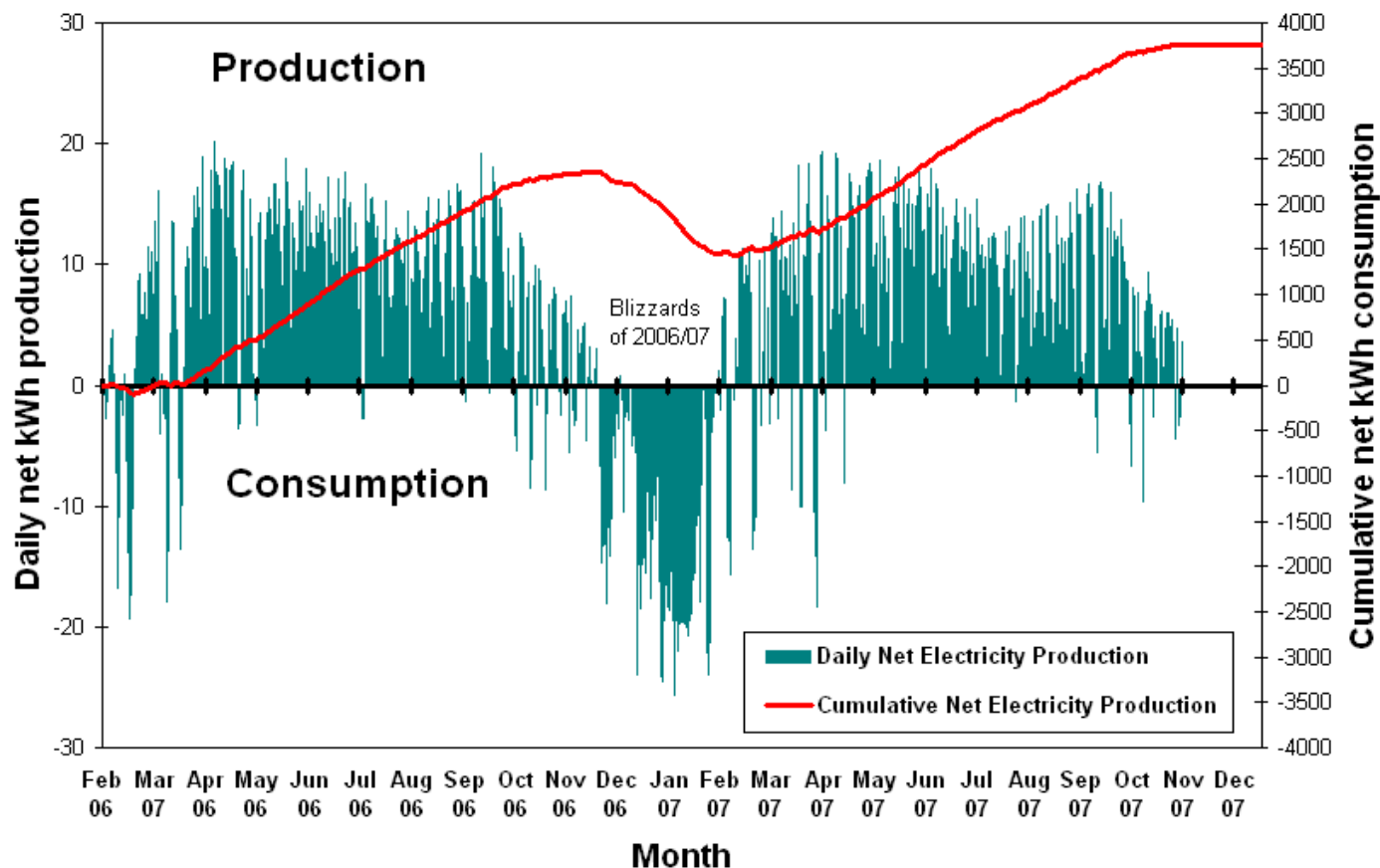


4 kW System
for net zero energy



NREL/Habitat ZEH Performance

Daily and Cumulative Net Electricity Production
February 2006 - March 2007





Zero Energy Retrofits

Can my existing home be converted
to a Zero Energy Home?



Zero Energy Retrofits

Yes.... But it is expensive





Zero Energy Retrofits

Step 1: Do the most cost effective changes first.

How? Get some expert advice!

