News from the Home Front

Green goals for historic homes: The Net Zero question

Mike Jackson, FAIA
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Historic Houses

Ireland

United States

Puerto Rico

Canada

Are Old Houses Doomed?

The “impossibility” of achieving 80% energy reduction

George Musser Scientific American: March 26, 2010

Conspicuous Conservation

LEED pilot project
www.greenhomechicago.us

The green market place and the "eco" teardown

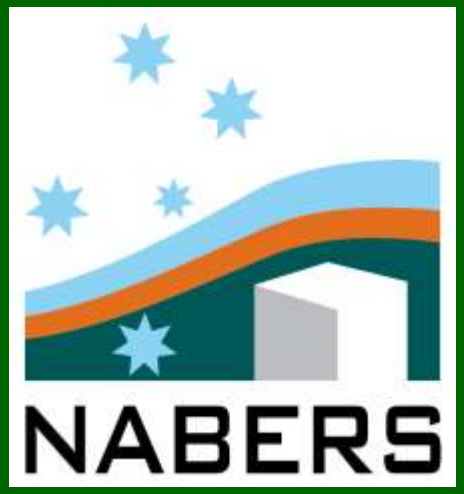
Green Home Rating Systems

There are many residential green building rating and certification systems and most of these are aimed at the new construction.

Germany

United States

United States



Australia

Great Britain

Green Home Metrics

Location/Site
Water
Energy
Resources
Health
Other

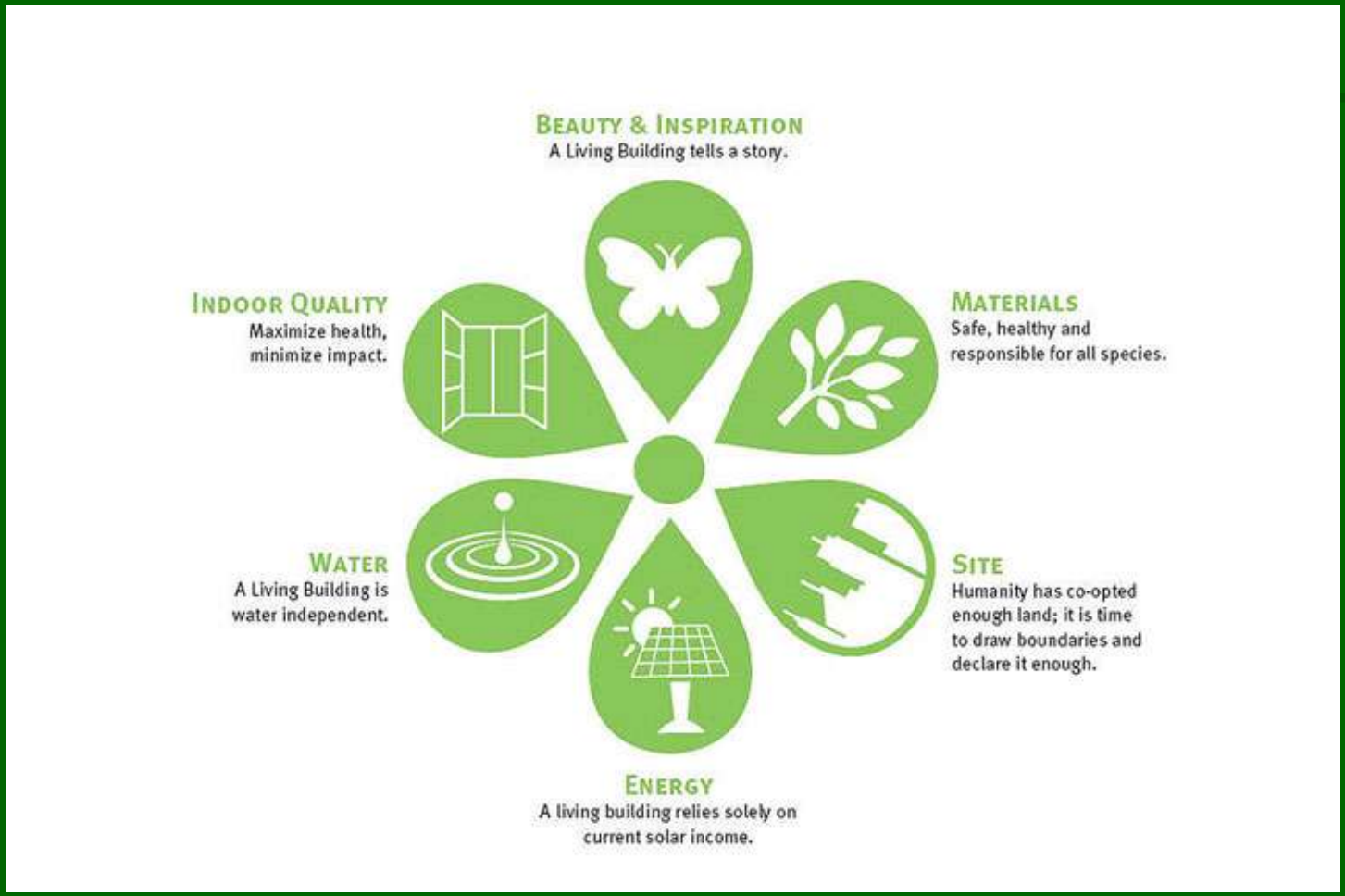
Green Home Rating Systems

There is no consensus on the relative ranking of environmental criteria. Comparison of seven different ratings.

