Rocky Mountain Land Use Institute—March 6, 2009

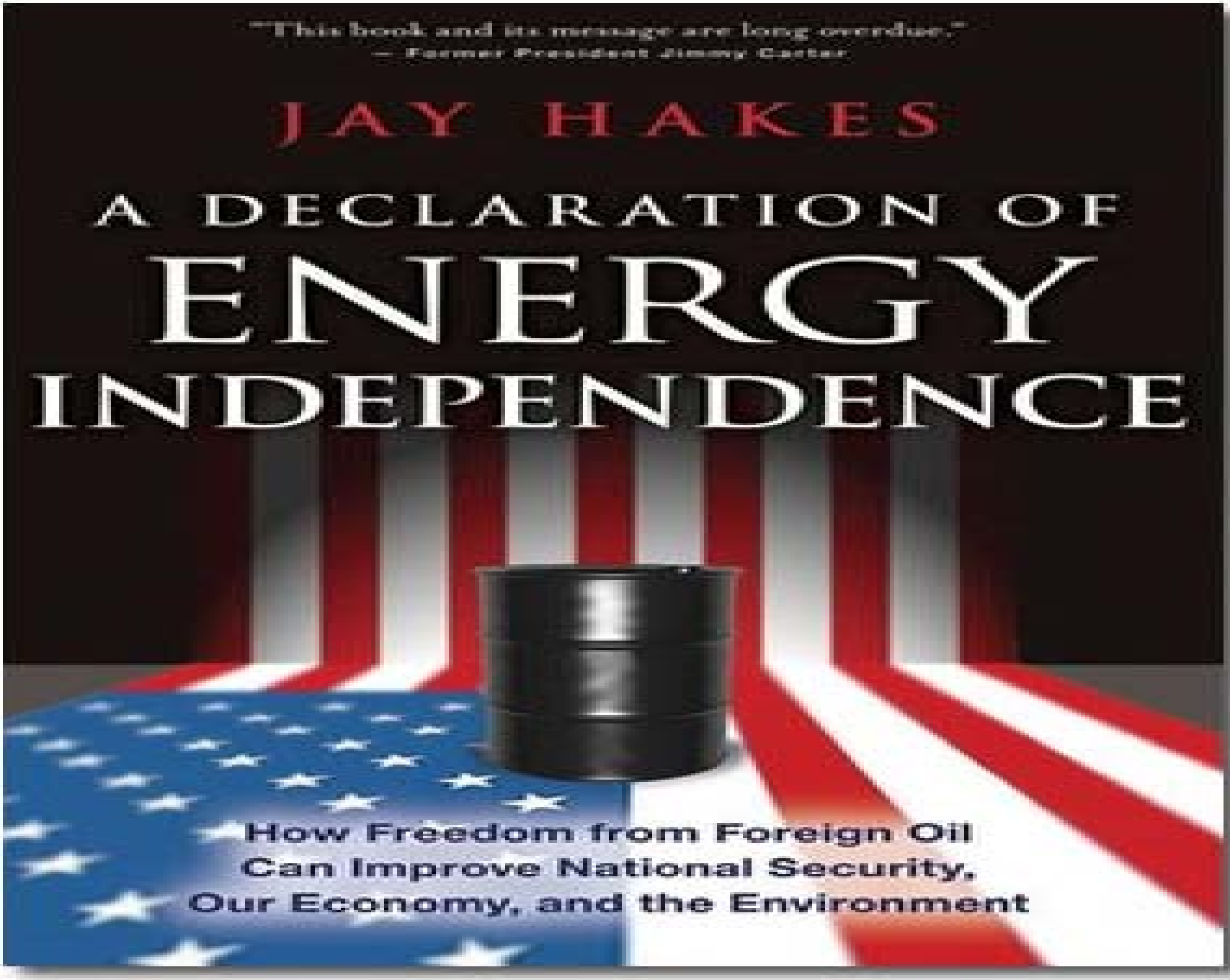
Green, Greener, Greenest:

Navigating the Forest of "Green" Building Standards

K.K. DuVivier
Associate Professor, D.U. Sturm College of Law

Lance Wright
President, Sunpower Homes, Inc.

Robby Schwarz
Principal, Energy Logic, Inc.


"This book and its message are long overdue."
— Former President Jimmy Carter
JAY HAKES
A DECLARATION OF
ENERGY
INDEPENDENCE
How Freedom from Foreign Oil
Can Improve National Security,
Our Economy, and the Environment

What is

Green?

Robby Schwarz www.nrglogic.com
Lance Wright www.greenenergyman.com

Everybody's Talking Green

GLOBALWARMING

1 Turn food into fuel

ARE CORN HUSKS BETTER THAN CORN FOR PRODUCING ENERGY? ETHANOL IS the alternative fuel that could finally wean the U.S. from its expensive oil habit and in turn prevent the millions of tons of carbon emissions that go with it. The Department of Energy has doubled its 2005 commitment to funding research into biofuels—any non-petroleum fuel source, including corn, soybean, switchgrass, municipal waste and (ick) used cooking oil. Already, half of the nearly 11 billion bushels of corn produced each year is turned into ethanol, and most new cars are capable of running on E10 (10% ethanol and 90% gas).

IMPACT LOW HIGH
TIME HORIZON NOW LATER
FEEL-GOOD FACTOR LOW HIGH

Yet the eco-friendly fuel is beginning to look less chummy of late. Some of the 114 ethanol plants in the U.S. use natural gas and, yes, even coal to run the processors. And ethanol has to be trucked. Existing gas pipelines can't carry it because it corrodes iron. Then there are the economics. Producers depend on federal subsidies, and increasing demand for corn as fuel means the kernels keep getting pricier.

That's why researchers are prospecting for more alternatives, preferably ones that don't rely on food crops or a 51¢-per-gal. tax break. Municipal waste, wood pulp and leftover grain and corn husks are all quite attractive; they can produce something called cellulosic ethanol, which contains more energy than corn. But they don't give up their bounty easily, so for now they're more expensive than corn-based ethanol to produce. Undeterred, researchers at several cellulosic-ethanol plants are developing innovative enzyme concoctions and heating methods to make the process more economic. Nothing like haste to make something out of waste. —BY ALICE PARK

2 Get blueprints for a green house

Reducing your impact on the earth is not just a question of what you drive but also of what you live in. Residential energy use accounts for 16% of greenhouse-gas emissions. If you begin thinking green at the blueprint stage, however, low-tech, pragmatic techniques will maximize your new home's efficiency. Installing those systems from the ground up is cheaper than retrofitting. "Doing simple things could drastically reduce your energy costs, by 40%," says Oru Bose, a sustainable-design architect in Santa Fe, N.M. For example, control heat, air and moisture leakage by sealing windows and doors. Insulate the garage, attic and basement with natural, non-toxic materials like reclaimed blue jeans. Protect windows from sunrays with large overhangs and double-pane glass. Emphasize natural cross ventilation. "You don't need to have 24th century solutions to solve 18th century problems," Bose says. Next, consider renewable energy sources like solar electric systems, compact wind turbines and geothermal heat pumps to help power your home. When you're ready to get creative, GreenHomeGuide.com will help you find bamboo flooring, cork tiles, and countertops made from recycled wastepaper. —BY LAURA LOCKE

IMPACT LOW HIGH
TIME HORIZON NOW LATER
FEEL-GOOD FACTOR LOW HIGH

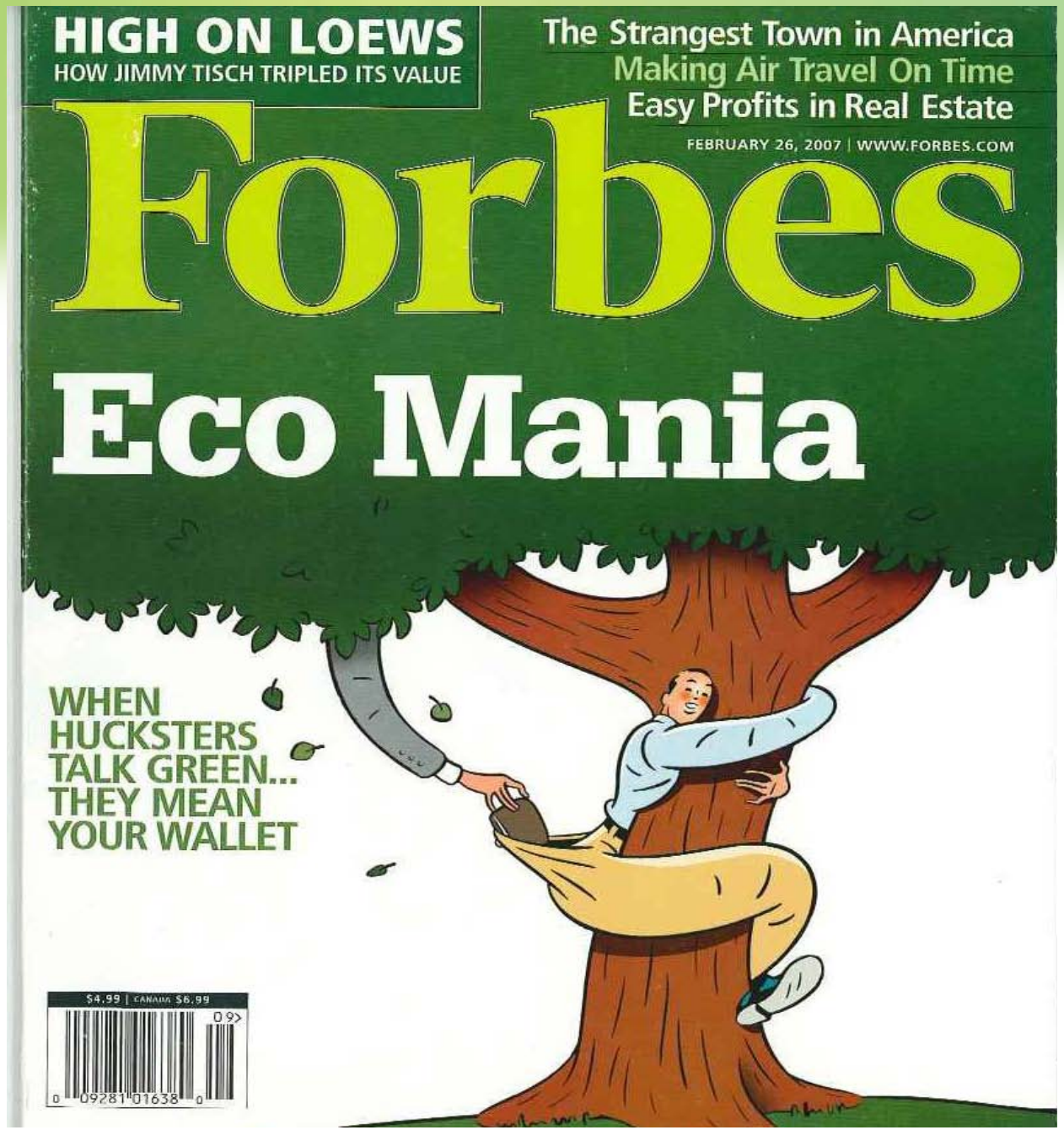
3 Change your lightbulbs

The hottest thing in household energy savings is the compact fluorescent lightbulb (CFL), a funny-looking swirl that fits into standard sockets. CFLs cost three to five times as much as conventional incandescent bulbs yet use one-quarter the electricity and last several years longer. They are available virtually everywhere lightbulbs are sold. Most labels don't say "CFL" (GE calls its bulbs Energy Savers), and in some cases the telltale twist is enclosed in frosted glass. The wattage gives them away: many 7-watt CFLs are comparable to a regular 40-watt bulb, 26 watts is the typical CFL equivalent of 100 watts and so on. Or just look for the Energy Star label.

CFLs have come a long way since they were first introduced in the mid-'90s (they don't flicker as much when you turn them on, for one thing), but because each bulb still contains 5 mg of mercury, you're not supposed to toss them out with the regular trash, where they could end up in a landfill. So the bulbs are one more thing for you to sort in the recycling bin.

Light-emitting diodes, or LEDs (see *item 4*), don't have this problem, but they can require a bit of DIY rewiring. LEDs work great as accents and task lights, and you can also buy LED desk and floor lamps. But if you're just looking to put a green bulb in your favorite table lamp, CFL is the way to go. —BY MARYANNE MURRAY BUECHNER


FOOD & WINE
AUGUST 2006
purely delicious
HOW TO BE AN ECO-EPICUREAN
chefs' healthiest recipes
lessons from a green kitchen
wines: the next eco-trend
Grilled
wild salmon skewers
with tomato jam
(page 106)


HIGH ON LOEWS
HOW JIMMY TISCH TRIPLED ITS VALUE
The Strangest Town in America
Making Air Travel On Time
Easy Profits in Real Estate
FEBRUARY 26, 2007 | WWW.FORBES.COM
Forbes
Eco Mania
WHEN HUCKSTERS TALK GREEN... THEY MEAN YOUR WALLET
$4.99 | CANADA $6.99

Global Climate Change


WATCH "RETURN TO TITANIC," NATIONAL GEOGRAPHIC CHANNEL, JUNE 2, 9 P.M. ET/PT
INSIDE THE WORLD OF IRAQ'S SHIITES
NATIONALGEOGRAPHIC.COM/MAGAZINE
JUNE 2004
NATIONAL GEOGRAPHIC
THE END OF CHEAP Oil
SPRAWL ON THE MALL?
BONUS TEAR-OUT MAP OF WASHINGTON, D.C.
VAMPIRE SQUID, FANGTOOTH FISH, AND OTHER SEA ODDITIES

Upsala Glacier, Argentina

1928

2004

LAND ICE

GREENLAND ICE LOSS RATE ↓ 36-60 cubic miles per year

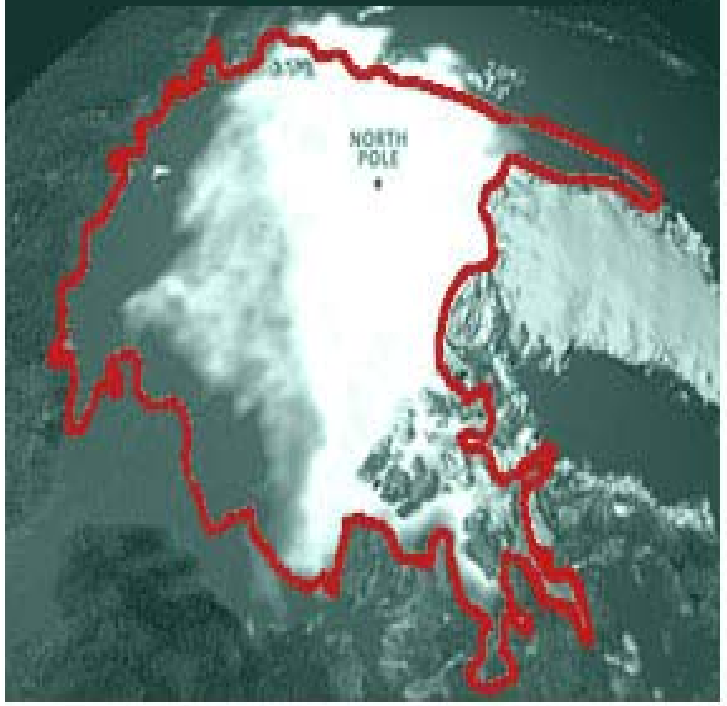
Satellite view of Greenland

Annual days of melt

4 21 36 54 75

SEA ICE

ARCTIC SEA ICE EXTENT ↓ 38%



Satellite view of the Arctic.

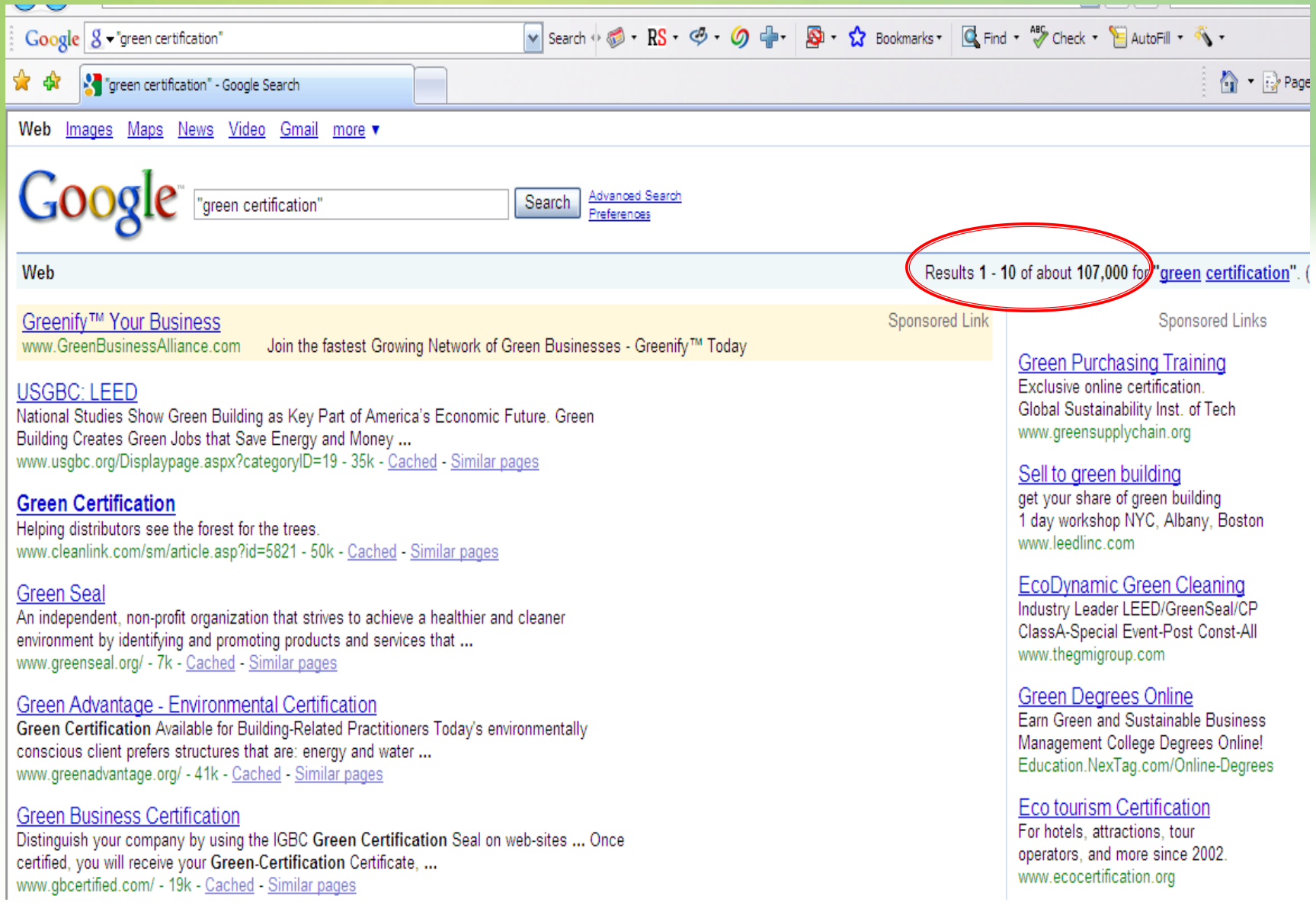
The red outline shows the ice cap extent in 1979

Source: NASA

Grace measures ice mass from space

Terra measures changes in ice surface temperature

QuikScat observes ice edge movements from space



Pale Green?