- Energy Audit
- Home Energy Rating (HERS)
- Home Performance with Energy Star (HPwES)



Residential Energy Audit

Example: Boulder, CO

Audit cost \$100

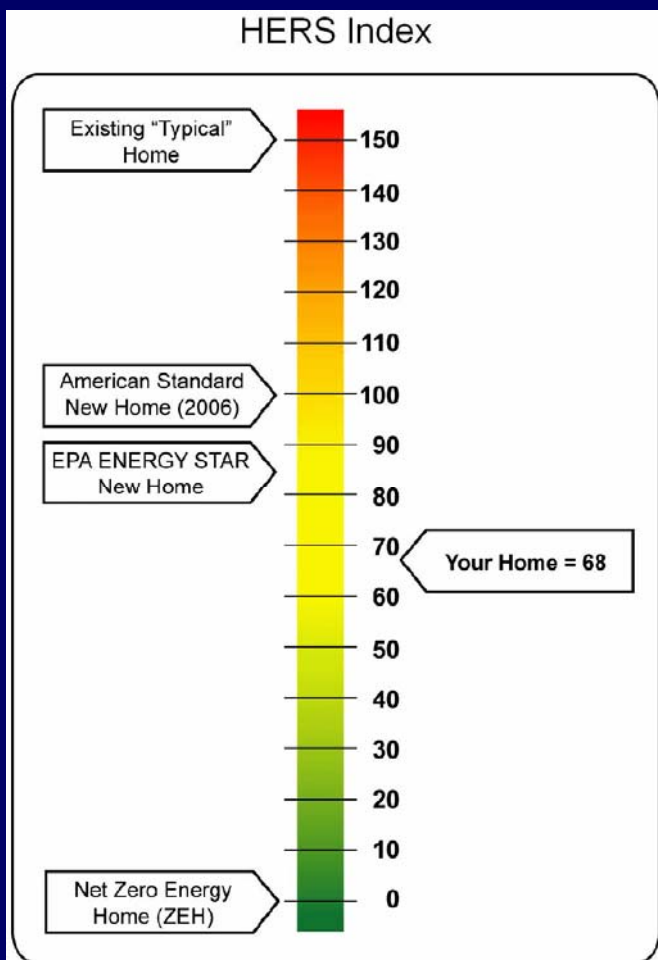
Includes blower door testing

Produces report of most cost effective changes

A screenshot of a web browser displaying the "Residential Energy Audit Program" website. The browser title is "Residential Energy Audit Program • CRC - Mozilla Firefox". The address bar shows "http://www.conservacioncenter.org/Energy_Audit_Pilot_Program.htm". The website has a blue header with navigation tabs: "About CRC", "Support the CRC", "Services For Cities", and "HOME". Below the header is a banner for the "ENERGY DIVISION" with a background image of wind turbines. The main content area features a green circular icon with a blue house silhouette, followed by the text "RESIDENTIAL ENERGY AUDIT PROGRAM". Below this is the slogan "KNOWLEDGE IS POWER" and a quote: "Every year, the average American spends \$450 on energy wasted through holes and cracks in their home." The page also includes a paragraph about the first step of an energy audit and a list of key areas: "Insulation" and "Air leakage". A right-hand sidebar contains sections for "Energy Division Information Resources & Information", "Programs & Events", "CRC General Resources", and "Donate". The Windows taskbar at the bottom shows the start button and several open applications: "ZEH Power Lunch", "Microsoft PowerPoint...", "Residential Energy A...", and "untitled - Paint".

HERS Rating and Projected HERS Rating

- Compares your home to IECC 2004.
- Can be used for Energy improvement Mortgage



RESNET
Residential Energy Services Network

[RESBlog](#) | [Site Map](#) | [Search](#)

Setting the STANDARD for QUALITY

About RESNET
[Join RESNET](#)
[Home Energy Ratings](#)
[Consumer Information](#)
[Builder Information](#)
[Rater Information](#)
[Provider Information](#)
[Lender Information](#)
[RESNET Standards](#)
[RESNET Conference](#)
[Member Information](#)
[Rater Insurance](#)
[Environmental Trading](#)
[RESBlog](#)
[Related Sites](#)

The Residential Energy Services Network's (RESNET) mission is to ensure the success of the building energy performance certification industry, set the standards of quality, and increase the opportunity in ownership of high performance buildings. RESNET is a membership 501-C-3 non profit organization.

RESNET's standards are officially recognized by the U.S. mortgage industry for capitalizing a building's energy performance in the mortgage loan certification of "White Tags" for private financial investors, and by the federal government for verification of building energy performance for such programs as federal tax incentives, the Environmental Protection Agency's ENERGY STAR program and the U.S. Department of Energy's Building America Program.

2008 RESNET Building Performance Conference
[Reside Today!](#)

IRS Releases Rules for Tax Credits
[Click Here](#)

Consumer Resources
Find a Certified Energy Rater.
[Click Here](#)

RESNET Rating provides a relative energy use index called the HERS Index - a HERS Index of 100 represents the energy use of the "American Standard Building" and an Index of 0 (zero) indicates that the Proposed Building uses no net purchased energy (a zero energy building). A set of rater recommendations for cost-effective improvements that can be achieved by the Rated Building is also produced.