Location/Site	**8 – 24%**	**Ave. 16 %**
Energy	**16 – 47%**	**Ave. 32%**
Resources	**11 – 30%**	**Ave. 23%**
Water	**0 – 15%**	**Ave. 8%**
Health	**4 - 23%**	**Ave. 14%**
Other*	**0 – 20%**	**Ave. 8%**

*** House size variable not included**

Living Building Challenge



Water and energy independence

Sustainability and Durability

“ I would have our ordinary dwelling houses built to last, and built to be lovely… “

John Ruskin

“The greenest house is the one that lasts the longest.”

Green Home Metrics

Location/Site
Water
Energy
Resources
Health
Other

Density (LEED)

Minimum of 10 houses per acre

These two both have 11.7 units per acre

Food Systems - Urban Chickens

URBAN CHICKENS

Urban Chicken Pioneer

Green Home Metrics

Location/Site
Water
Energy
Materials
Health
Other

Assumption of consumption

"It's an entire Web site of things you can buy to consume less."

A Better Equation

- **“the environmental impact of replacing an element is far greater than reusing the element already in place.”**
- **The greenest material is the one that already exists**

New Tricks with Old Bricks

Key finding:

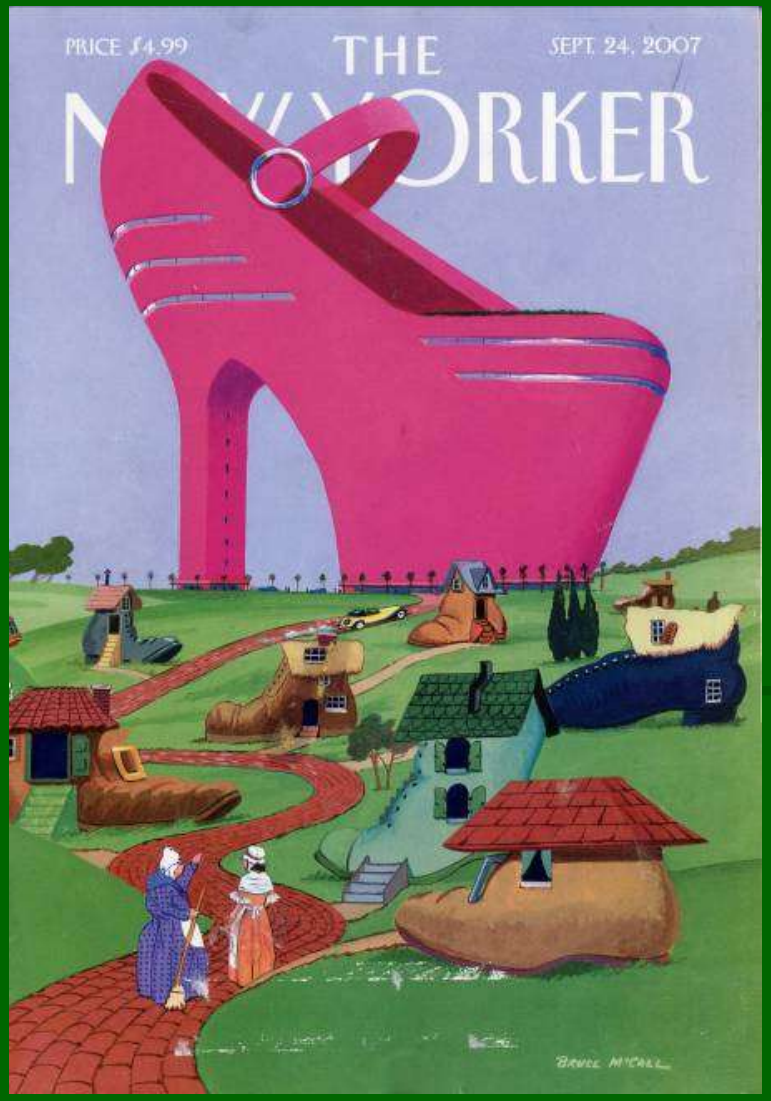
Reusing an existing home has an initial savings of 35 tons of CO^2 over new construction.
It takes 30+ years for new construction and renovation to equalize.

www.emptyhomes.com

Life Cycle Assessment

It takes 30 – 40 years for a new building to achieve any net energy savings.

House Size



There is a major debate going on about house size in green rating systems.
1950 - 1,200 sq ft
2010 - 2,400 sq ft
Larger houses have to get more points to be certified.

Green Home Metrics

Location/Site
Water
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Water Use in the USA

Homes	1%
Public Supply	11%
Livestock	1 %
Irrigation	31 %
Aquaculture	2 %
Industry	4 %
Mining	1 %
Electric power	49 %

Buildings use very little water compared to electricity and agriculture. Water is more of a regional issue of supply.