Or

Deep Green?

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- Home
- About Us
- Why Go Green
- GREENIFY your Business
- GREENIFY your Home
  - How To GREENIFY
  - Enrollment Form
- GREENVISIBILITY™ Directory
- GREENIFY Store
- In the News

How to Go Green at Home

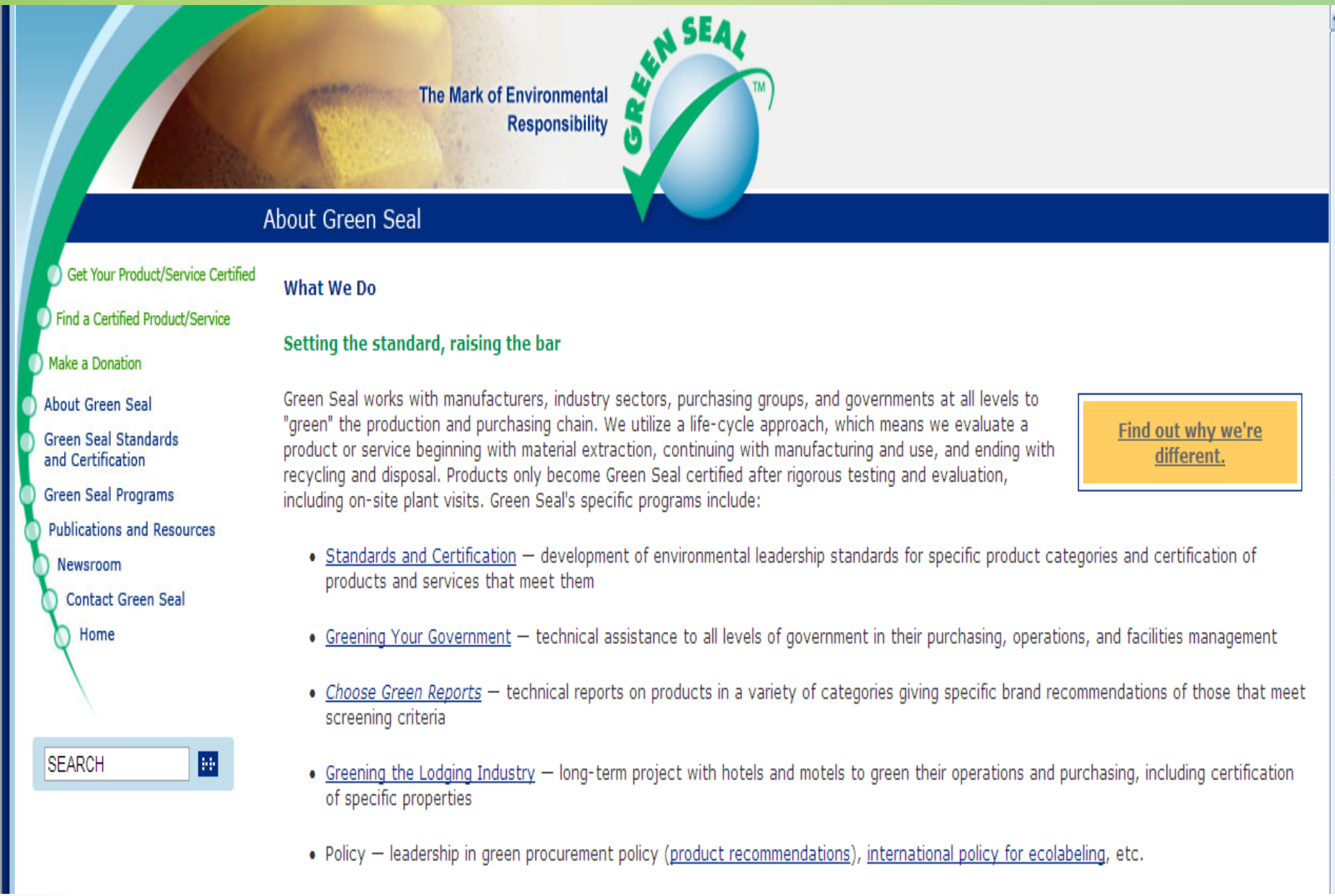
We use the term GREENIFY to characterize the steps involved for you to go GREEN at home. Our program has been carefully designed to help GREENIFY your home without causing any unnecessary interruptions to your daily tasks.

Getting Started

- Complete a very brief enrollment form and pay your application fee (low price of $149.00).
- Receive an email with our GREENIFY Guidelines (View Sample)
- Work to implement the items on the list. Let us know any time you have questions.
- Fax or mail the signed and notarized GREENIFY Guidelines Submission page to Green Business Alliance.

Upon review and acceptance of the GREENIFY Guidelines, you will receive:

1. GREENIFIED plaque to prominently display in your residence
2. Window cling with the 2009 GREENIFIED Seal
3. GREENIFIED wrist bands for family members
4. Green Business Alliance canvas tote bag


The Mark of Environmental Responsibility
GREEN SEAL
About Green Seal
Get Your Product/Service Certified
Find a Certified Product/Service
Make a Donation
About Green Seal
Green Seal Standards and Certification
Green Seal Programs
Publications and Resources
Newsroom
Contact Green Seal
Home
SEARCH
What We Do
Setting the standard, raising the bar
Green Seal works with manufacturers, industry sectors, purchasing groups, and governments at all levels to "green" the production and purchasing chain. We utilize a life-cycle approach, which means we evaluate a product or service beginning with material extraction, continuing with manufacturing and use, and ending with recycling and disposal. Products only become Green Seal certified after rigorous testing and evaluation, including on-site plant visits. Green Seal's specific programs include:
Find out why we're different.
Standards and Certification – development of environmental leadership standards for specific product categories and certification of products and services that meet them
Greening Your Government – technical assistance to all levels of government in their purchasing, operations, and facilities management
Choose Green Reports – technical reports on products in a variety of categories giving specific brand recommendations of those that meet screening criteria
Greening the Lodging Industry – long-term project with hotels and motels to green their operations and purchasing, including certification of specific properties
Policy – leadership in green procurement policy (product recommendations), international policy for ecolabeling, etc.

Smarter living

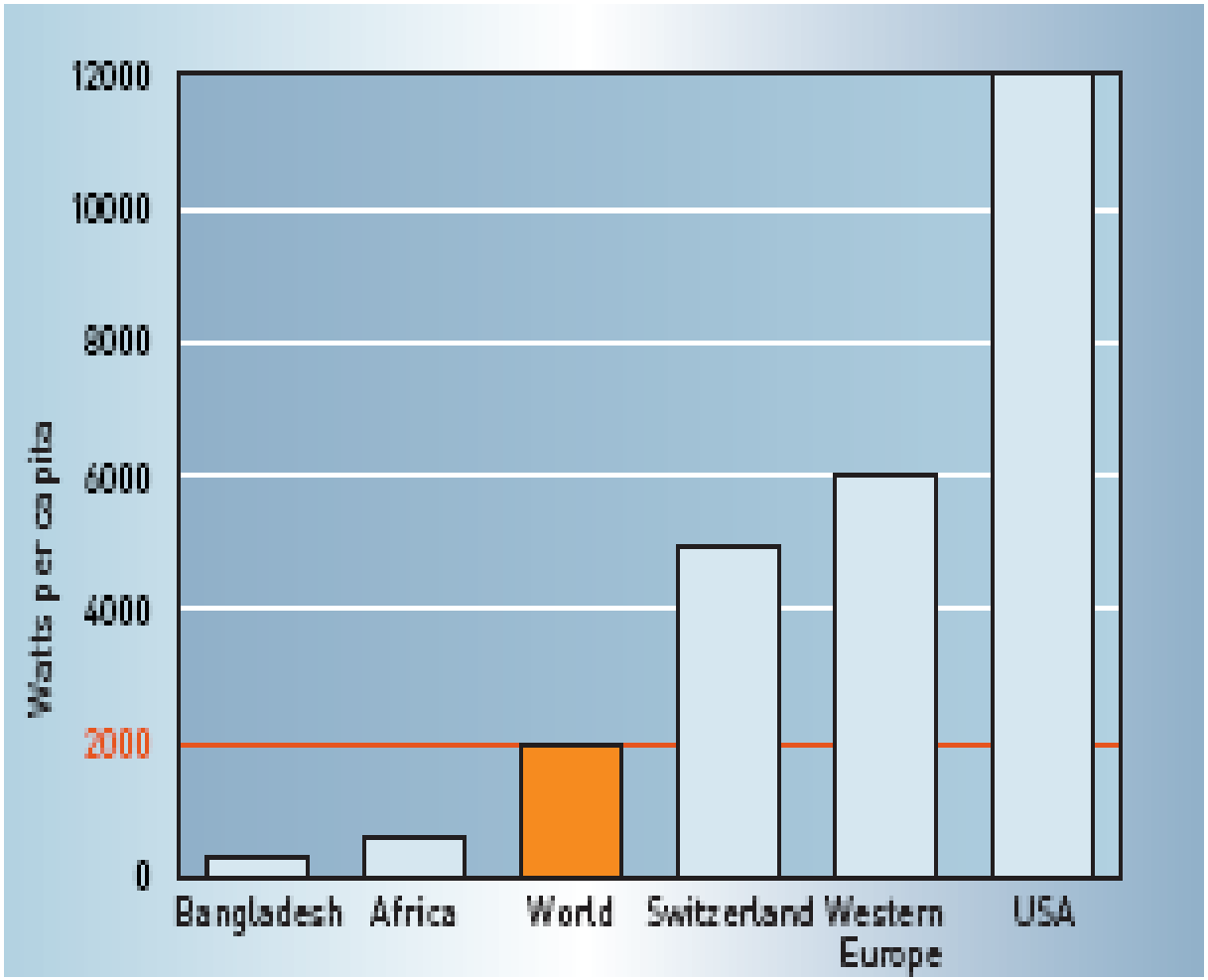
Generating a new understanding for natural resources as the key to sustainable development – the 2000-watt society

novatlantis
Sustainability at the ETH domain

sia

swissenergy

Energy Use



The average energy requirement per capita world-wide is 2000 watts, but this fluctuates enormously from country to country. In developing nations it is often just a few hundred watts, while in other countries it may be up to 20 times higher!

Your location: Home > Kyoto Protocol

TEXT SIZE + -

Kyoto Protocol


ALL THE NEWS WITHOUT FEAR OR FAVOR

The Japan Times

Conference adopts Kyoto Protocol

Greenhouse gas emissions to be cut by average of 5.2%

KYOTO COP3

Kyoto convention's success open to debate

Gist of Kyoto Protocol

Delegates celebrated adoption of the Protocol in 1997.

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions .These amount to an average of five per cent against 1990 levels over the five-year period 2008-2012.

The major distinction between the Protocol and the Convention is that while the Convention **encouraged** industrialised countries to stabilize GHG emissions, the Protocol **commits** them to do so.

Recognizing that developed countries are principally responsible for the current high levels of GHG emissions in the atmosphere as a result of more than 150 years of industrial activity, the Protocol places a heavier burden on developed nations under the principle of "common but differentiated responsibilities."

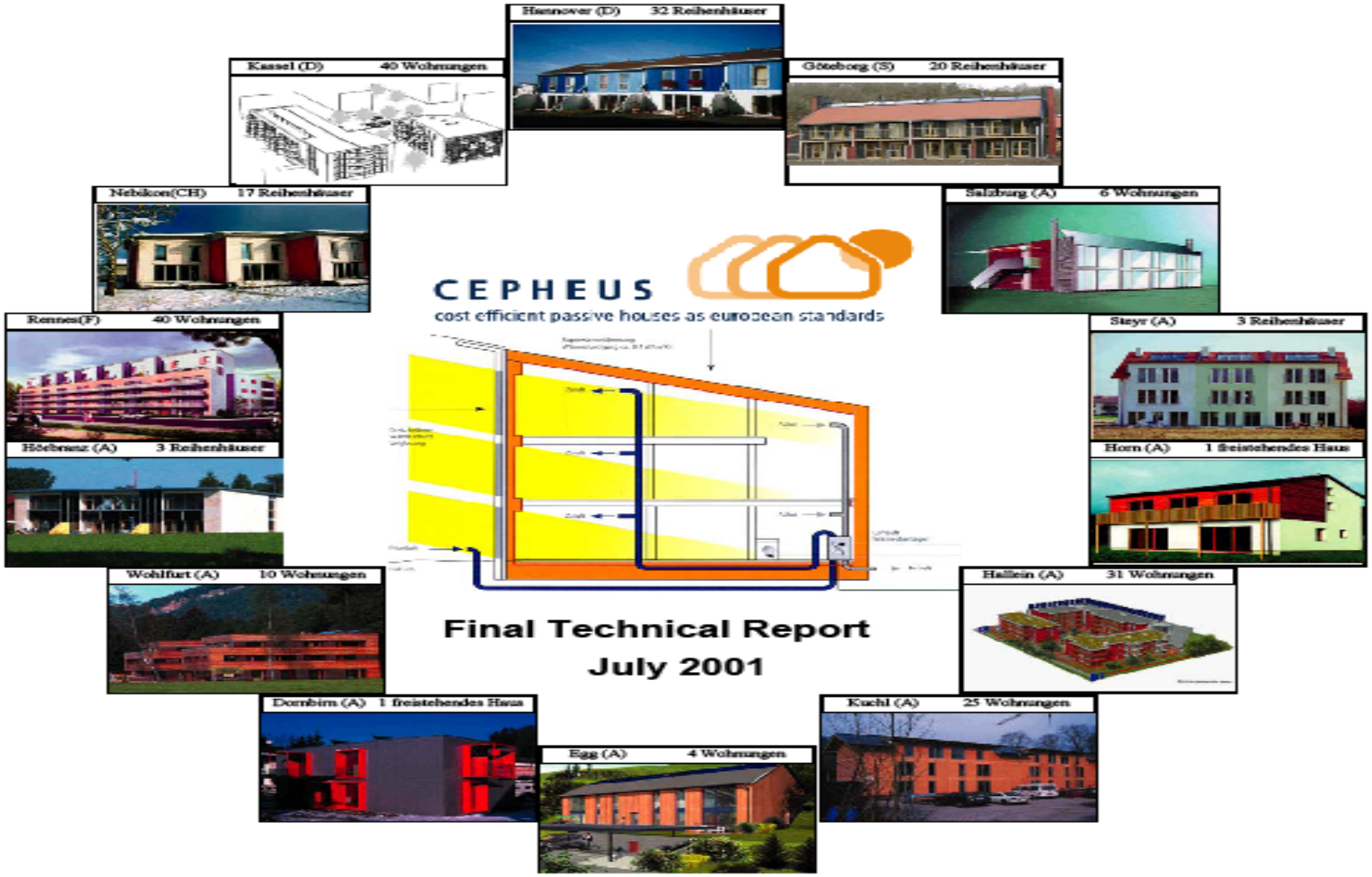
The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. 184 Parties of the Convention have ratified its Protocol to date. The detailed rules for the implementation of the Protocol were adopted at COP 7 in Marrakesh in 2001, and are called the "Marrakesh Accords."