RESNET standards encompass three areas:

- Software accreditation achieved by



Home Performance with ENERGY STAR®

Contractor does home energy audit AND can perform the work

<http://coloradohomeperformance.org>

National average spent on an energy upgrade: \$9,000

Average energy savings:
25%

The screenshot shows a web browser window displaying the Colorado Home Performance with ENERGY STAR website. The browser title is "Make your home energy efficient with Colorado Home Performance with ENERGY STAR: E-Star - Mozilla Firefox". The address bar shows "http://coloradohomeperformance.org/". The website content includes a navigation menu with "HOME PERFORMANCE WITH ENERGY STAR" and "energy" logos. A main heading reads "Colorado Home Performance with ENERGY STAR®". Below this, there are sections for "What makes Home Performance with ENERGY STAR different?", "Common Recommendations", "Typical Results", "Get More Information", and "Information for Contractors". A "FIND A CONTRACTOR" button is visible. The main content area features a section titled "Colorado Home Performance with ENERGY STAR - Advancing Home Energy Efficiency" with a list of questions: "Does your home have drafty windows and doors?", "Does your home have rooms that are too hot or too cold?", and "Do you have high energy bills?". Below this, there is a paragraph explaining common issues and a "Learn More" link. Further down, there are links for "Smart Energy Living Energy Makeover Contest" and "Contractor's Corner for Existing Contractors". A "Supporting Organizations:" section lists logos for Rheem Team, City of Boulder, and City of Fort Collins Utilities. The browser's taskbar at the bottom shows the start button and several open applications: ZEH Power Lunch, Microsoft PowerPoint, and the current website.



Home Performance with ENERGY STAR®

Contractor does home energy audit AND can perform the work

<http://coloradohomeperformance.org>

National average spent on an energy upgrade: \$9,000

Average energy savings:
25%

A screenshot of a Mozilla Firefox browser window displaying the website "Colorado Home Performance with ENERGY STAR". The browser's address bar shows the URL "http://coloradohomeperformance.org/findContractor.html". The website content includes a navigation menu on the left with options like "What makes Home Performance with ENERGY STAR different?", "Common Recommendations", "Typical Results", "Get More Information", and "Information for Contractors". The main content area features a "Get More Information" section with a link "Why should I hire a Home Performance Contractor?". Below this, there are sections for "Home Performance Contractors" in Boulder, Colorado Springs, and Castle Rock/Denver Metro. The Boulder section lists "Big Horn Builders" and "Ecofutures Building, Inc." with their contact information. The Colorado Springs section lists "Atlantic Heating & Air Conditioning". The Castle Rock/Denver Metro section lists "Mountain Air Comfort Systems". A photograph of a contractor working on a window is visible on the right side of the page. The Windows taskbar at the bottom shows the Start button and several open applications, including "ZEH Power Lunch", "Microsoft PowerPoint", and "Get More Information...".





The Devil is in the details....

- What about using off-site renewable energy production?
- Site energy vs. source energy
- Use and offset natural gas?
- Utility issues
 - Intermittency of renewable energy
 - The power is supplied on an unscheduled basis
 - Peak demand is as important as energy production



Resources

A screenshot of the Building America website as it appeared in a Mozilla Firefox browser window. The browser's address bar shows the URL "http://www.eere.energy.gov/buildings/building_america/". The website header includes the U.S. Department of Energy logo and the text "Energy Efficiency and Renewable Energy". Below this is the "Building Technologies Program" banner. A navigation menu includes "About the Program", "Program Areas", "Information Resources", "Financial Opportunities", "Technologies", "Deployment", and "Home". The main content area is titled "Building America" and features a sidebar on the left with a red circle around the "Research Highlights" link. The main content includes a "Research Highlights" section with several articles, such as "Building America Wins 2005 Green Building Award" and "26,746 Homes Built in Building America Research Projects". A search bar is located in the top right corner. The browser's taskbar at the bottom shows various open applications and the system clock indicating 8:00 AM.