Water Use in the US 2005 - http://pubs.usgs.gov/circ/1344/

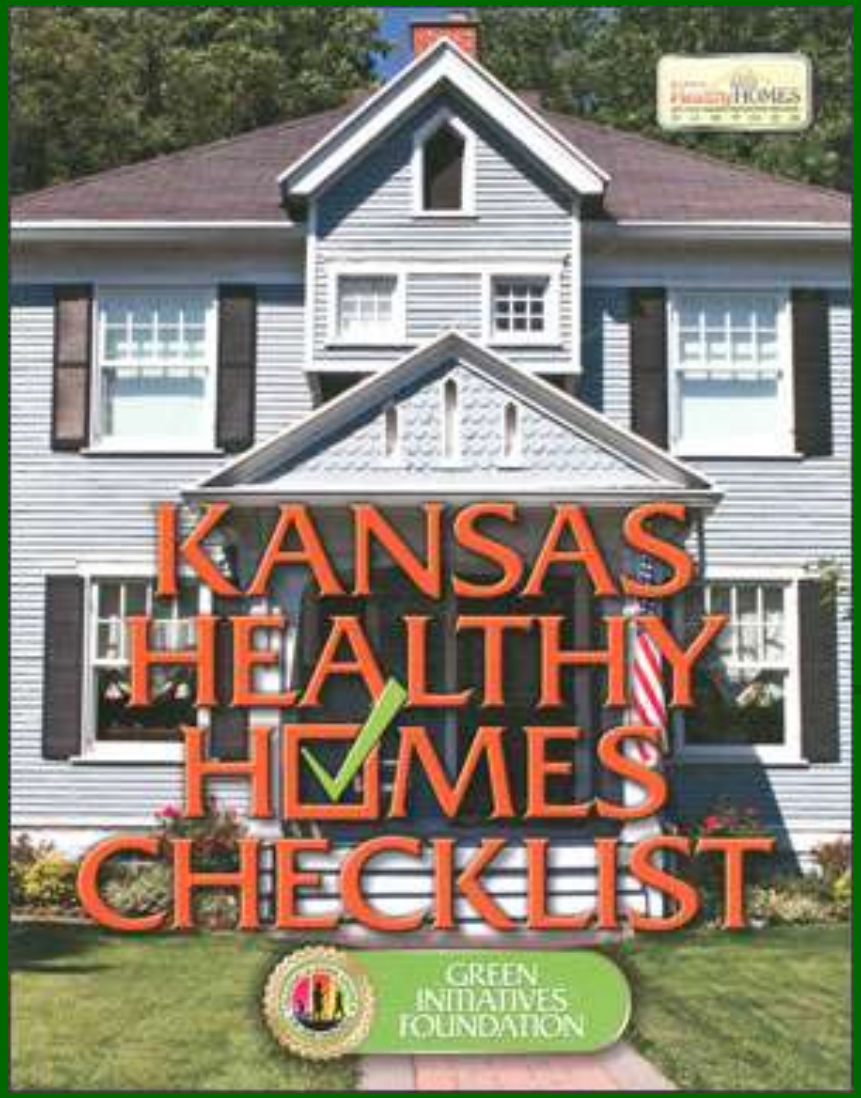
Water Efficiency + Site

Yesterday's cistern is today's rain barrel

Green Home Metrics

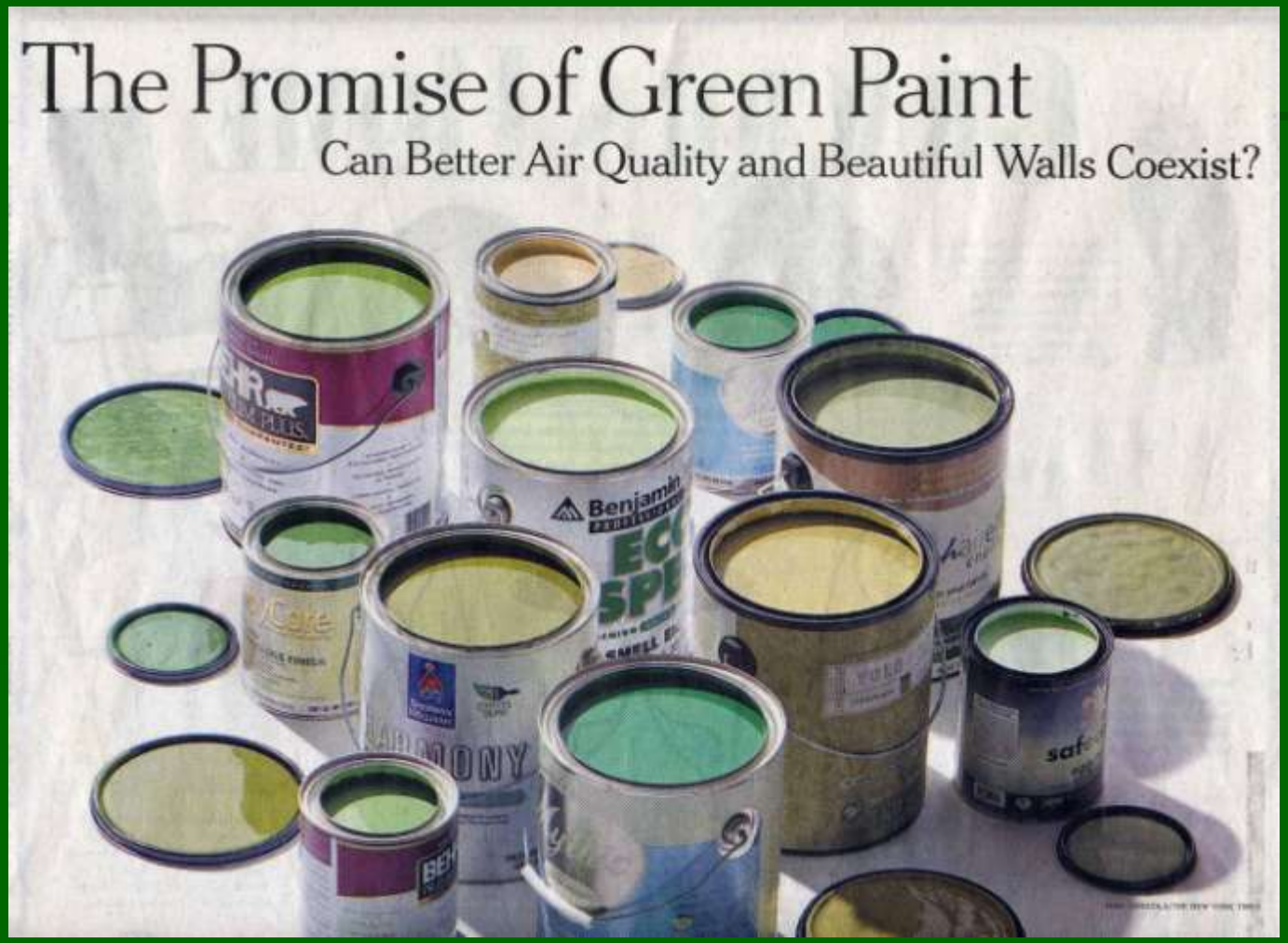
Location/Site
Water
Energy
Resources
Health
Other