Energieinstitut Vorarlberg

enercity
positive energie
Die Marke der Stadtwerke Hannover

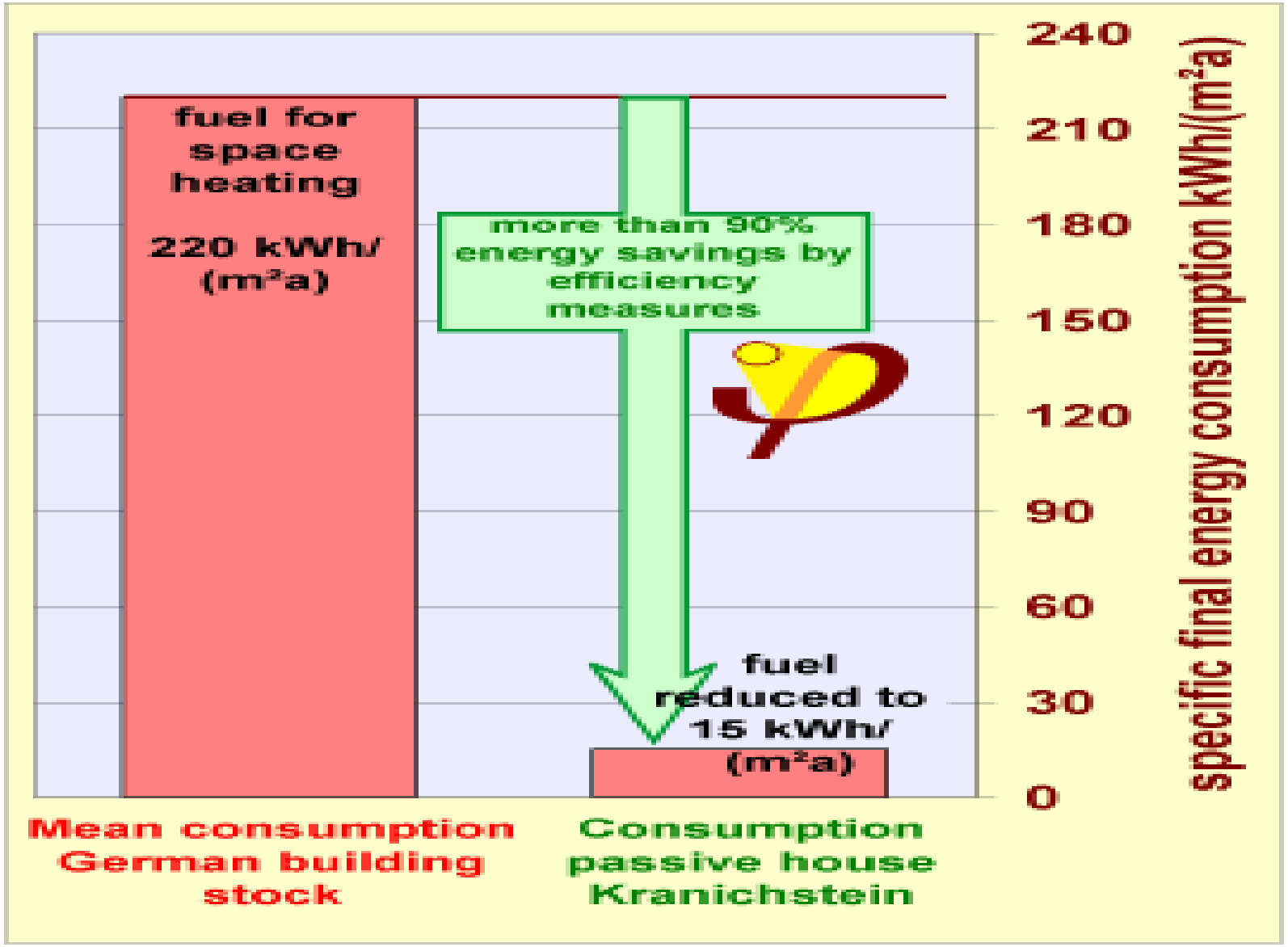
Passiv Haus Institut
Dr. Wolfgang Feist

CEPHEUS-Projectinformation No. 36



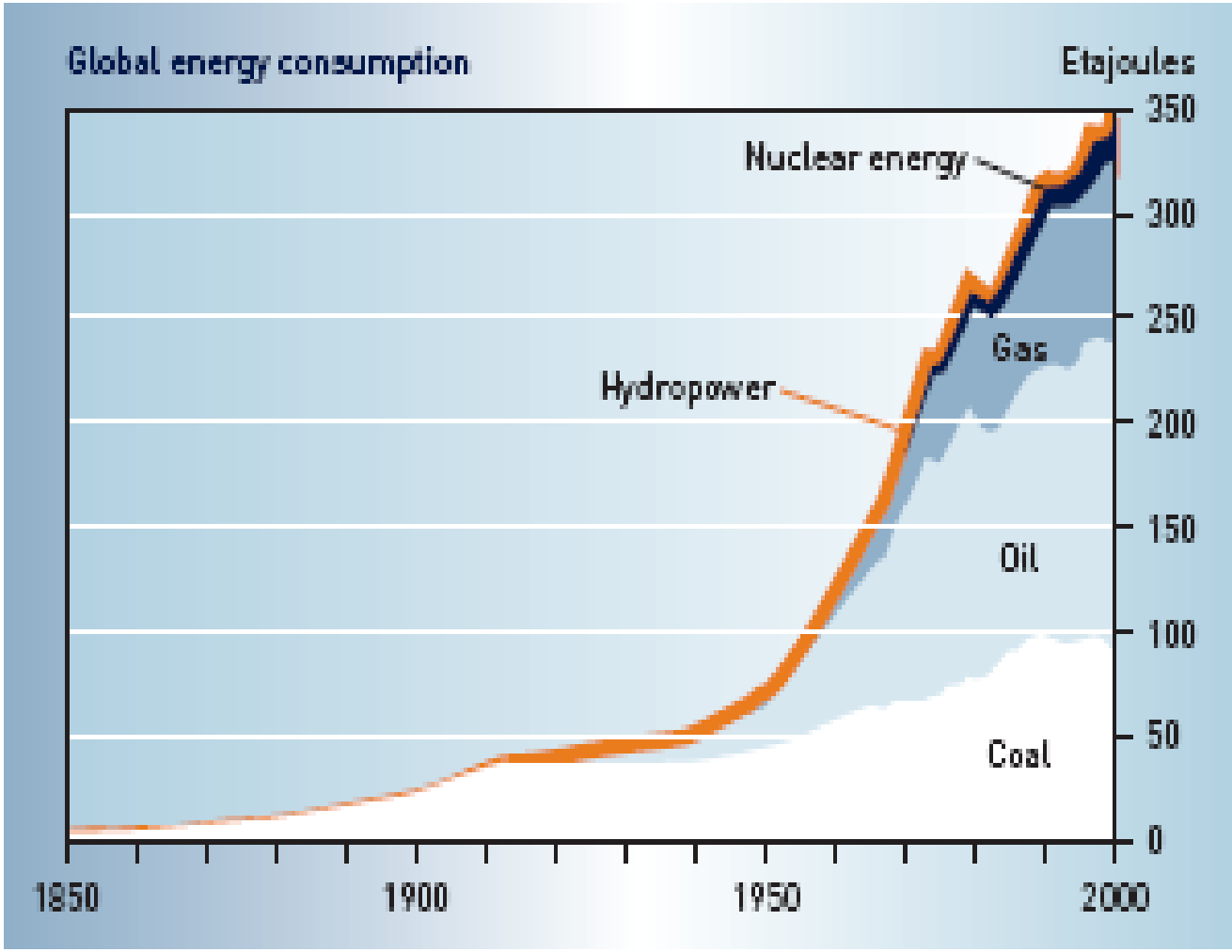
Final Technical Report
July 2001

Project supported by the Thermie-Program of EU (BU/0127/97)


fuel for space heating
220 kWh/ (m²a)
more than 90% energy savings by efficiency measures
fuel reduced to 15 kWh/ (m²a)
240
210
180
150
120
90
60
30
0
specific final energy consumption kWh/(m²a)
Mean consumption German building stock
Consumption passive house Kranichstein

Unsustainable Growth

Given the explosive nature of the development in energy consumption, we clearly cannot speak of «normal» growth. Over the past 50 years, global consumption has increased more than fourfold. [Chart excluding renewable energies and waste]



2.1.2 Definition of the Passive House standard

The term "Passive House" refers to a construction standard. The standard can be met using a variety of technologies, designs and materials. It is a refinement of the low-energy house (LEH) standard.

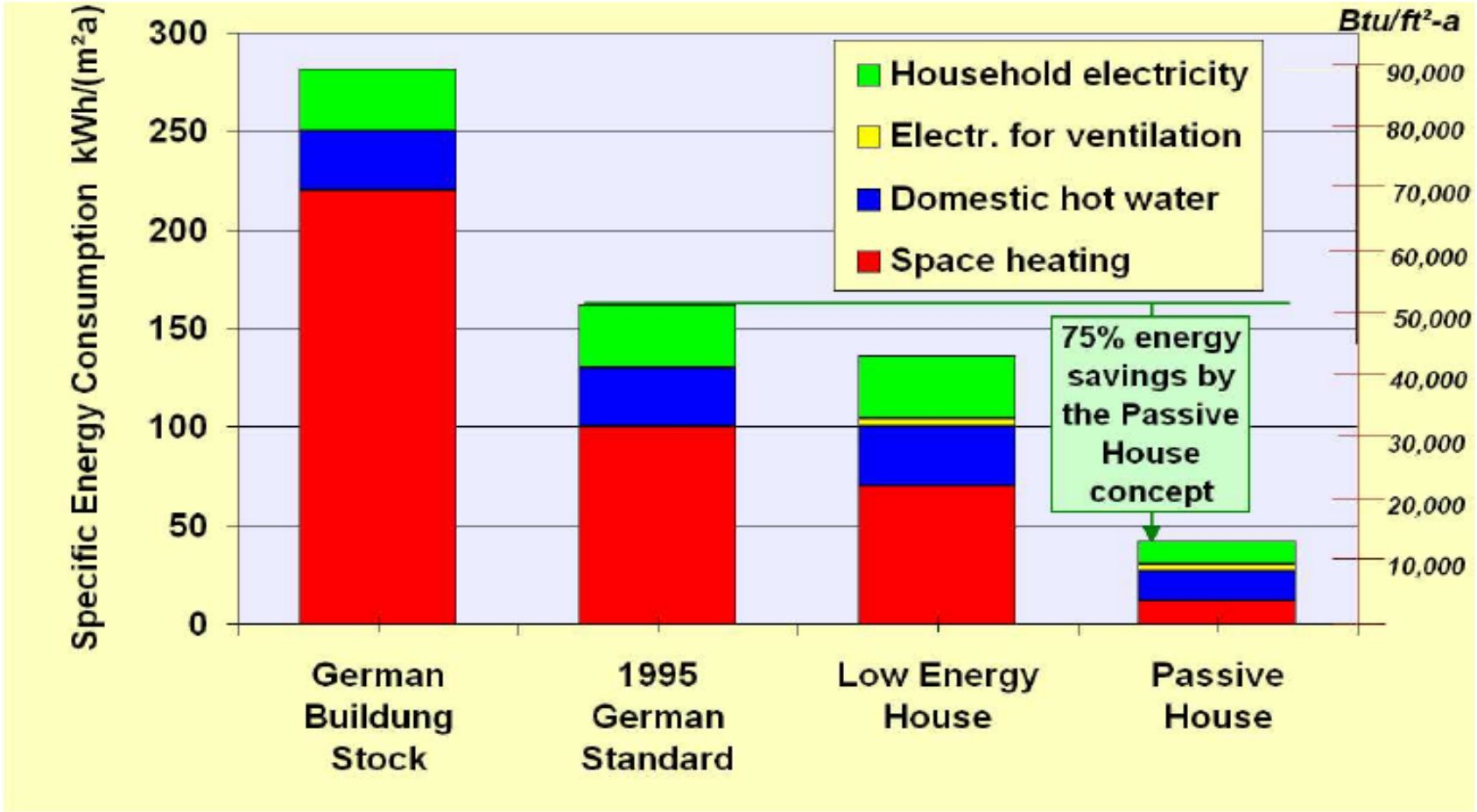
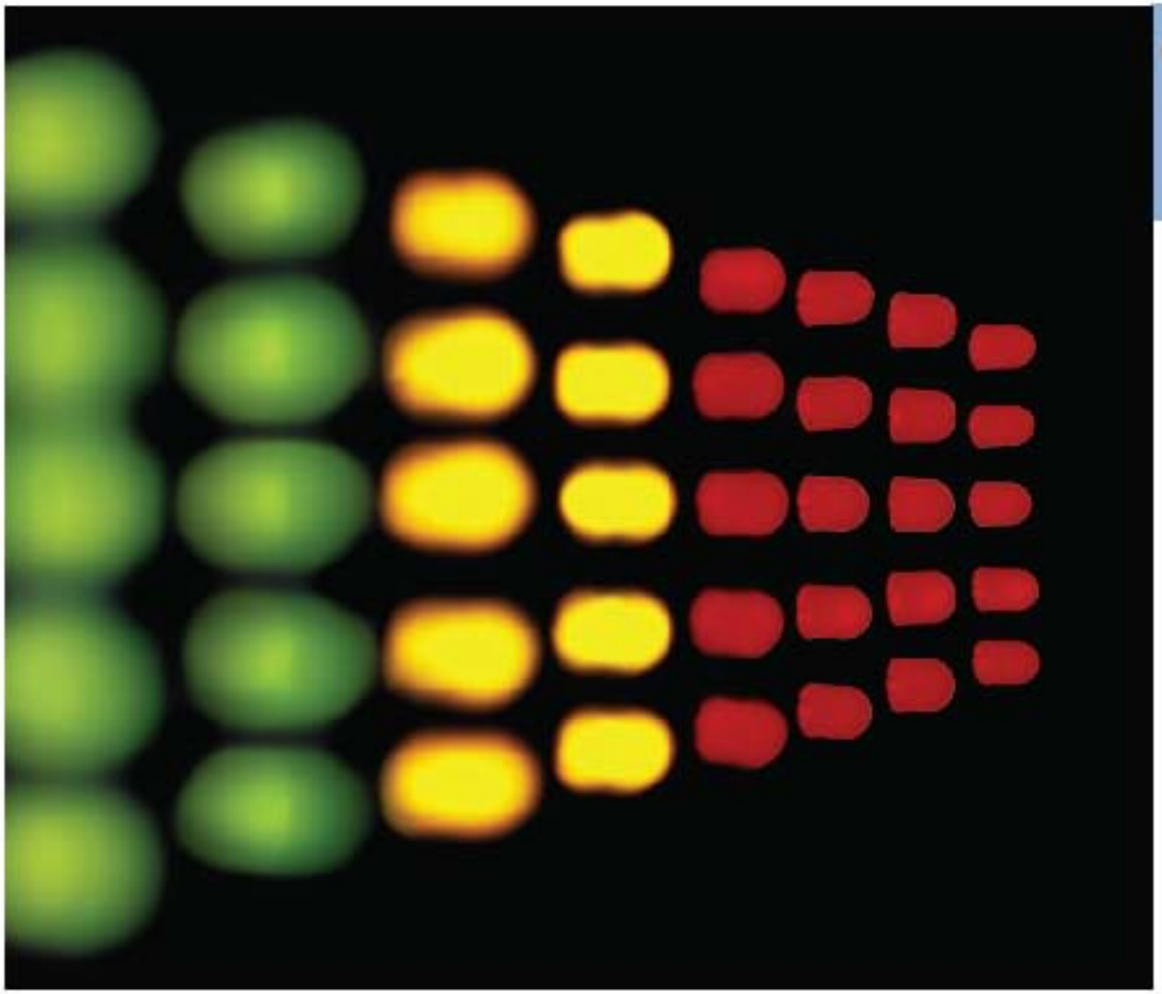
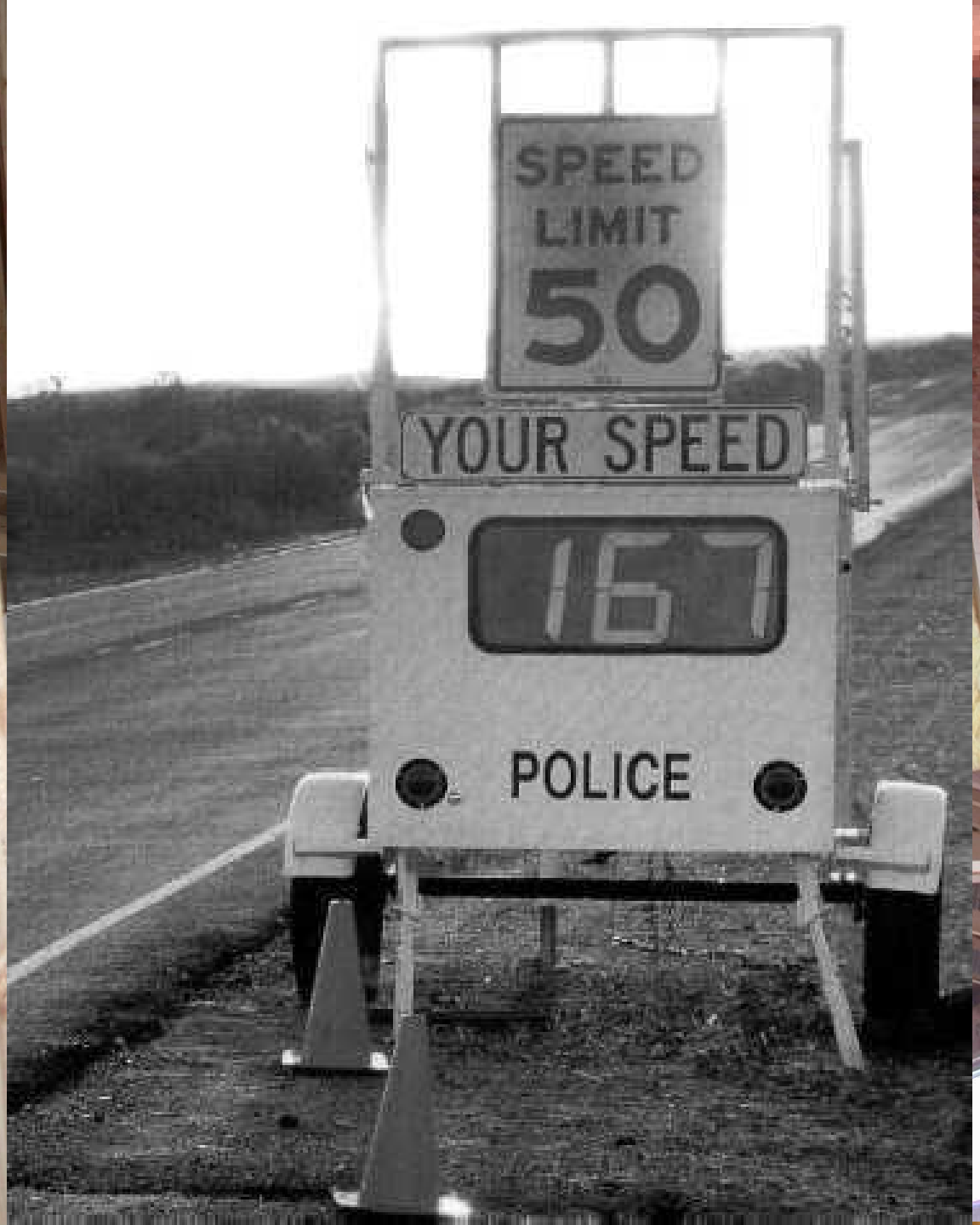


Figure 1: Comparison of specific energy consumption levels of dwellings



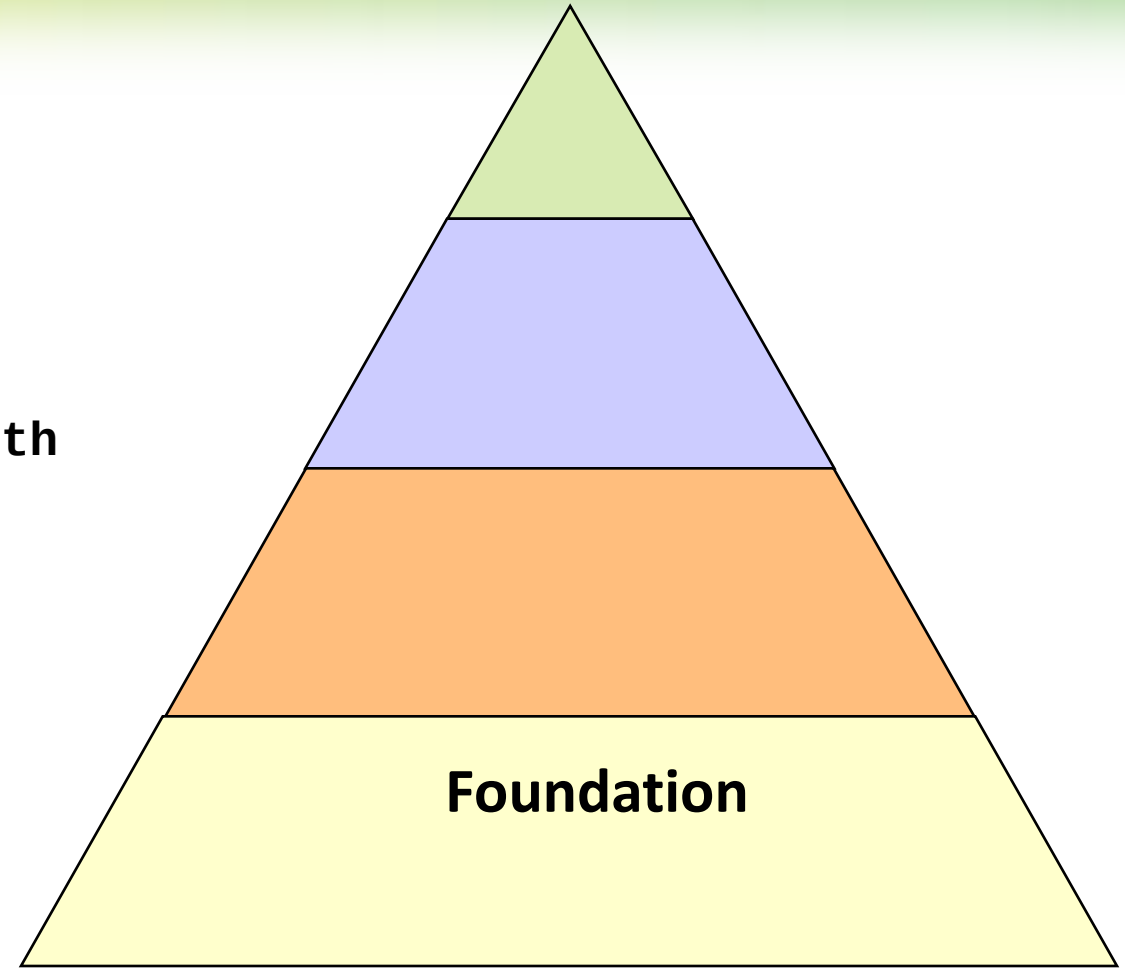
The increase in efficiency in the area of light production is a prime example of rapid technological development. In 1879, the Edison light bulb produced a luminous flux of 3 lumens per watt, compared with 100 lumens per watt produced by fluorescent lamps and LED elements (see large photo).