Building America Website
www.BuildingAmerica.gov
Includes an extensive
document database



Resources

A screenshot of the Building America website as it appeared in a Mozilla Firefox browser window. The browser's address bar shows the URL: http://www.eere.energy.gov/buildings/building_america/for_builders.html. The website header includes the U.S. Department of Energy logo and the text "Energy Efficiency and Renewable Energy" with the tagline "Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable". The main navigation bar is green and contains the text "Building Technologies Program". Below this is a secondary navigation bar with links: "About the Program", "Program Areas", "Information Resources", "Financial Opportunities", "Technologies", "Deployment", and "Home". The main content area is titled "Building America" and features a sidebar on the left with a "For Builders" link circled in red. The main text area contains several articles, including "For Builders" (with a circled link to a list of top web sites), "NAHB Green Home Building Guidelines", "EarthCraft House™ Integrates Building America Research to Achieve Higher Levels of Energy Savings", "Industry Conferences Take Building America Research on the Road", and "Houses That Work Seminars". On the right side of the page, there is a search bar and a "PUBLICATIONS" section listing several PDF documents such as "Strategies for Energy Efficient Remodeling", "The New American Home 2005", "IBACOS Builder System Performance Packages", and "Introduction to Building Systems Performance: Houses That Work". A "FEATURE" section at the bottom right includes a link to "Sign up to Receive Recent Building America Research Results". The browser's taskbar at the bottom shows the Start button, several application icons, and the system clock displaying 8:02 AM.

Building America Website
www.BuildingAmerica.gov
Includes an extensive
document database



Building America: Top Web Sites For Builders - Mozilla Firefox

http://www.eere.energy.gov/buildings/building_america/for_builders_top_sites.html

U.S. Department of Energy
Energy Efficiency and Renewable Energy
Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

Building Technologies Program

About the Program Program Areas Information Resources Financial Opportunities Technologies Deployment Home

Building America

Search
Search Help More Search Options
EERE Information Center

Top Web Sites for Builders

The top Web sites for builders of energy-efficient homes:

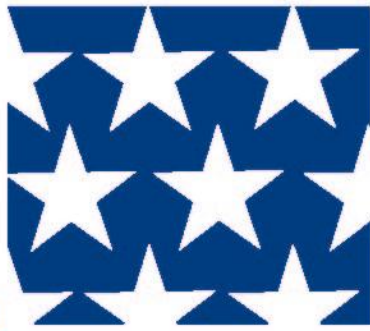
1. [Advanced Energy Corporation](#): Great publications, particularly "Building Solutions On-line" and "High Performance Homes."
2. [Building Energy Codes](#): Your resource for tools to facilitate energy code compliance, development, adoption, implementation, and enforcement.
3. [BuildIQ](#): BuildIQ is an Internet-based knowledge network that provides education in best homebuilding practices to production builders around the nation. We are totally committed to helping you integrate quality across the most important areas of your business-your customers, your homes and your team.
4. [Building Science Consortium](#): Building America team leader with newly revised web site. Lots of practical text and graphic resources on energy-efficient design and construction, particularly under "Houses That Work" and "Case Studies."
5. [Canada Mortgage and Housing Corporation](#): Lots of quality information and technical resources for cold climates for both builders and home buyers/owners.
6. [Consortium for Advanced Residential Buildings \(CARB\)](#): Building America team leader, Steven Winter Associates. Check out their "Projects" and "CARB-News."
7. [Energy & Environmental Building Association](#): This is THE trade organization for energy-efficient builders. Especially go to "Building Info Central" and "Communications," and "Houses that Work" seminars.
8. [Environmental Building News](#): Lots of news stories and feature articles offered on-line that deal with energy efficiency in design and construction.
9. [DSIRE - Database of State Incentives for Renewable Energy](#): This database is a comprehensive source of information on state, local, utility, and selected federal incentives that promote renewable energy.
10. DOE's [Efficient Windows Collaborative](#): Great resources on why and how to select high performance, climate-tuning glazing.
11. EPA's [ENERGY STAR](#)™: Really good product-specific information on high performance appliances and lighting for the home.
12. EPA's [ENERGY STAR](#)™ Homes: ENERGY STAR™ Web site just for high performance homes. Good subsection for homebuilders.

Transferring data from www.eere.energy.gov...

Start | Paul's Documents | 3:01 PM

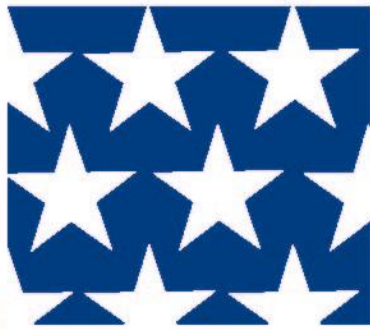
List of top 25 energy efficiency home design and construction web sites

Building
AMERICA



U.S. Department of Energy

Building
AMERICA



U.S. Department of Energy



Alphabet soup

ZEH

NZEH

NZEH

ZENH

ZEMH

ZEN



Alphabet soup

ZEH – Zero Energy Home

NZEH – Net Zero Energy Home

NZEH – Near Zero Energy Home

ZENH – Zero Energy New Homes (California)

ZEMH – Zero Energy Manufactured Homes

ZEN – Zero Energy Neighborhood

Passivhaus – Passive House (Germany)

Factor9 home – Canada

Green homes

Carbon neutral homes