Healthy Homes



Clean
Chemically safe
Well maintained
Hazard free
- Lead
- Asbestos
- Mold

Indoor Air Quality



Avoid products that "off-gas" Low VOC paints

Green Home Metrics

Location/Site
Water
Energy
Resources
Health
Other

Are old houses energy hogs?

Can Deep Green Retrofits meet Preservation Standards?

The home energy challenge

Year Built	KBtu/sq ft/yr
Prior to 1950	74.5
1950 to 1969	66.0
1970 to 1979	59.4
1980 to 1989	51.9
1990 to 1999	48.2
2000 to 2005	44.7

Pre-1950 homes need a 40% improvement to be equal to the typical new home today.

Source: Residential Energy Consumption Survey, 2005

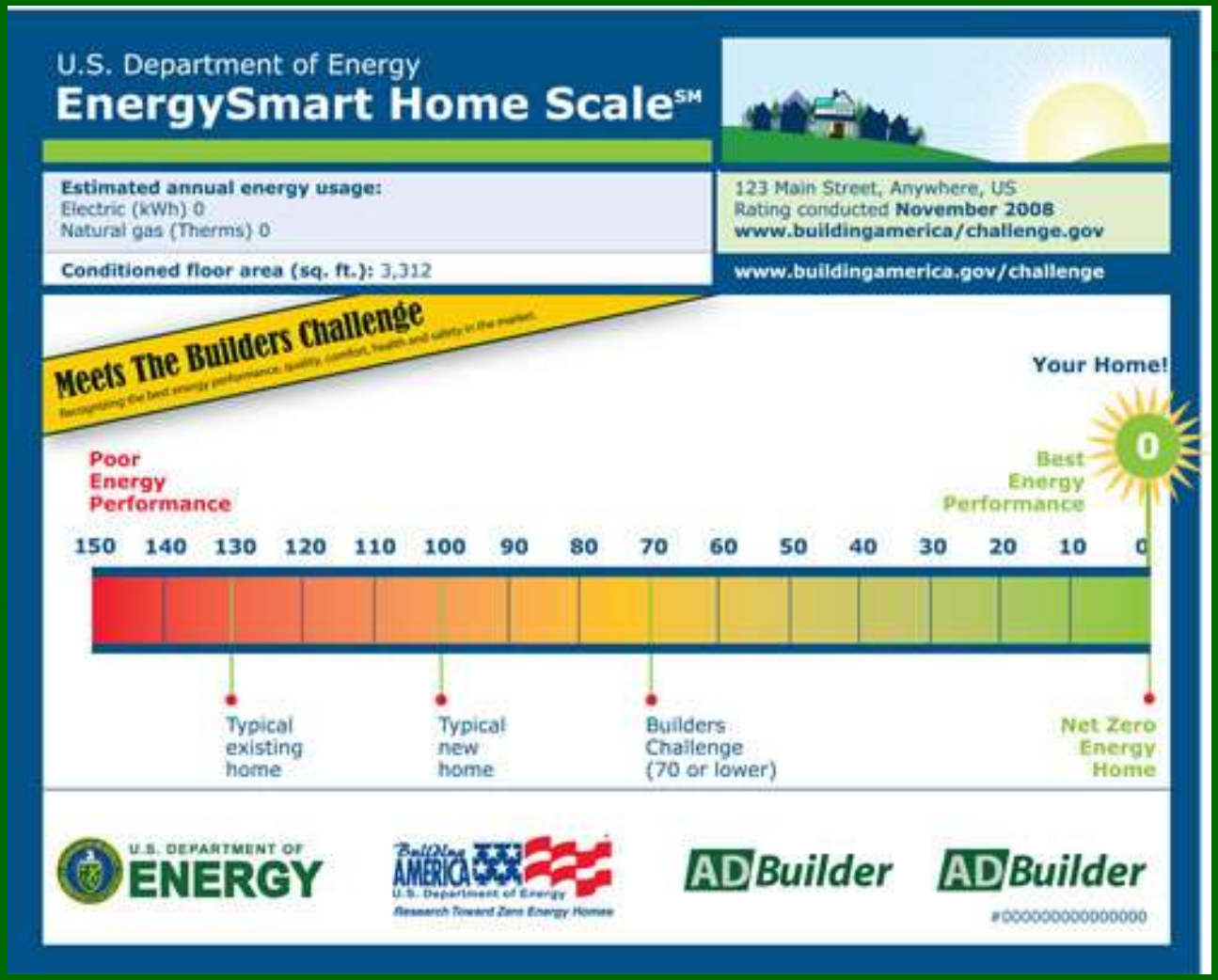
Residential Operating Energy btu/sq ft/yr