SPEED
LIMIT
50
YOUR SPEED
16?
POLICE

Focus starting to be put on housing

Systems Thinking

- **Holds it all together**
  - **Changes the way we think about houses**
    - **How they are built**
    - **How they interact with people**
    - **How they integrate with the environment**
    - **How they perform**



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Building a House Yesterday

Trades
- **Design**
- **Foundation**
- **Framing**
- **Plumbing**
- **Electrical**

Individual & Separate

Drafty, uncomfortable, yet durable houses

Expectation?

1910

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Building a House Today

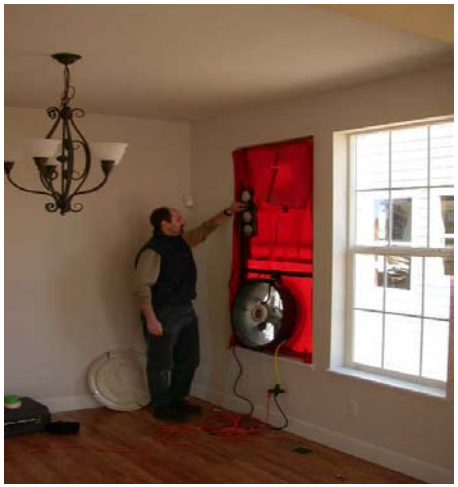
We have added

- **Thermal Insulation**
- **Tighter Building Envelopes**
- **Heating & Cooling Systems**

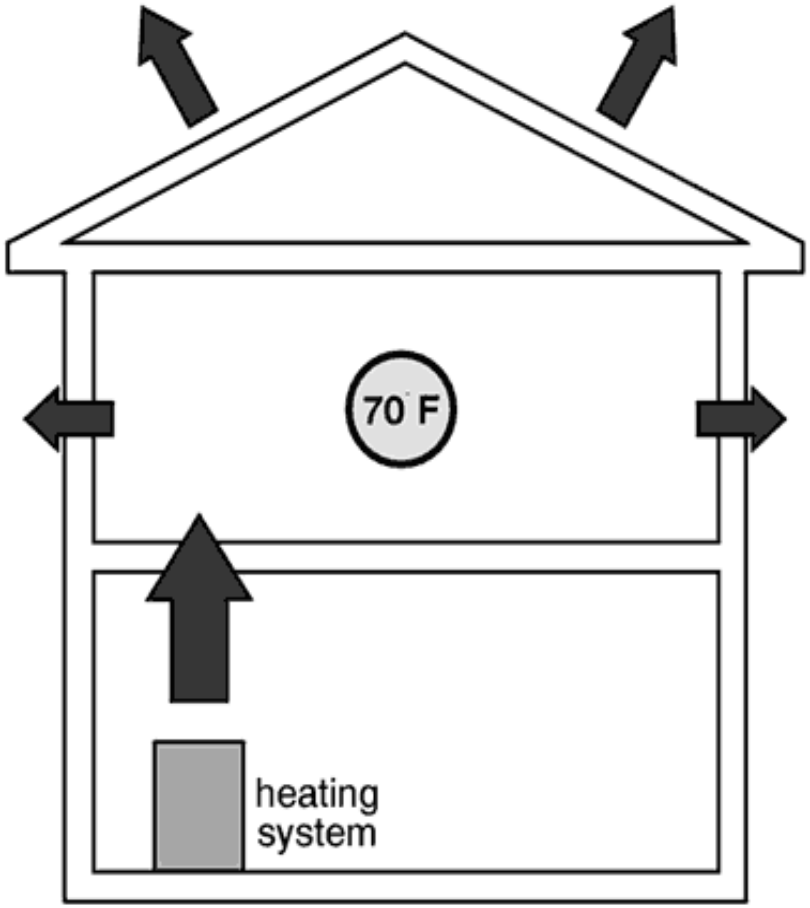
Yet is our House

- **comfortable**
- **Durable**
- **Safe**
- **Energy Efficiency**
- **Environmental**

Expectation

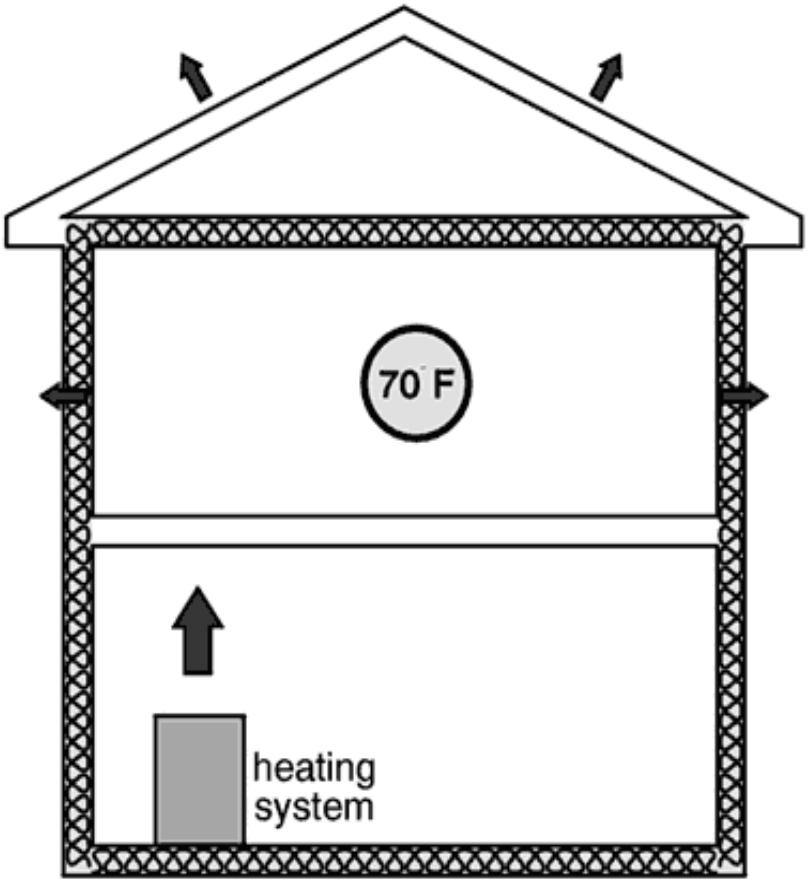


Two comfort strategies



poorly insulated house

heating system has to work harder (use more fuel/higher costs) because a lot more heat is escaping to the outside but, the house is still maintained at a comfortable 70° F



well insulated house

less fuel is required to keep the house at 70° F because the insulation reduces heat loss - keeping heat inside the house longer

Move to a Systems Approach

- The various parts work together
- Achieving what they could not on their own
  - Safety
  - Comfort
  - Durability
  - Efficiency
  - Environmental

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If the House is an Operating System

There are

three main components

to the system...

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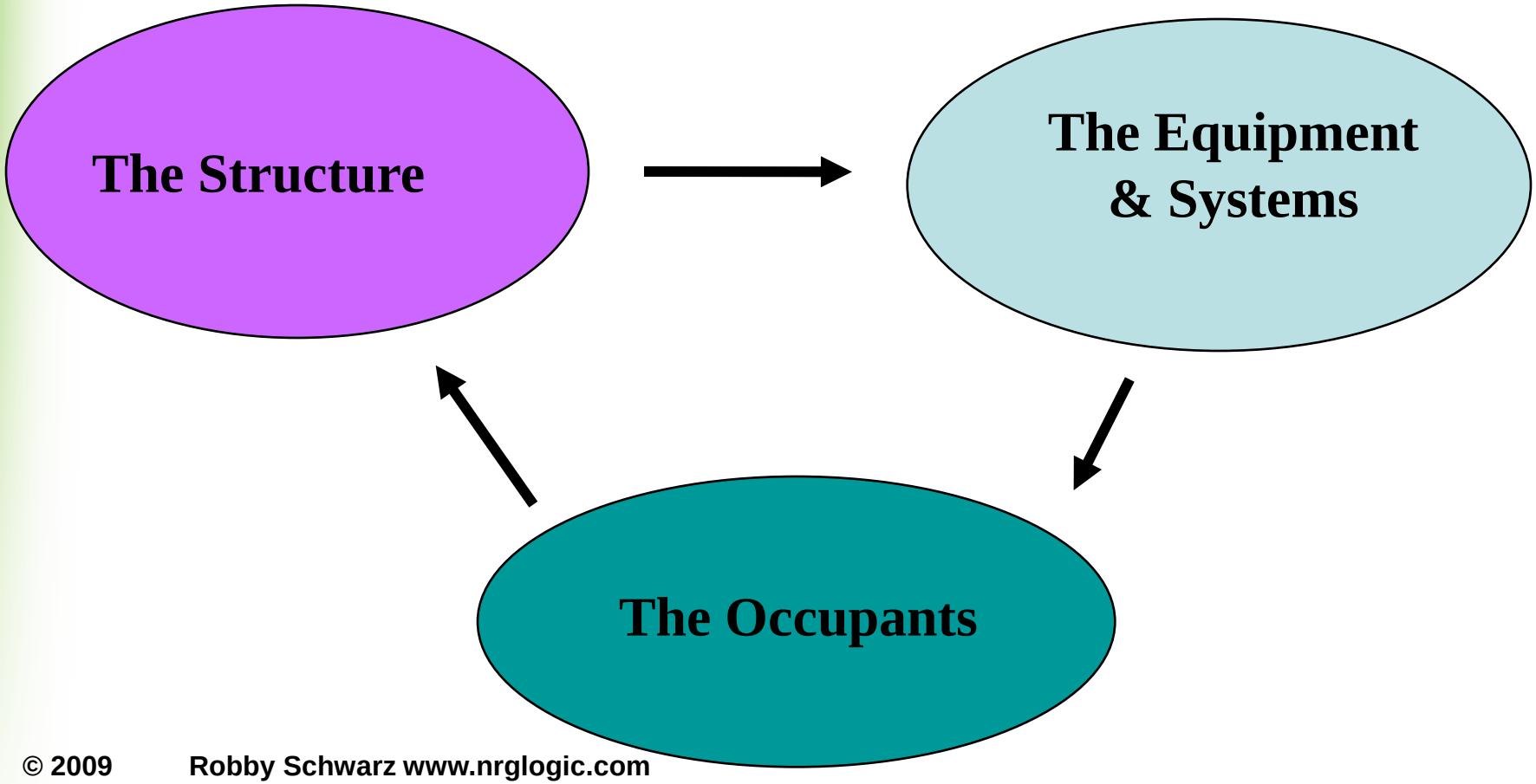
The Components of the System



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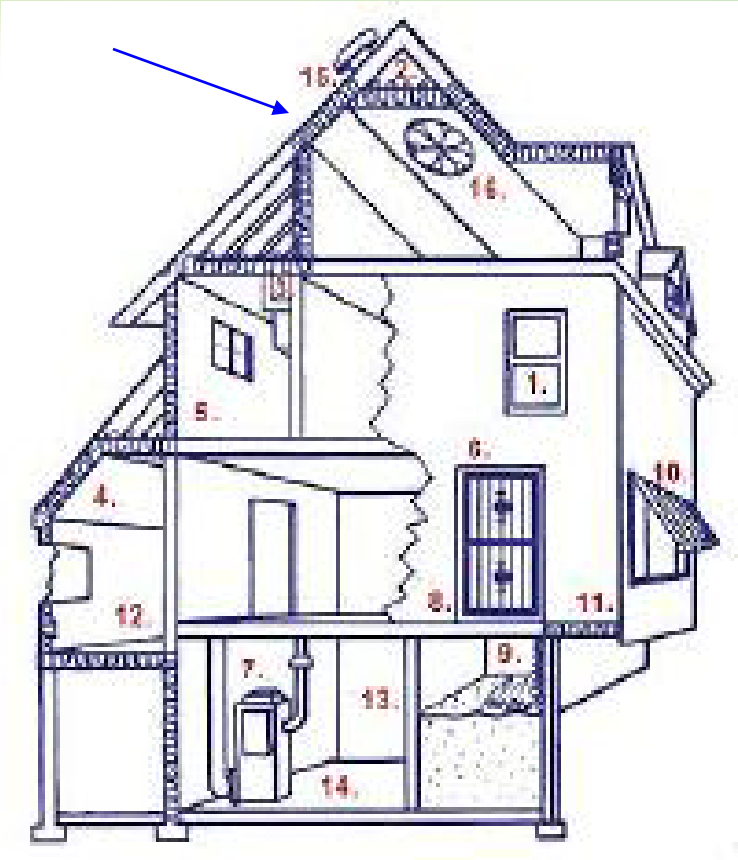
The Basic Requirements of the Thermal Envelope

Barrier / Boundary

Control Heat flow
Control air flow
Control water and vapor flow
Control rain penetration
Control light and solar gain
Control noise
Provide strength and rigidity

Be Durable & Provide

Safety
Comfort
Efficiency
Environmental



Can You Define Where It Is?

Where is the Thermal Envelope?

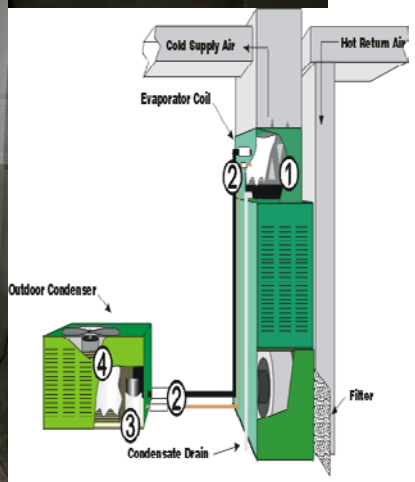
Systems for Comfort & Security

Heating equipment
Cooling equipment
Humidification & dehumidification equipment

Others systems
- Lights & Appliances
- Electronics
- Security
- Plumbing

Safety and Comfort
- Durable
- Efficient
- Environmental

Whose Responsible for it ?



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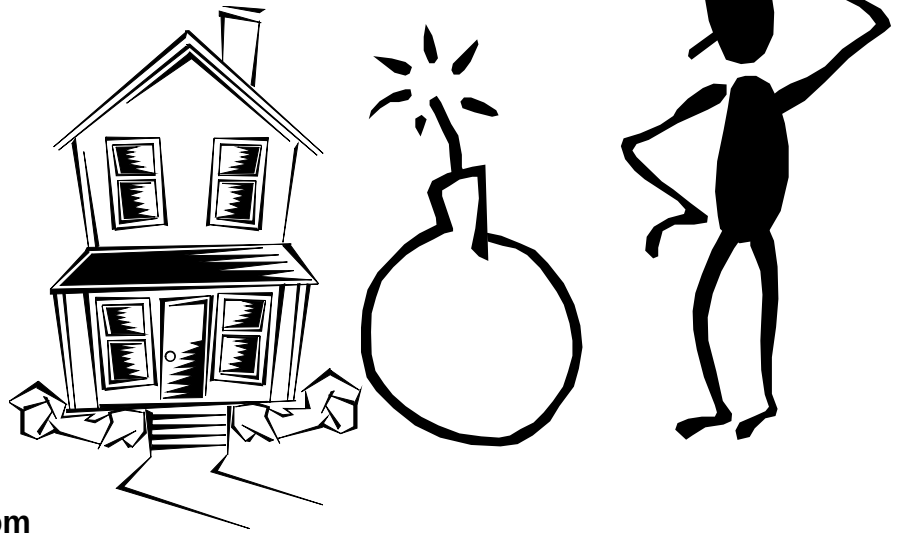
Occupant Factors