National Average = 60,900 Btu/sq ft/yr*

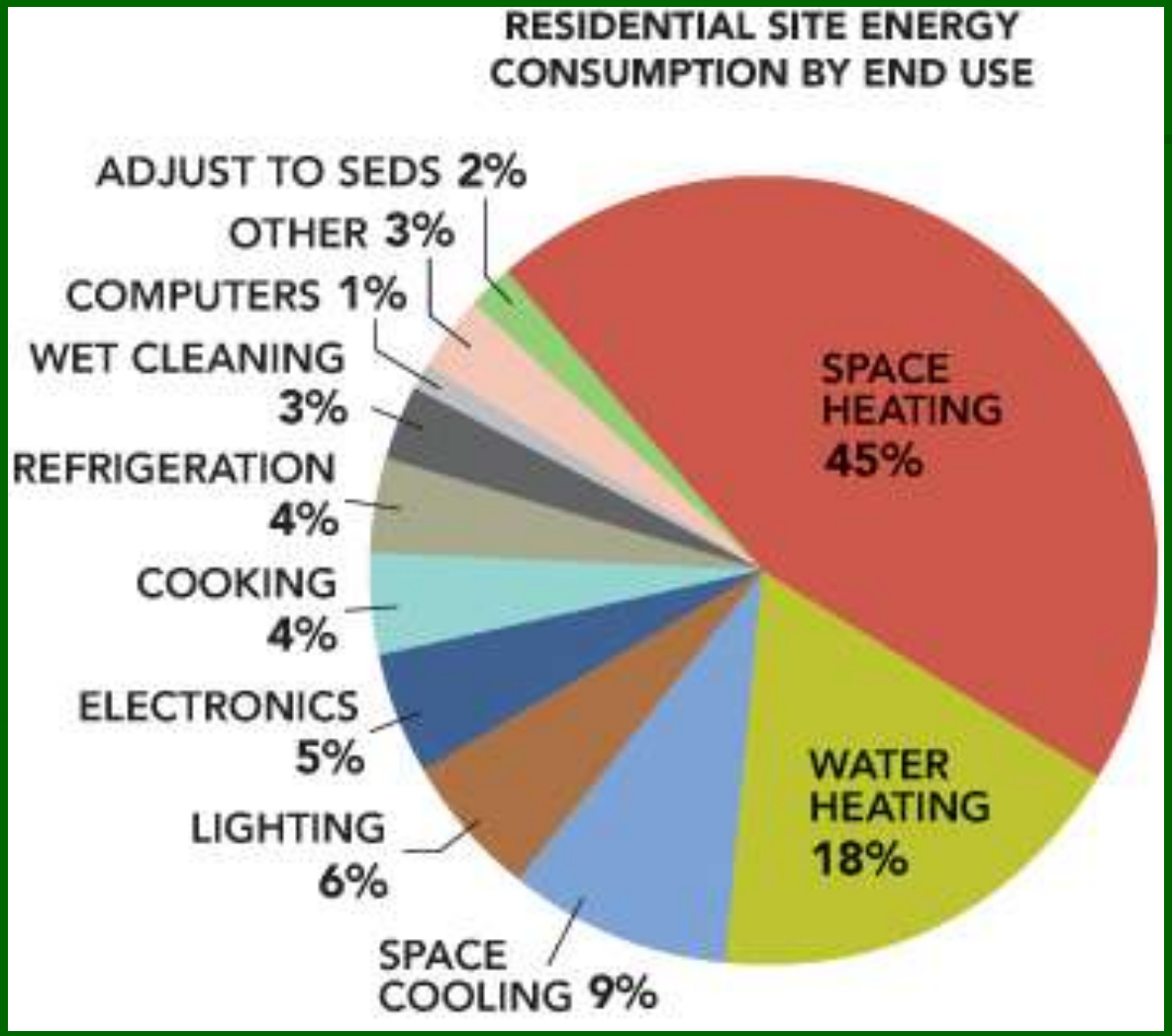
Northeast	Midwest	South	West
			
70,000	**76,700**	**54,200**	**46,300**

http://buildingsdatabook.eere.gov

Energy efficiency index

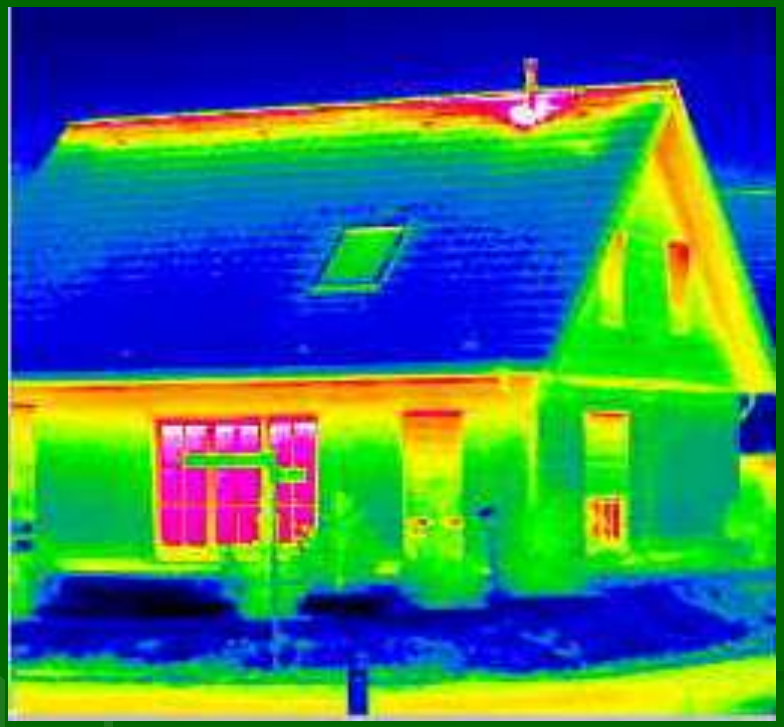


Household Energy Use



http://buildingsdatabook.eere.energy.gov

Energy Efficiency First



High Tech thermal scan

DIY Thermal scan

Energy Audits are cost effective

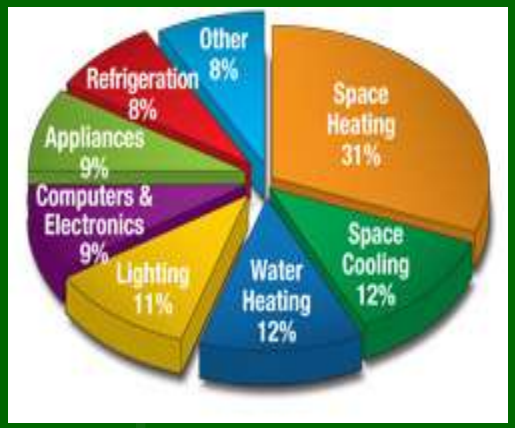
Goal: educate auditors about history

Energy Efficiency

Change your behavior

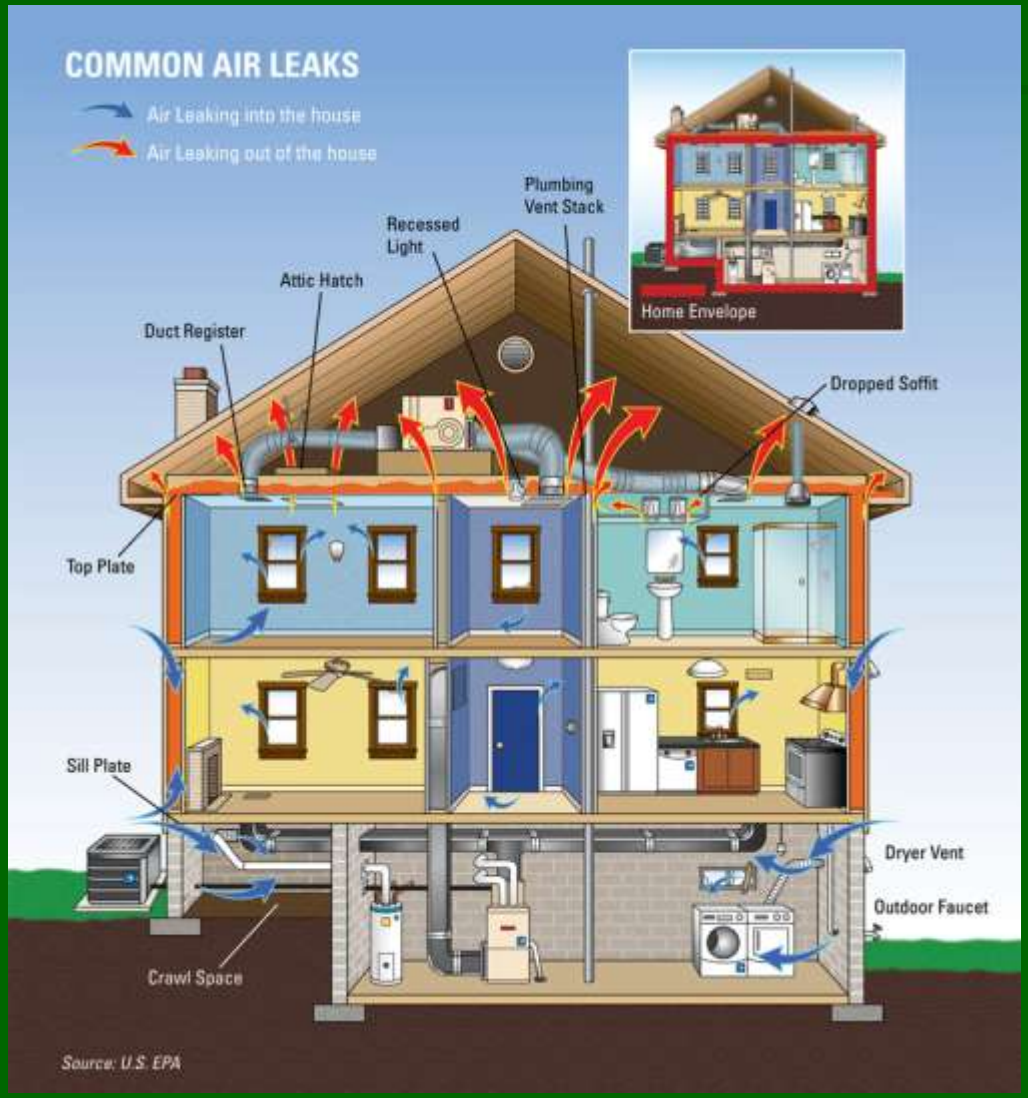
Solar Clothes Dryer