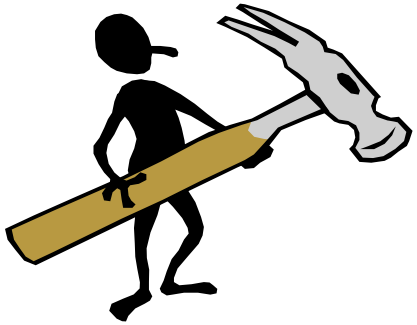
Density of bodies

Lifestyle

Operation



Maintenance



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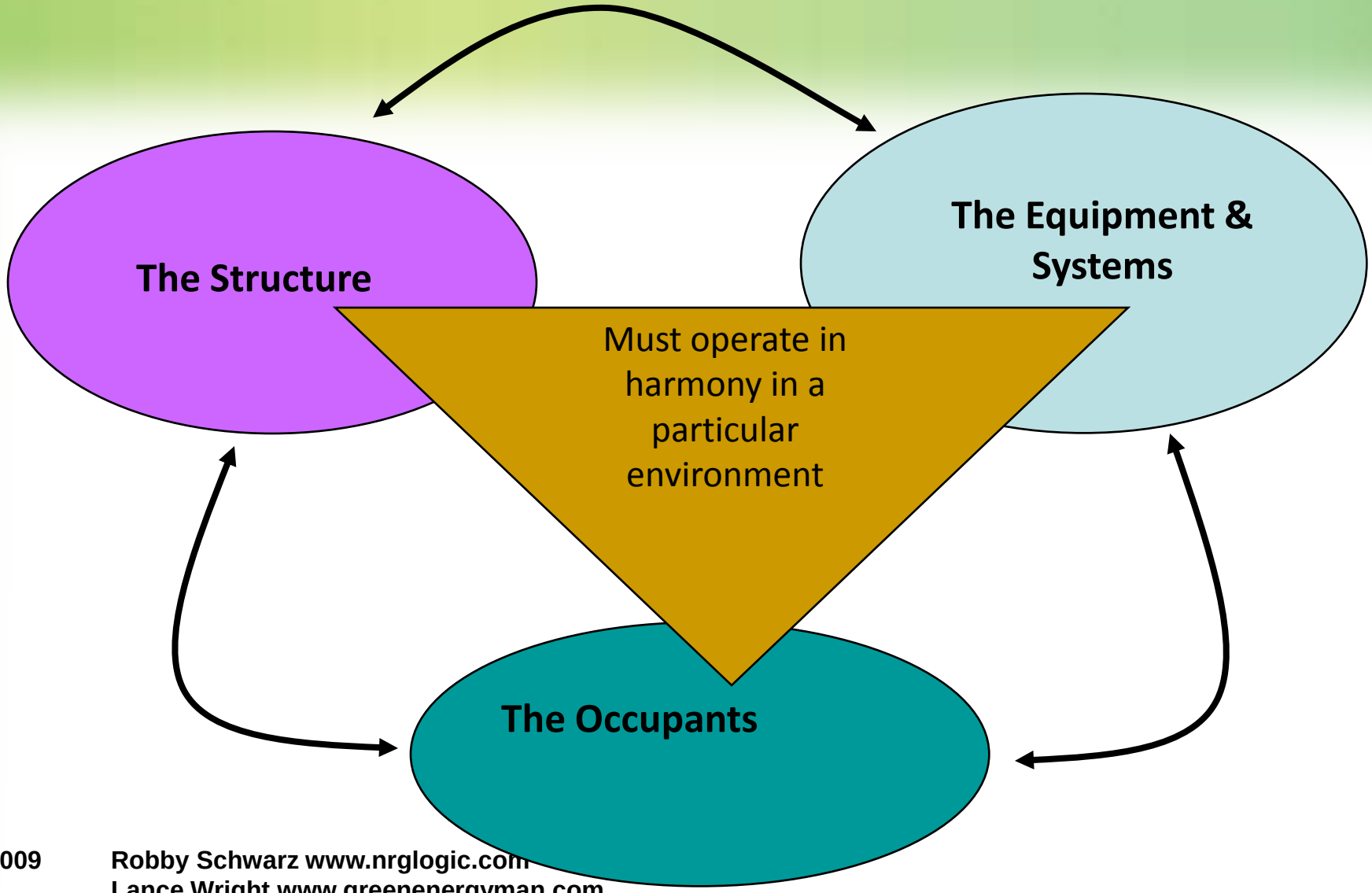
Three Components of the System



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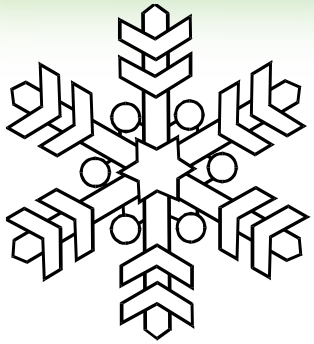
Controlling the Elements in the Environment



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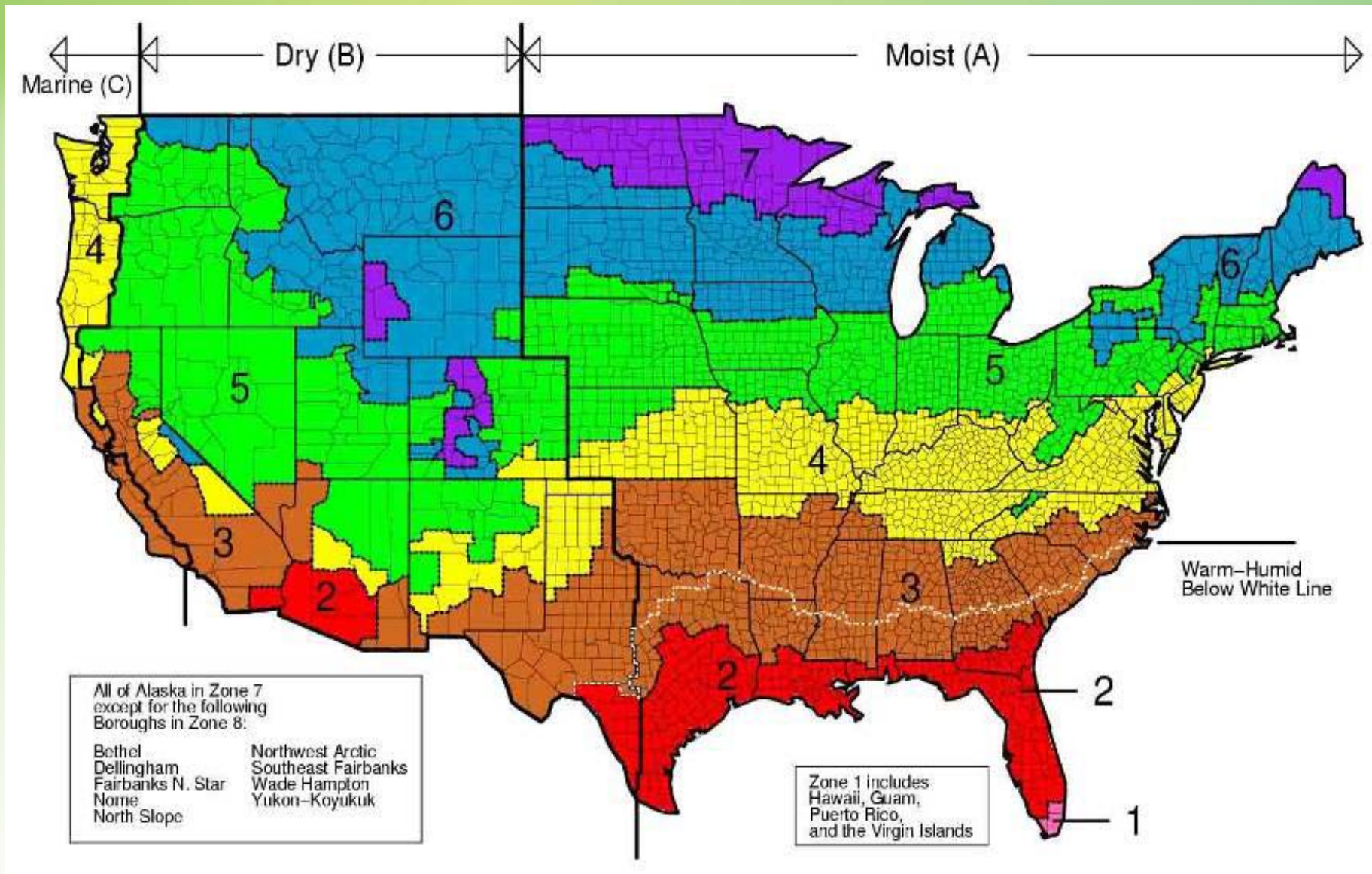
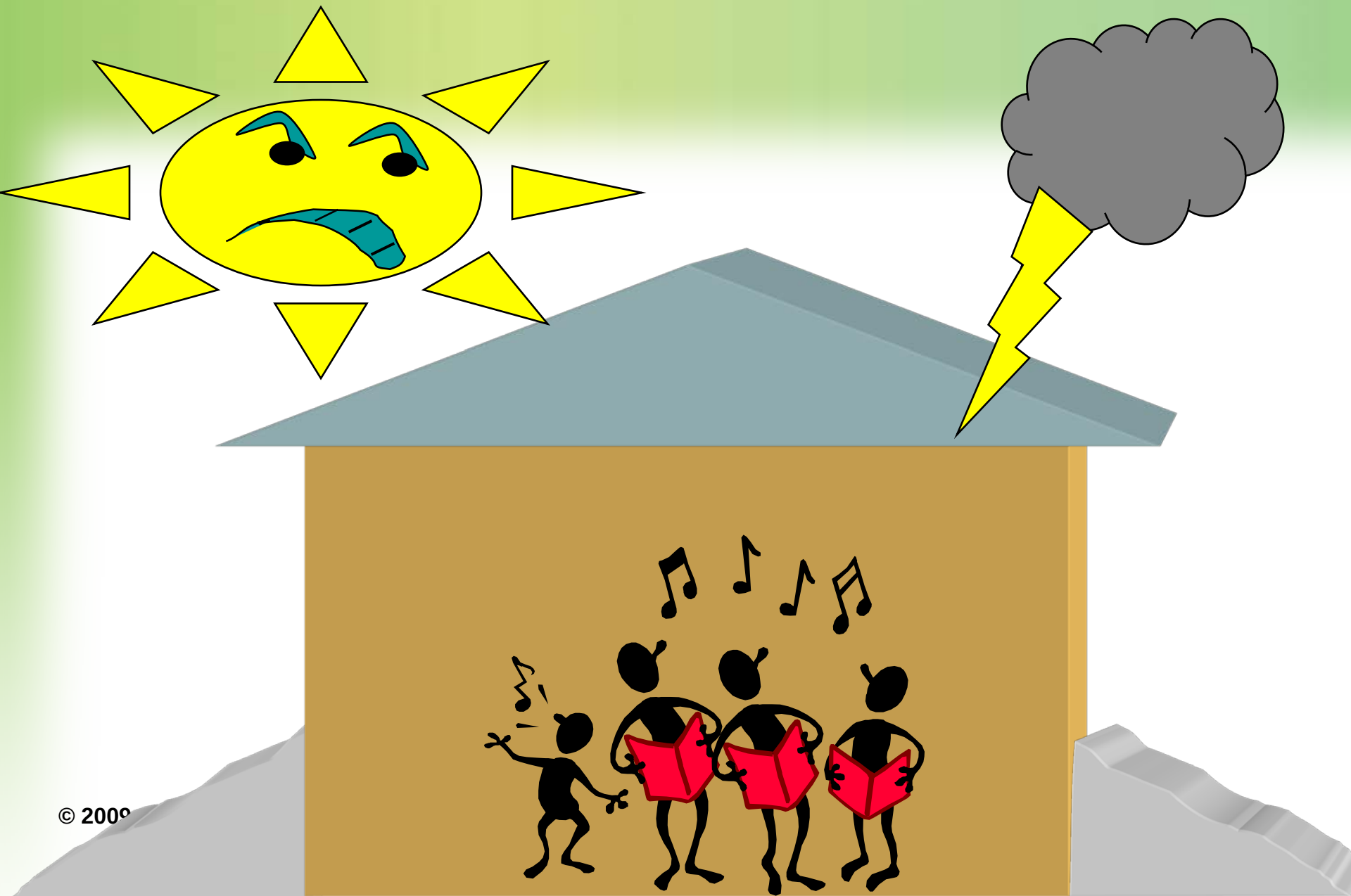
Climate Zones—2006 IECC



We Create Micro Climates



Micro Climate

- **Controlled environment**
  - **Consistent Comfort**
    - **Temperature**
    - **Humidity**
  - **Air Quality**
- **Predictability / Control**
  - **Tighter**
  - **Insulation**
  - **Mechanical Systems**
  - **Ventilation**

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Systems Thinking

House as a system is the backbone of applied building science.

Revolutionized how we think about housing today.

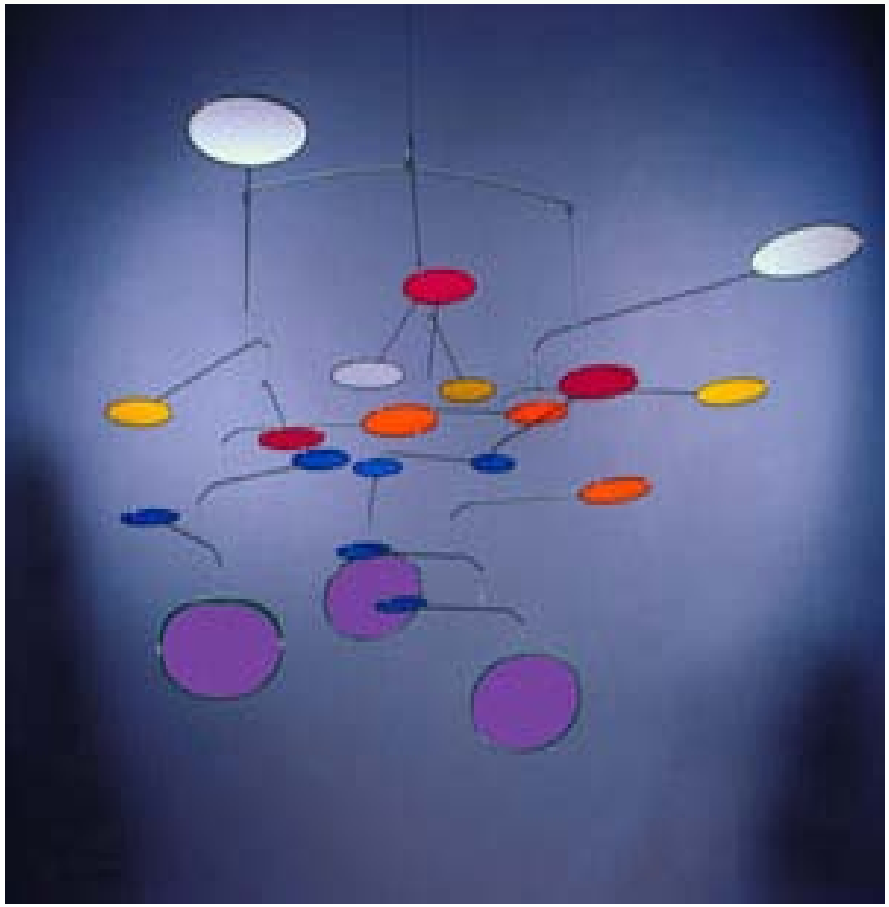
Every change must be evaluated to determine its effect on the system.

The components working together to achieve what they could not on their own!

Will it affect

- **Moisture, heat or air flow?**
- **Indoor air quality?**
- **Comfort, safety or health of the occupants?**
- **Durability & Performance**
- **Efficiency**
- **Environment**

It's a "holistic" approach



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Key Players

Green, Greener, Greenest by DuVivier, Schwarz, Wright

Organization	Who are they?	Standard Developed
I. Standards Groups International Code Council (ICC)	A membership association dedicated to building safety and fire prevention by the development of international residential and commercial building codes. ICC holds hearings and adopts updated codes every three years.	International Energy Conservation Code (IECC) **www.iccsafe.org**
National Association of Home Builders (NAHB)	D.C.-based trade association for the housing & building industry with the mission to provide safe and affordable housing. Founded in 1942, NAHB is a federation of more than 800 state and local associations.	National Green Building Standard ICC-700 - jointly developed with ICC and including both energy guidelines and a rating system. **www.nahbgreen.org**
II. Government Entities	Various state, county, and local entities.	Varies
III. Certification Groups U.S. Green Building Council (USGBC) *and others*	The U.S. Green Building Council (USGBC) is a 501(c)(3) non-profit community of leaders working to make green buildings available to everyone. Expressed through LEED certification, this rating system defines how buildings compare within a wide range of measureable criteria.	Leadership in Energy and Environmental Design (LEED). Presently the most widely known rating system in the U.S. ***www.usgbc.org***

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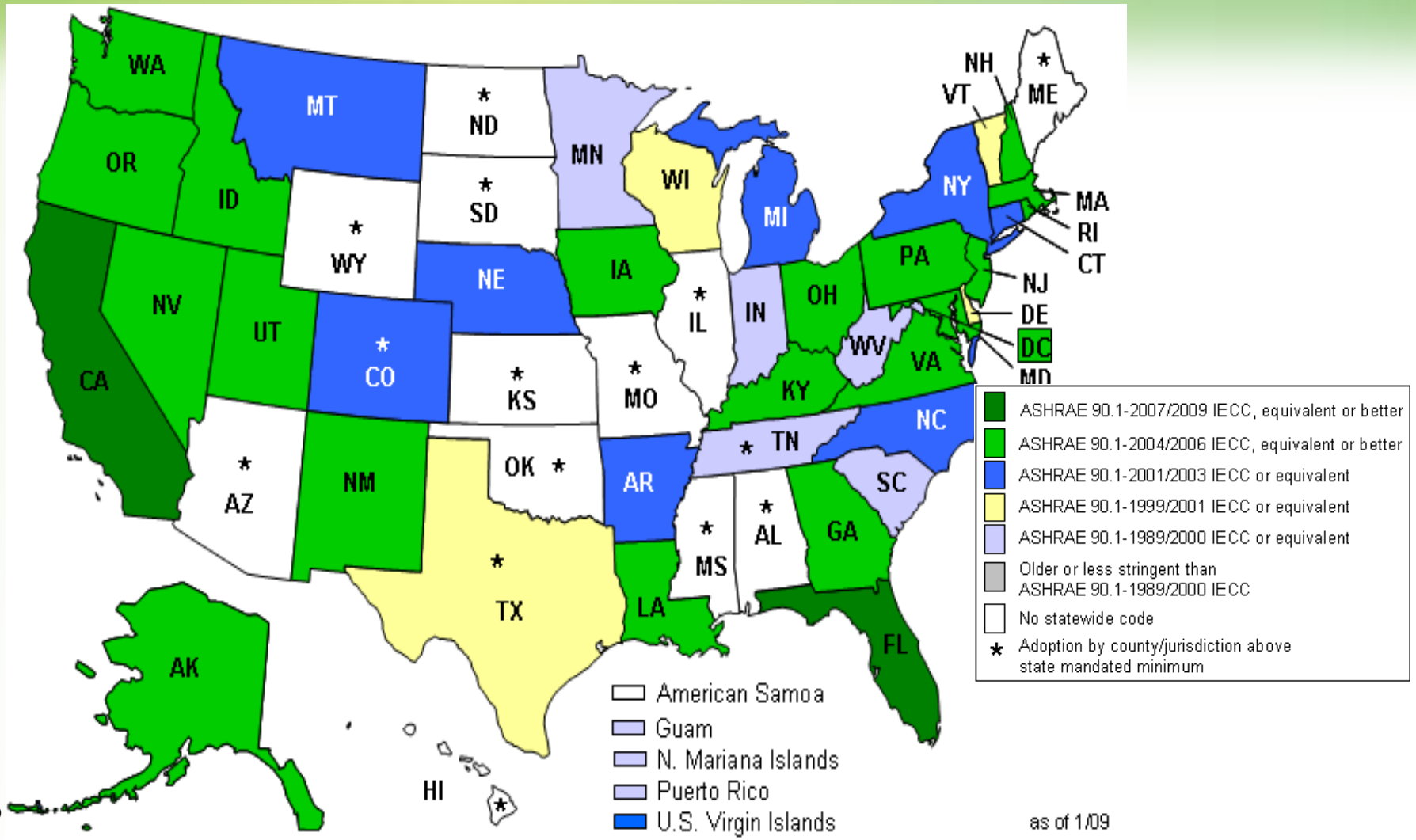
Lance Wright www.greenenergyman.com