Energy Efficiency Strategies



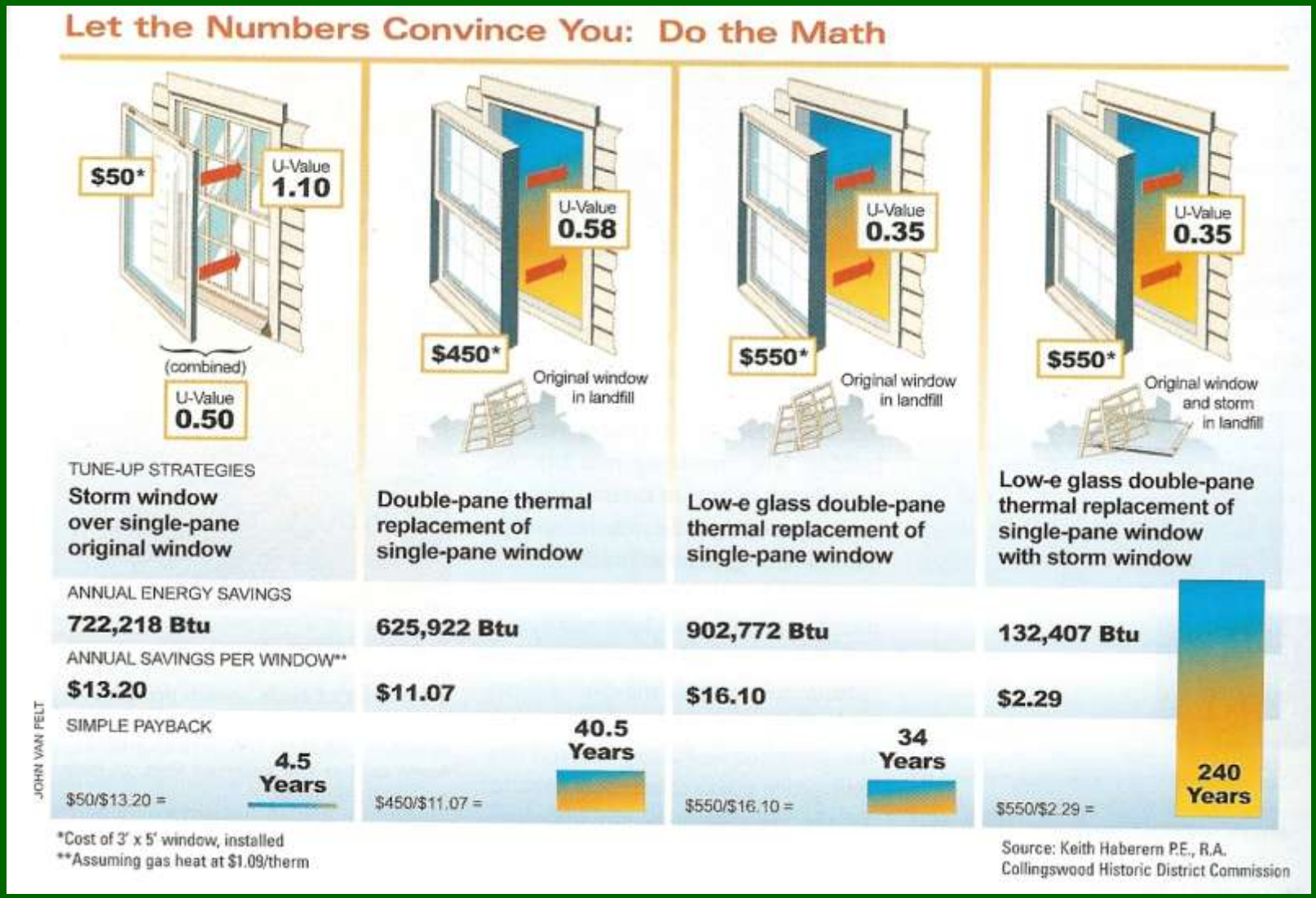
- **Building Envelope**
  - **Air Sealing**
  - **Insulation**
  - **Windows**
- **Operation**
  - **Programmable thermostat**
  - **Plug strips**
- **Equipment**
  - **HVAC**
  - **Appliances**
  - **Water Heating**