Residential State Energy Codes

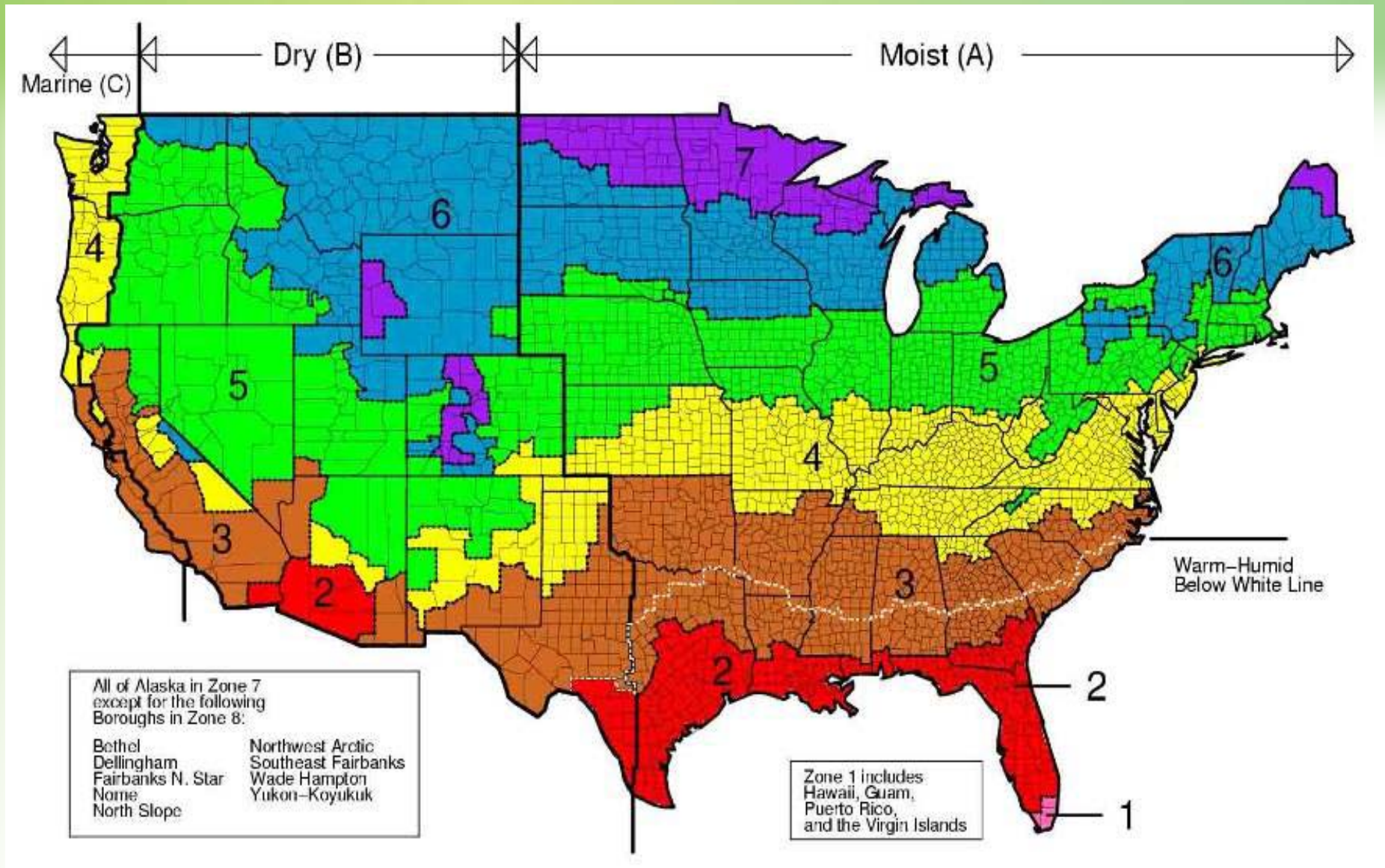


http://www.energycodes.gov/implement/state_codes/

Summary of Sustainability Rating Systems

Rating Systems	Organization	Energy Efficiency	Green	Notes/Comments
National Green Building ICC-700	National Ass. of Home Builders (NAHB) and ICC	Energy Star or similar	X	The newest program - NAHB Green Building Program offers two resources for scoring homes: the ANSI approved ICC 700-2008 National Green Building Standard, and the NAHB Model Green Home Building Guidelines. Both offer a variety of line items that a builder can choose from in creating a green home. http://www.iccsafe.org/news/green/ ICC jointly developed this system with the NAHB.
LEED for Homes	U.S. Green Building Council (USGBC)	ES or similar	X	LEED's certification programs are presently the most widely known benchmarks for the design, construction, and operation of high performance green buildings. LEED promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality. http://www.usgbc.org/DisplayPage.aspx?CMSPageID=147
Built Green Colorado	Denver's HBA (Home Builders Association)	ES	X	Introduced in 1995, Built Green Colorado is one of oldest and largest green home building programs in the nation–a voluntary, industry-driven program of the Home Builders Association of Metro Denver offered to builders across the state. The purpose of Built Green Colorado is to encourage home builders to use technologies, products, and practices that result in homes that are better built and better for the environment. http://www.builtgreen.org/
Energy Star	EPA And DOE	ES		To earn the ENERGY STAR rating, a home must meet guidelines for energy efficiency set by the U.S. Environmental Protection Agency. These homes are at least 15% more energy efficient than homes built to the *2004 International Residential Code (IRC)*, and typically include additional energy-saving features that make them 20–30% more efficient than standard homes. http://www.energystar.gov/index.cfm?c=new_homes.nh_featureshttp://www.energystar.gov/
Passive House	Passive House Institute US	Passive House Planning Program (PHPP)	No sep. green credit for matrls, size, site, or water issues.	Passivhaus is a European energy certification system that is often described as "the world's strictest energy standard." It was formally introduced into the United States in January of 2008. Passive House design uses strict building techniques to capture solar energy instead of relying predominantly on "active" systems to bring a building to near-zero-energy use. High performance windows, super-insulation, an airtight building shell, limitation of thermal bridging, and balanced energy recovery ventilation make possible extraordinary reductions in energy use and carbon emission. http://www.passivehouse.us/passiveHouse/PassiveHouseInfo.html

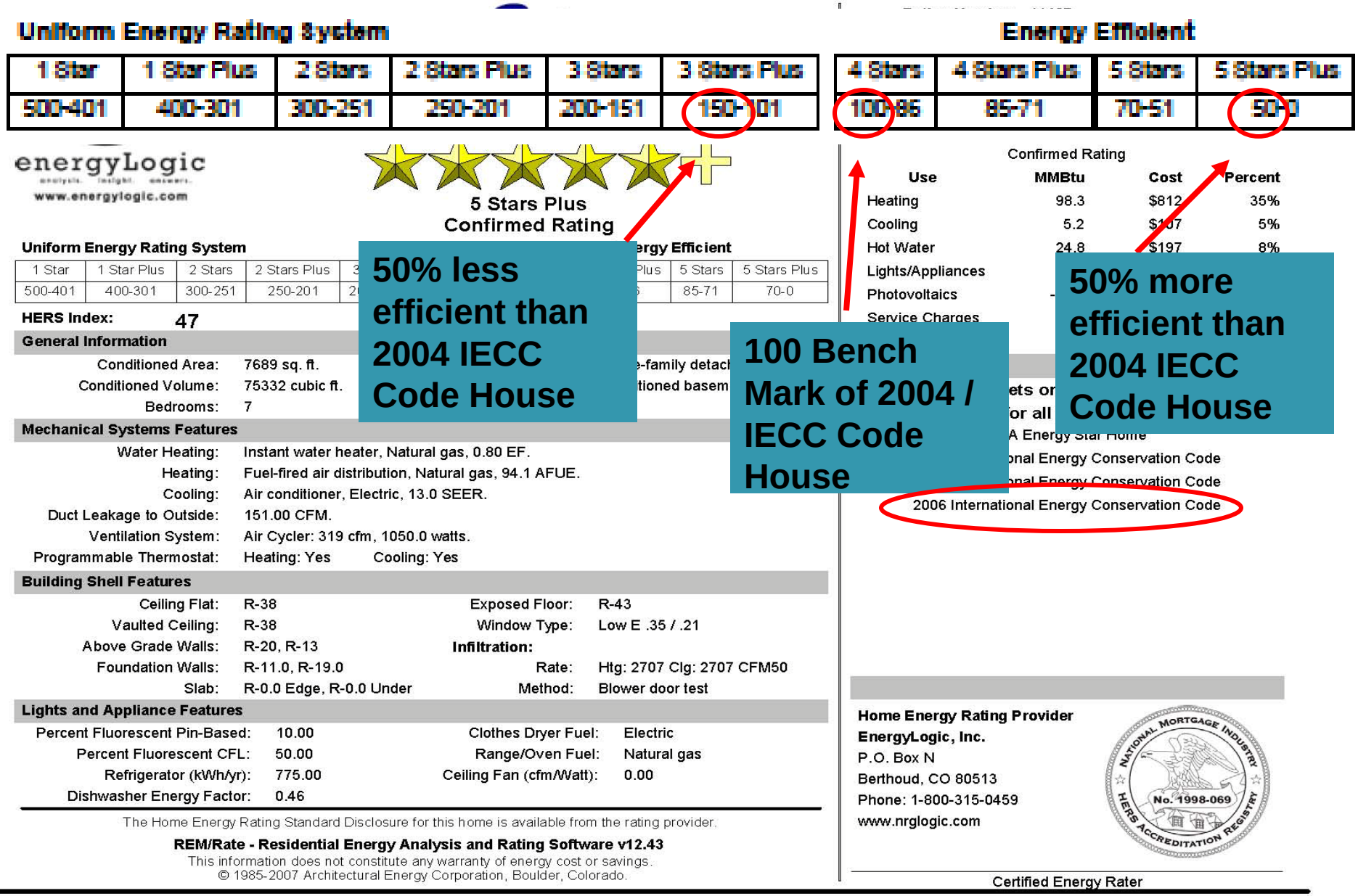
Climate Zones—2006 IECC



Prescriptive table

Package	Window U-Factor	Skylight U-Factor	Ceiling R-Value	Wood Framed Wall R-Value	Mass Wall R-Value	Floor R-Value	Basement Wall R-Value	Slab R-Value and Depth	Crawl Space Wall R-Value
Climate Zone 4	**0.4**	**0.60**	**R-38**	**R-13**	**R-5**	**R-19**	**R-10/13**	**R-10, 2ft**	**R-10/13**
Climate Zone 5	**.035**	**0.60**	**R-38**	**R-19 or 13+5**	**R-13**	**R-30**	**R-10/13**	**R-10, 2ft**	**R-10/13**
Climate Zone 6	**0.35**	**0.60**	**R-49**	**R-19 or 13+5**	**R-15**	**R-30**	**R-10/13**	**R-10, 4ft**	**R-10/13**
Climate Zone 7	**0.35**	**0.60**	**R-49**	**R-21**	**R-19**	**R-30**	**R-10/13**	**R-10, 4ft**	**R-10/13**

HERS Index and the IECC



Uniform Energy Rating System

1 Star	1 Star Plus	2 Stars	2 Stars Plus	3 Stars	3 Stars Plus
500-401	400-301	300-251	250-201	200-151	150-101

Energy Efficient

4 Stars	4 Stars Plus	5 Stars	5 Stars Plus
100-86	85-71	70-51	50-0

energyLogic
www.energylogic.com

5 Stars Plus
Confirmed Rating

50% less efficient than 2004 IECC Code House

100 Bench Mark of 2004 / IECC Code House

50% more efficient than 2004 IECC Code House

Confirmed Rating

Use	MMBtu	Cost	Percent
Heating	98.3	$812	35%
Cooling	5.2	$107	5%
Hot Water	24.8	$197	8%
Lights/Appliances			
Photovoltaics			
Service Charges			

Uniform Energy Rating System

1 Star	1 Star Plus	2 Stars	2 Stars Plus	3	Plus	5 Stars	5 Stars Plus
500-401	400-301	300-251	250-201	2		85-71	70-0

ergy Efficient

HERS Index: 47

General Information

Conditioned Area:	7689 sq. ft.
Conditioned Volume:	75332 cubic ft.
Bedrooms:	7

-family detach
tioned basem

ets or
or all
A Energy Star Home
onal Energy Conservation Code
onal Energy Conservation Code
2006 International Energy Conservation Code

Mechanical Systems Features

Water Heating:	Instant water heater, Natural gas, 0.80 EF.
Heating:	Fuel-fired air distribution, Natural gas, 94.1 AFUE.
Cooling:	Air conditioner, Electric, 13.0 SEER.
Duct Leakage to Outside:	151.00 CFM.
Ventilation System:	Air Cycler: 319 cfm, 1050.0 watts.
Programmable Thermostat:	Heating: Yes Cooling: Yes

Building Shell Features

Ceiling Flat:	R-38	Exposed Floor:	R-43
Vaulted Ceiling:	R-38	Window Type:	Low E .35 / .21
Above Grade Walls:	R-20, R-13	**Infiltration:**	
Foundation Walls:	R-11.0, R-19.0	Rate:	Htg: 2707 Clg: 2707 CFM50
Slab:	R-0.0 Edge, R-0.0 Under	Method:	Blower door test

Lights and Appliance Features

Percent Fluorescent Pin-Based:	10.00	Clothes Dryer Fuel:	Electric
Percent Fluorescent CFL:	50.00	Range/Oven Fuel:	Natural gas
Refrigerator (kWh/yr):	775.00	Ceiling Fan (cfm/Watt):	0.00
Dishwasher Energy Factor:	0.46		

The Home Energy Rating Standard Disclosure for this home is available from the rating provider.

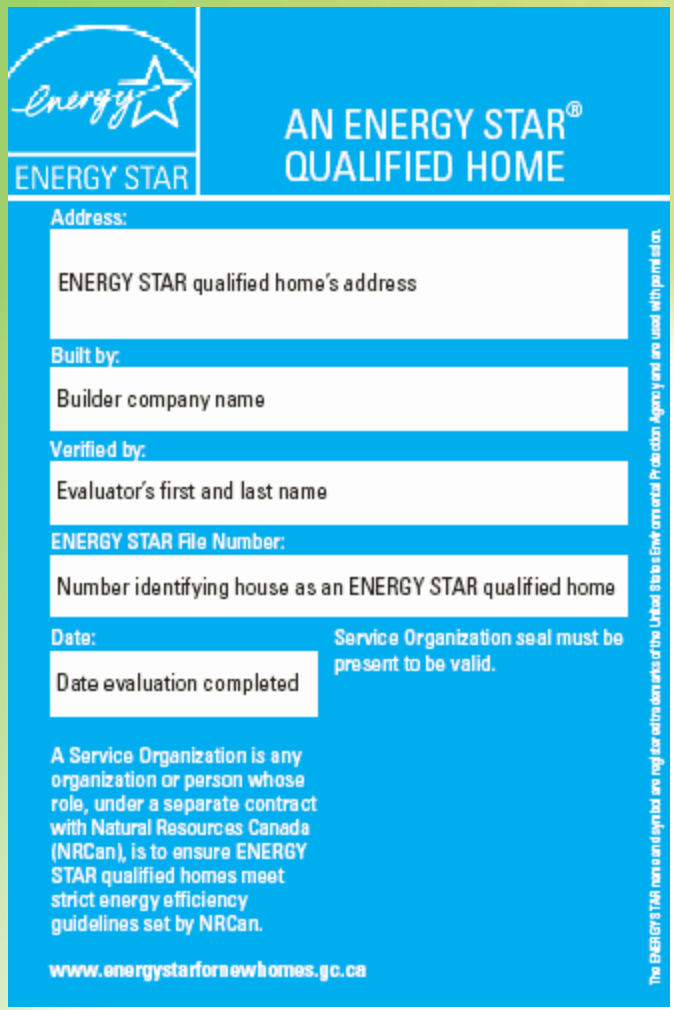
REM/Rate - Residential Energy Analysis and Rating Software v12.43

This information does not constitute any warranty of energy cost or savings.

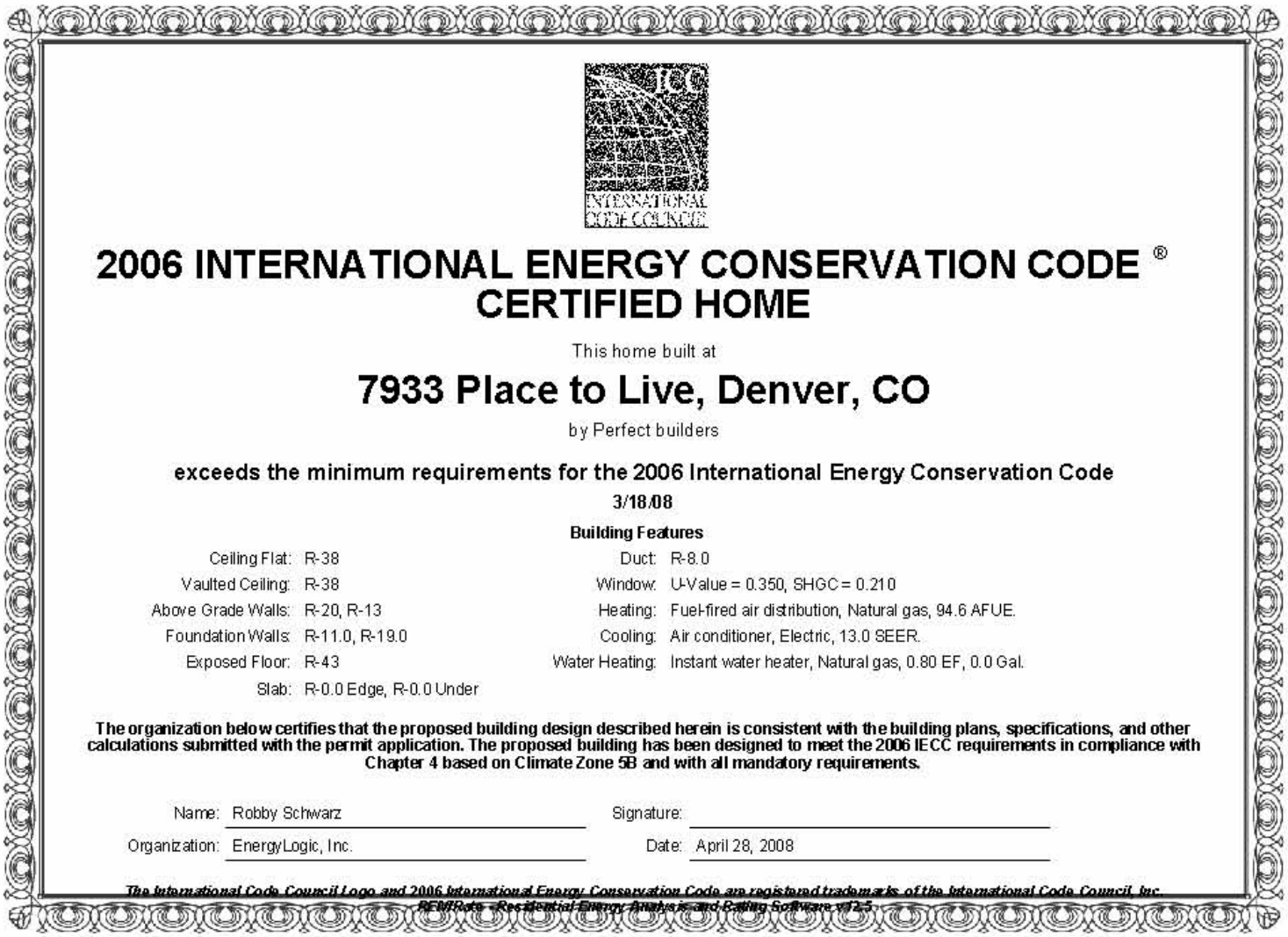
Home Energy Rating Provider
EnergyLogic, Inc.
P.O. Box N
Berthoud, CO 80513
Phone: 1-800-315-0459
www.nrglogic.com

NATIONAL MORTGAGE INDUSTRY HERS ACCREDITATION REGISTRY No. 1998-069

Certified Energy Rater



Code Certificate



2006 INTERNATIONAL ENERGY CONSERVATION CODE ® CERTIFIED HOME

This home built at

7933 Place to Live, Denver, CO

by Perfect builders

exceeds the minimum requirements for the 2006 International Energy Conservation Code

3/18/08

Building Features

Ceiling Flat:	R-38	Duct:	R-8.0
Vaulted Ceiling:	R-38	Window:	U-Value = 0.350, SHGC = 0.210
Above Grade Walls:	R-20, R-13	Heating:	Fuel-fired air distribution, Natural gas, 94.6 AFUE.
Foundation Walls:	R-11.0, R-19.0	Cooling:	Air conditioner, Electric, 13.0 SEER.
Exposed Floor:	R-43	Water Heating:	Instant water heater, Natural gas, 0.80 EF, 0.0 Gal.
Slab:	R-0.0 Edge, R-0.0 Under		

The organization below certifies that the proposed building design described herein is consistent with the building plans, specifications, and other calculations submitted with the permit application. The proposed building has been designed to meet the 2006 IECC requirements in compliance with Chapter 4 based on Climate Zone 5B and with all mandatory requirements.