Weatherization – air sealing



Great payback

Storm Windows



The Perfect Storm Window

Insulated Glass Storm Window - R-3+

Appliances - Plug Load

“Energy Vampires”
Plug load

HVAC equipment

90% +
No chimney

Deep Energy Retrofit

- 70% reduction from code
- For a typical historic home this is extremely difficult
  - First goal - equal to code – 30%
  - Future goal of 50% below code
    - Super insulated not feasible
    - Geothermal very feasible
    - Green power very feasible

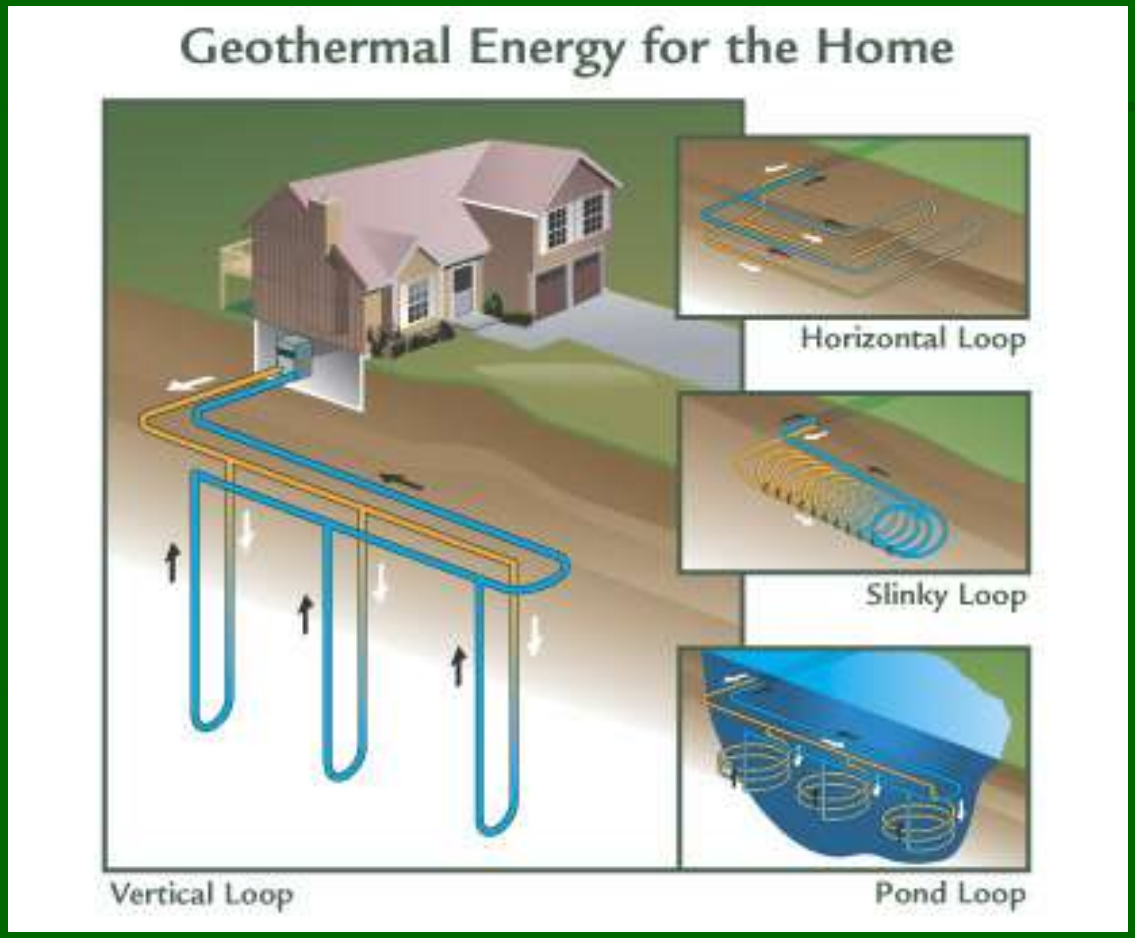
The Net* Zero challenge

"A building should produce as much energy as it consumes."

No building or object is sustainable
Only systems are sustainable
Micro wind and solar PV is expensive
Fossil Fuel Free is the real goal
Community/regional scale solutions

* "net" because the home is still connected to the utility grid

Onsite renewable energy



Geo exchange system

Onsite renewable energy

"…there is no financial payback within the expected life of the systems, with the current system and electricity costs."

Onsite renewable energy

Solar thermal

Cost effective with current technology

Onsite renewables - PV

Photovoltaic panels

Alternative: make your home “future ready” for PV

Shade trees save energy

Sacramento CA program planted 400,000+ trees to save electricity

Net Zero Preservation

Grocoff House
Ann Arbor, Michigan

Historic rehab
Geothermal HVAC
Exist. windows + storm
Cellulose wall insulation
Foam rafter insulation
Plug load efficieny

www.greenovationtv.com

On-site PV Electricity vs Green Power (off site)

8 Kwh solar PV system produces
10,550 Kwh per year
$ 56,000 minus incentives

Green Currents option cost
2 cents/Kwh above the base rate
100% renewable energy off-site

Geothermal system $ 19,000

Lessons learned

- Energy efficiency first
  - Fossil Fuel Free (not net zero)
  - Make your home “future ready”
- Green ratings systems are based upon the “assumption of consumption”
- On-site renewable energy technologies are rapidly evolving but not perfected
- Preservationists are helping to build a culture that sustains design

Thank you

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