Name: Robby Schwarz Signature: _____

Organization: EnergyLogic, Inc. Date: April 28, 2008

The International Code Council Logo and 2006 International Energy Conservation Code are registered trademarks of the International Code Council, Inc.
REMRate - Residential Energy Analysis and Rating Software v12.5

Built Green Certificate

BUILT GREEN.

EnergyLogic, Inc.

has verified that the home located at

15399 W. Iliff Drive, Lakewood, CO 80228

meets the requirements of

Built Green Colorado®

with an energy rating of 71 points and a green rating of 83 points from the Built Green Checklist

Robby Schwarz
2008.12.15 13:04:42
-07'00'

EnergyLogic, Inc. | Date or Rating

Upsala Glacier, Argentina

1928

2004


WATCH "RETURN TO TITANIC," NATIONAL GEOGRAPHIC CHANNEL, JUNE 2, 9 P.M. ET/PT
INSIDE THE WORLD OF IRAQ'S SHIITES
NATIONALGEOGRAPHIC.COM/MAGAZINE
JUNE 2004
NATIONAL GEOGRAPHIC
THE END OF CHEAP Oil
SPRAWL ON THE MALL?
BONUS TEAR-OUT MAP OF WASHINGTON, D.C.
VAMPIRE SQUID, FANGTOOTH FISH, AND OTHER SEA ODDITIES

Why Passive House?

Optimize the House…

… to the Heating System

PHIUS
Passive House Institute US

Economic Feasibility as Core Concept:

(W. Feist 2006)

PASSIV HAUS INSTITUT

Passive House Concept Developed in the early 1990s by Dr. Wolfgang Feist and Professor Bo Adamson as optimization of early superinsulation work

First Passive House Prototype built in 1990 in Kranichstein, Germany

70-80% reduction in overall energy consumption, 90-95% reduction of heating and cooling energy

Passivhaus Institut (PHI) founded in 1996

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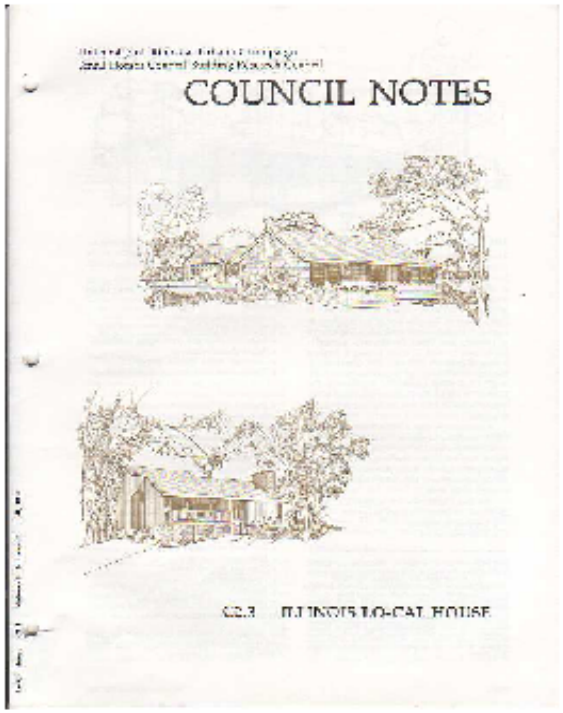
Passive House Institute US

The Small Homes Council
University of Illinois, Urbana-Champaign:
Wayne Schick's Team develops the Lo-Cal House in 1974-76



Walls:

Double stud Walls,

R-30

Roof:

R-40

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Passive House Institute US

Harold Orr builds the Saskatchewan Conservation House

In Saskatoon, Canada in 1977

First superinsulated house that showed that airtight construction is feasible. It is equipped with a ventilation system with an air-to-air heat exchanger.

Peak heat load at -10 degrees Fahrenheit is 3000 watts (10,640 Btu per hour)

Walls: 12" thick, R-44

Roof: R-60

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Eugene Leger builds the Leger House in Eastern Massachusetts

in the US in 1979

The Leger House looked like a conventional American home, heated only by its own water heater

It was widely published and inspired William Shurcliff, a Harvard physicist/author on solar heated homes to a press release on superinsulation

Larger developments followed in Canada in 1980 (14 superinsulated homes, in Minnesota (140 superinsulated homes)

1982-83 Canada sponsors the R2000 program with free training for builders and small subsidies to offset cost and requirement for an airtightness test: a blower-door test. Over 1000 homes were built.

Conservative estimate of total superinsulated homes 1985 in the states and Canada is 10,000.

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Envelope and Thermal Comfort Principles

1. **Continuous Insulation-** creating steady indoor temperatures that won't drop below 50 degrees without heating source

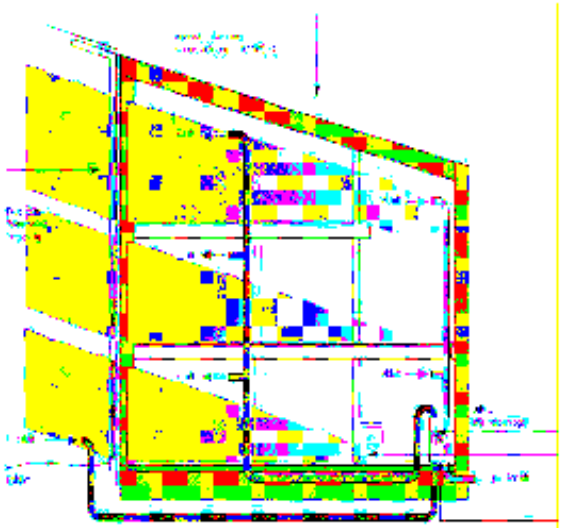
2. **Thermal Bridge Free Construction-** minimizes condensation/ building deterioration

3. **Compact Building Shape-** excellent surface-to-volume ratio (< 1)

4. **Airtightness-** minimizes moisture diffusion into wall assembly

5. **Balanced Ventilation with Heat Recovery with minimal Space Conditioning System -** exceptional efficiency, indoor air-quality and comfort

6. **Optimal Solar Orientation and Shading** – maximizing solar gains for winter, minimizing gains for the summer case



7. **Energy Efficient Appliances and Lighting-** highly efficient use of household electricity

8. **User Friendliness -** user manuals are recommended to be given homeowners

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May 20-22, 2008

Amory and Hunter Lovins finish the Rocky Mountain Institute

in Snowmass, Colorado in 1984

"Tunneling through the cost barrier"
Amory Lovins

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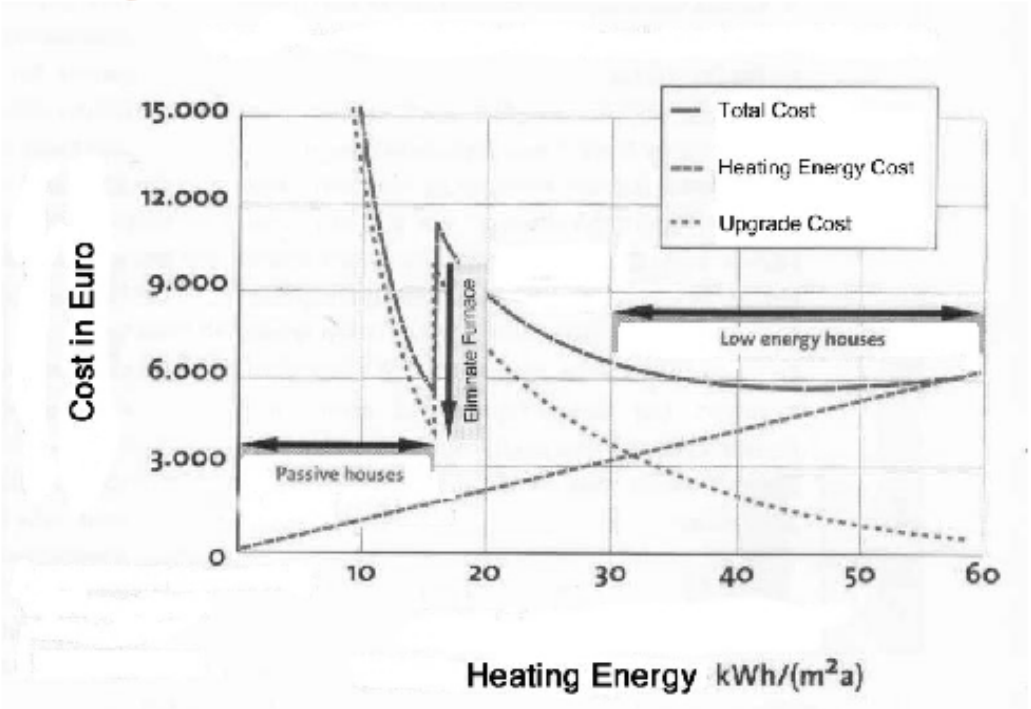
Passive House Institute US

Eliminating the Heating System for Market Viability:



Cost asymptote occurs when standard heating system is eliminated

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Passive House Institute US

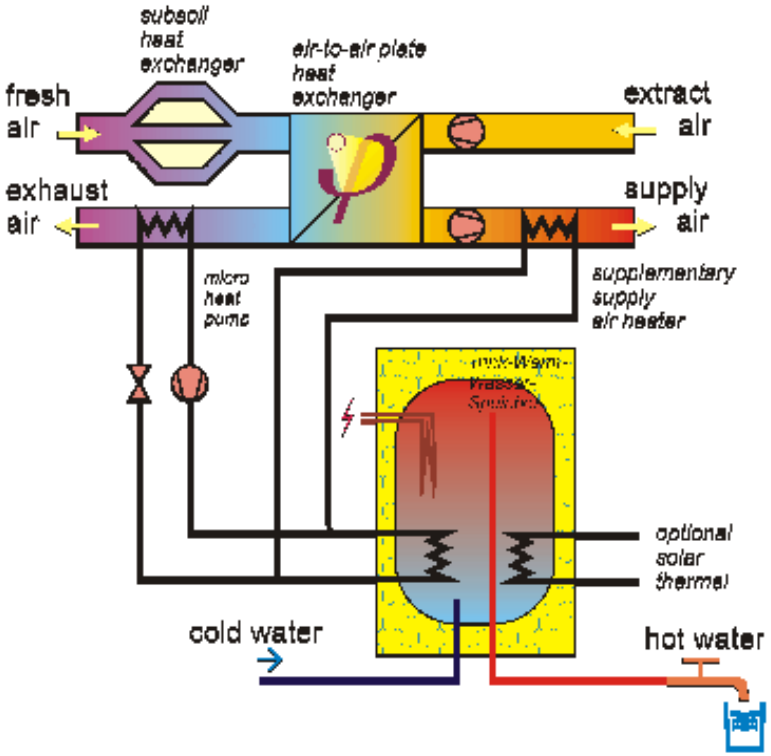
Wall Construction Components

Wall Type	*Insulation Type*
Structural insulated panel (SIP)	foam
Insulated Concrete Form (ICF)	
Double stud wall	cellulose, fiberglass, foam, cotton, wool, etc
Wooden I-Joist	
Straw Bale	Straw

No 'best' method, just must meet the thermal resistance requirements of the building in the specific climate

PHIUS
Passive House Institute US

Component Diagram of the Minimized Mechanical System:



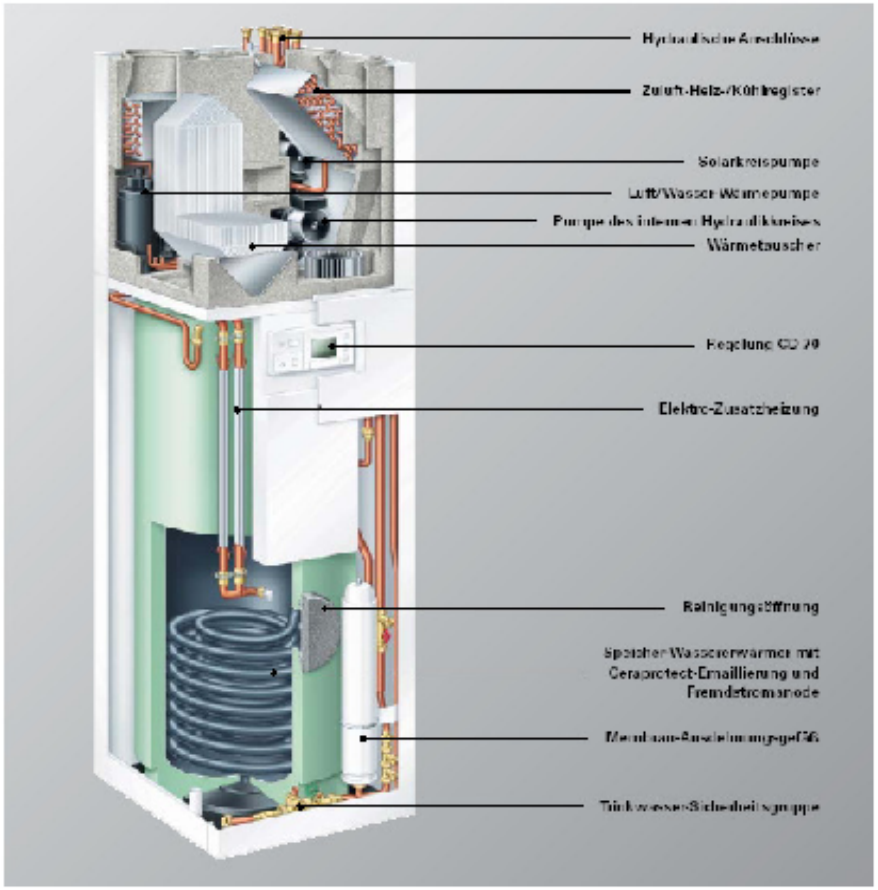
- **ERV/HRV with integrated hot water coil and/or Air to Air Heat Pump for heating/cooling**
- **Insulated Hot Water Tank w/ solar thermal collectors for DHW**

(Image: Passivhaus Institut)

The Compact Energy Tower: "The Magic Box"

Vitodens 343
Gas-Brennwert-
Compact-Tower
mit Solarspeicher

PHIUS
Passive House Institute US



The Compact Energy Tower:

- Models exist on European market
- Could be produced economically in US if given demand

Viessmann Vitores 343 ©Viessmann Corp

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Passive House Institute US

2.1.2 Definition of the Passive House standard

The term "Passive House" refers to a construction standard. The standard can be met using a variety of technologies, designs and materials. It is a refinement of the low-energy house (LEH) standard.

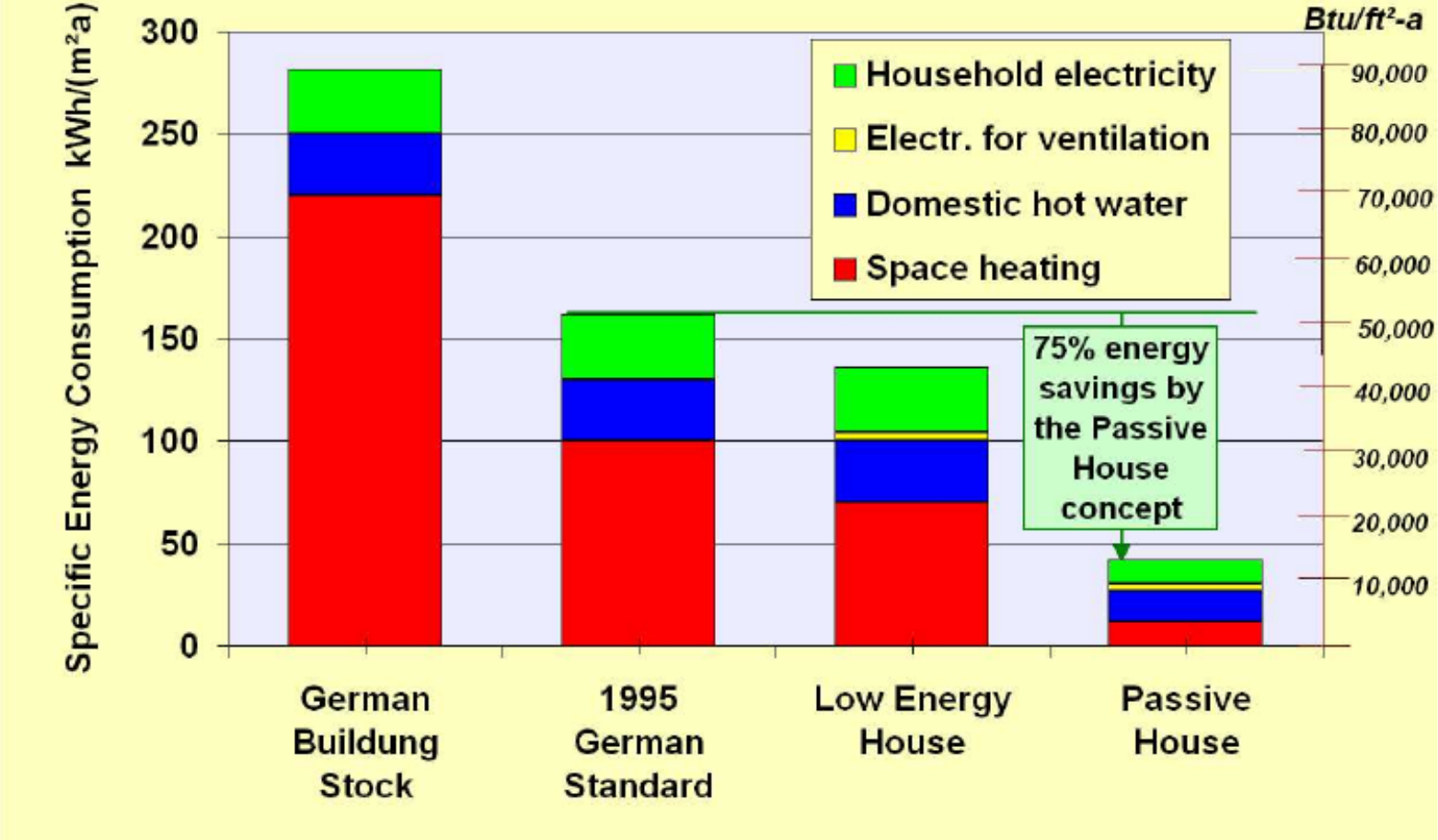
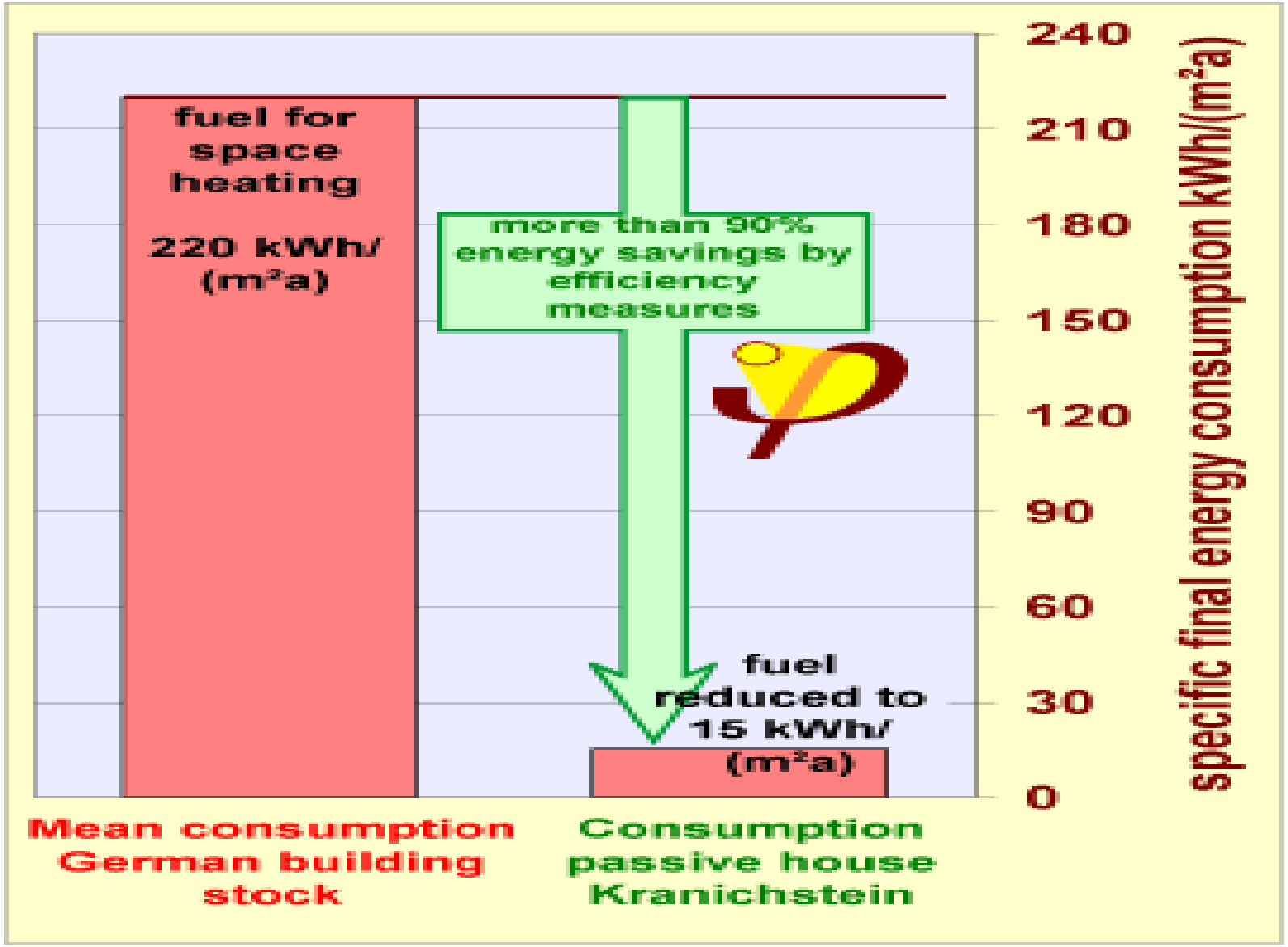
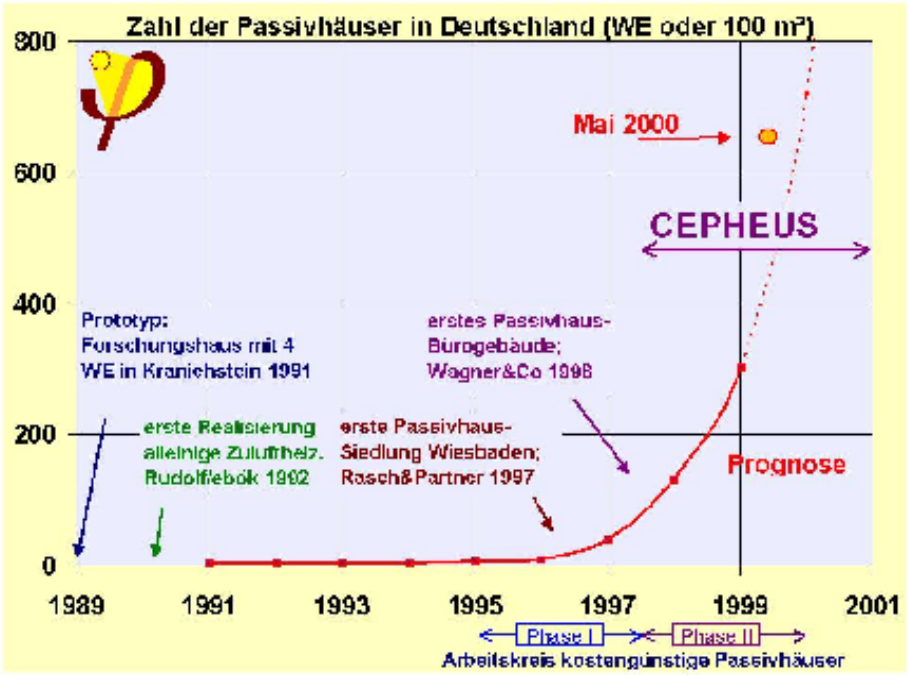


Figure 1: Comparison of specific energy consumption levels of dwellings


fuel for space heating
220 kWh/ (m²a)
more than 90% energy savings by efficiency measures
fuel reduced to 15 kWh/ (m²a)
240
210
180
150
120
90
60
30
0
specific final energy consumption kWh/(m²a)
Mean consumption German building stock
Consumption passive house Kranichstein

Outlook:



Passive House construction has grown exponentially in Germany and Austria and continues with that trend.

10,000 passive house units had been constructed by the end of 2007 and are inhabited.

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Passive Houses in Europe

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May 20-22, 2008

European Passive House Examples:

Single Family Residence, Austria

PHIUS
Passive House Institute US

European Passive House Examples:

Passive House Office Building
Ulm, Germany

Single Family Passive House,
Austria

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European Passive House Examples:

Passive House Gym
Heidelberg, Germany

Passive House School
Waldshut, Germany

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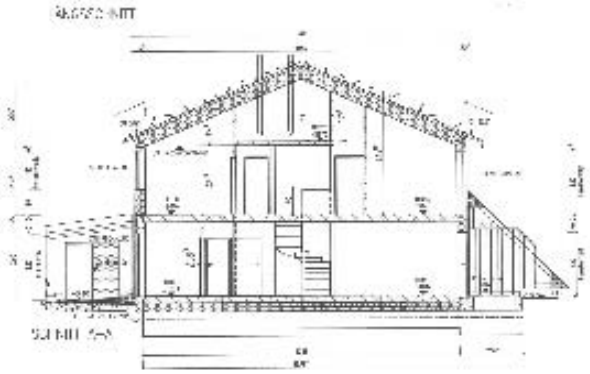
European Passive House Examples:



Townhouses, Kronsberg
Hannover Germany

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Passive Houses in various Climate Zones of the USA

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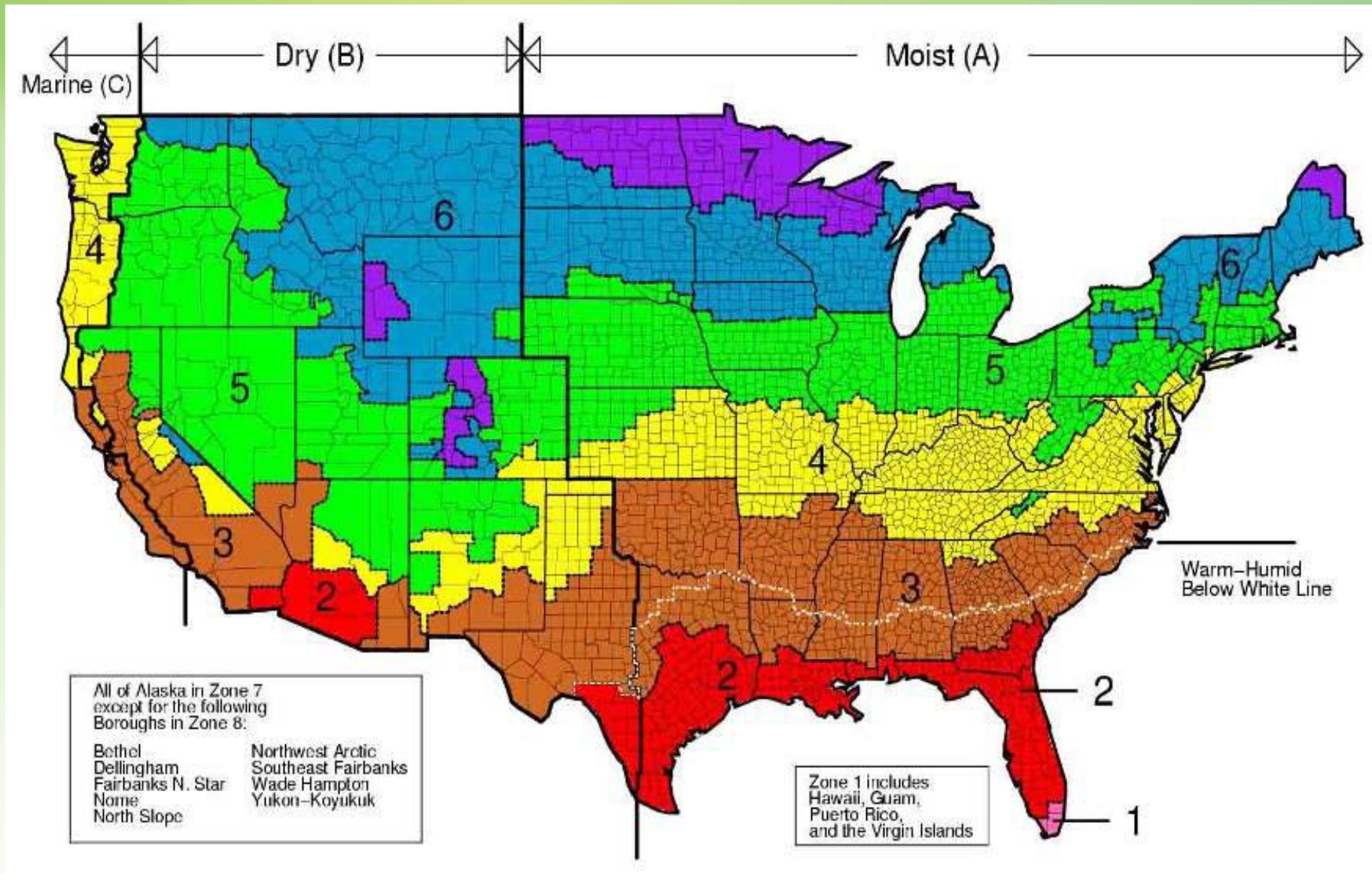
Climate Zones—2006 IECC



3 Passive Houses in Illinois

Fairview 1+2 and Smith House in Urbana, built in 2005-07 and 2003

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May 20-22, 2008

Smith House - 2003

PHIUS
Passive House Institute US

The Fairview House

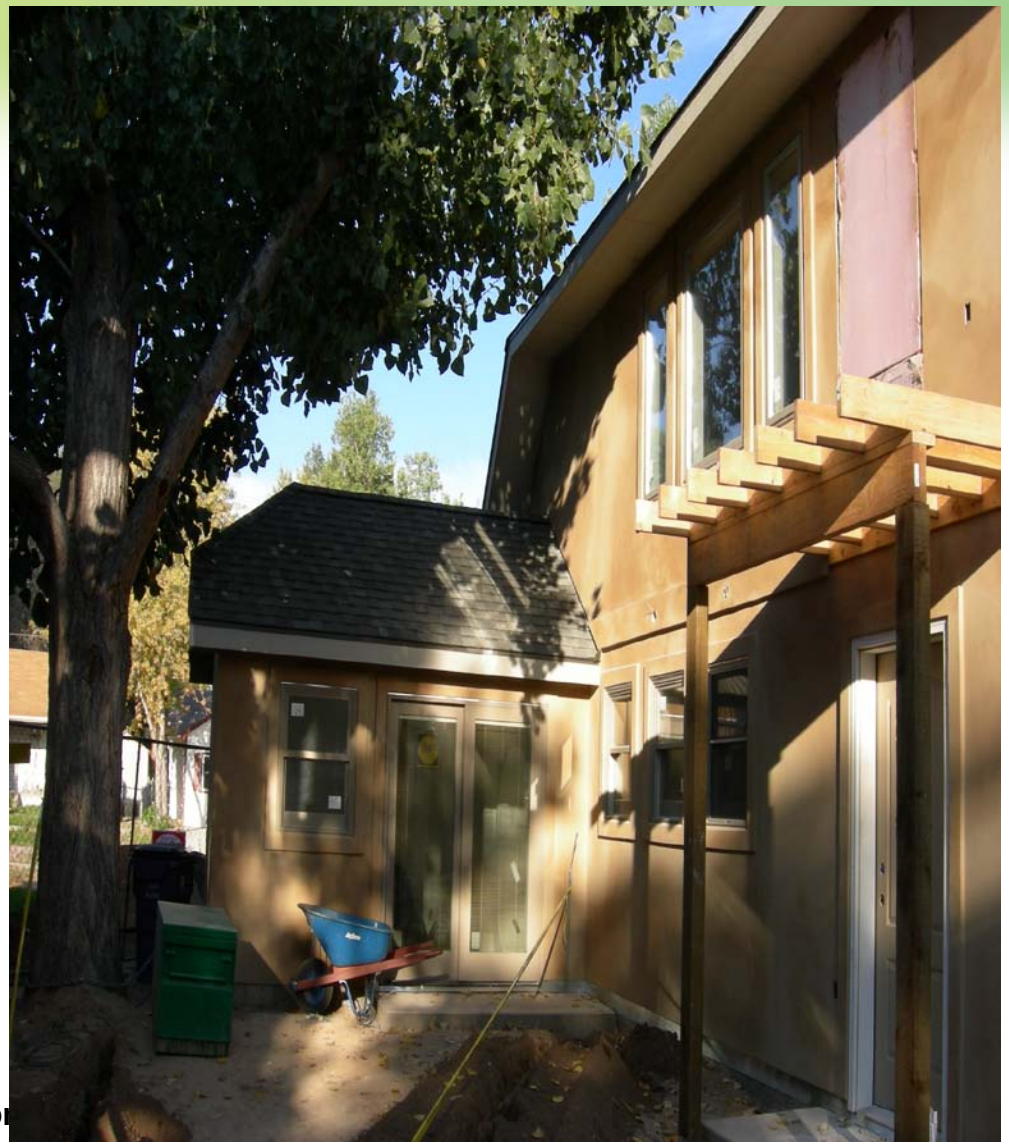
Finished view from South-West

PHIUS
Passive House Institute US

Tahan Residence, Berkeley - 2008

PHIUS
Passive House Institute US

Wright-DuVivier Home - 2008
1960 South Gilpin, Denver, Co

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THE END OF CHEAP Oil
SPRAWL ON THE MALL?
BONUS TEAR-OUT MAP OF WASHINGTON, D.C.
VAMPIRE SQUID, FANGTOOTH FISH, AND OTHER SEA ODDITIES

Global Climate Change

1928

2004

Conclusions/ Questions?

Green is IN:

Environment, Economy, National Security

–Don't just go with the most publicized program; choose one that will really make a difference for the community and the world.

–Look for programs with a strong systems approach and energy component.

-The foundation is *Energy Efficiency, otherwise,* it can't be truly "green."

Robby Schwarz www.nrglogic.com
Lance Wright www.greenenergyman.com

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Carolynne C. White & Kevin Holst, *Colo. Local Government Regulation of Land Use for Climate Change*, 37 Colo. L. 29 (Dec. 2008)

International Conservation Council (ICC) and International Energy Conservation Code (IECC)

http://www.iccsafe.org/

National Association of Home Builders (NAHB)

Green Building Program: http://www.iccsafe.org/news/green/

National Green Building Standard ICC-700 - www.nahbgreen.or

Guidelines: http://www.nahbgreen.org. or http://www.nahbgreen.org/Guidelines/default.aspx

U.S. Green Building Council(USGBC), Leadership in Energy and Environmental Design (LEED) Rating Systems

http://www.usgbc.org/DisplayPage.aspx?CMSPageID=147

Built Green Colorado

http:// www.builtgreen.org/