ecoEdge

Green Building

- A Vision for Today and Tomorrow

Uwe Heine

www.ecoedgetech.com

April 25, 2009

Agenda



- Global Warming and Green House Gas Emissions
- Case Study on Green Building
- More sources
- Questions

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Surface Melt on Greenland

Melt descending into a moulin, a vertical shaft carrying water to ice sheet base.



Source: Roger Braithwaite, University of Manchester (UK)

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Initial Target CO_2: 350 ppm



Technically Feasible

(but not if business-as-usual continues)

Quick Coal Phase-Out Critical

(long lifetime of atmospheric CO_2)

(must halt construction of any new coal plants that do not capture & store CO_2)

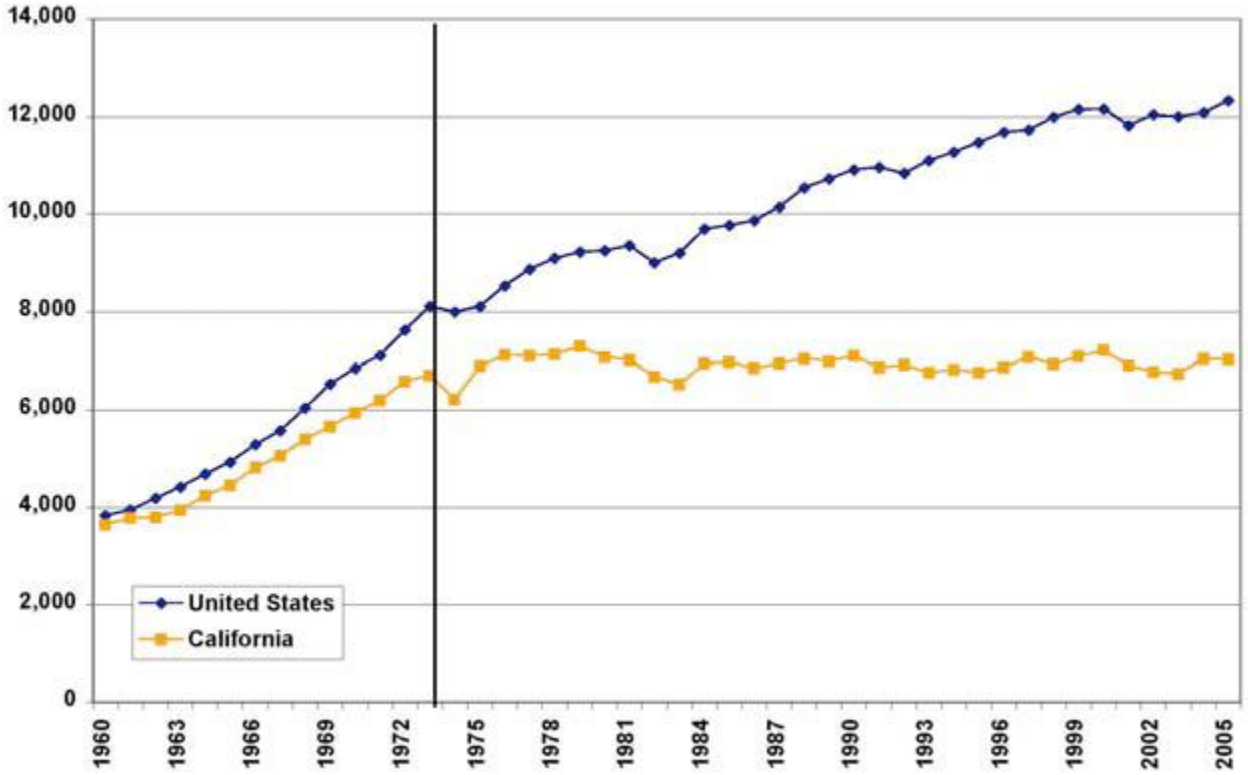
Source: Jim Hansen: Climate Threat to the planet June 3rd 2008
Target Atmospheric CO2: Where Should Humanity Aim?

- **1981-present Director: NASA Goddard Institute for Space Studies**
- **1985-present Adjunct Professor: Earth and Environmental Sciences, Columbia University**

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U.S. v. California Per Capita Electricity Sales

> (Per Capita Electricity Sales in Kilowatt Hours per Person)



Source: California Energy Commission

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Executive Order S-3-05

June 1, 2005

CA will reduce Greenhouse Gases to:

- **2000 levels by 2010**
- **1990 levels by 2020**
- **80% below 1990 levels by 2050**

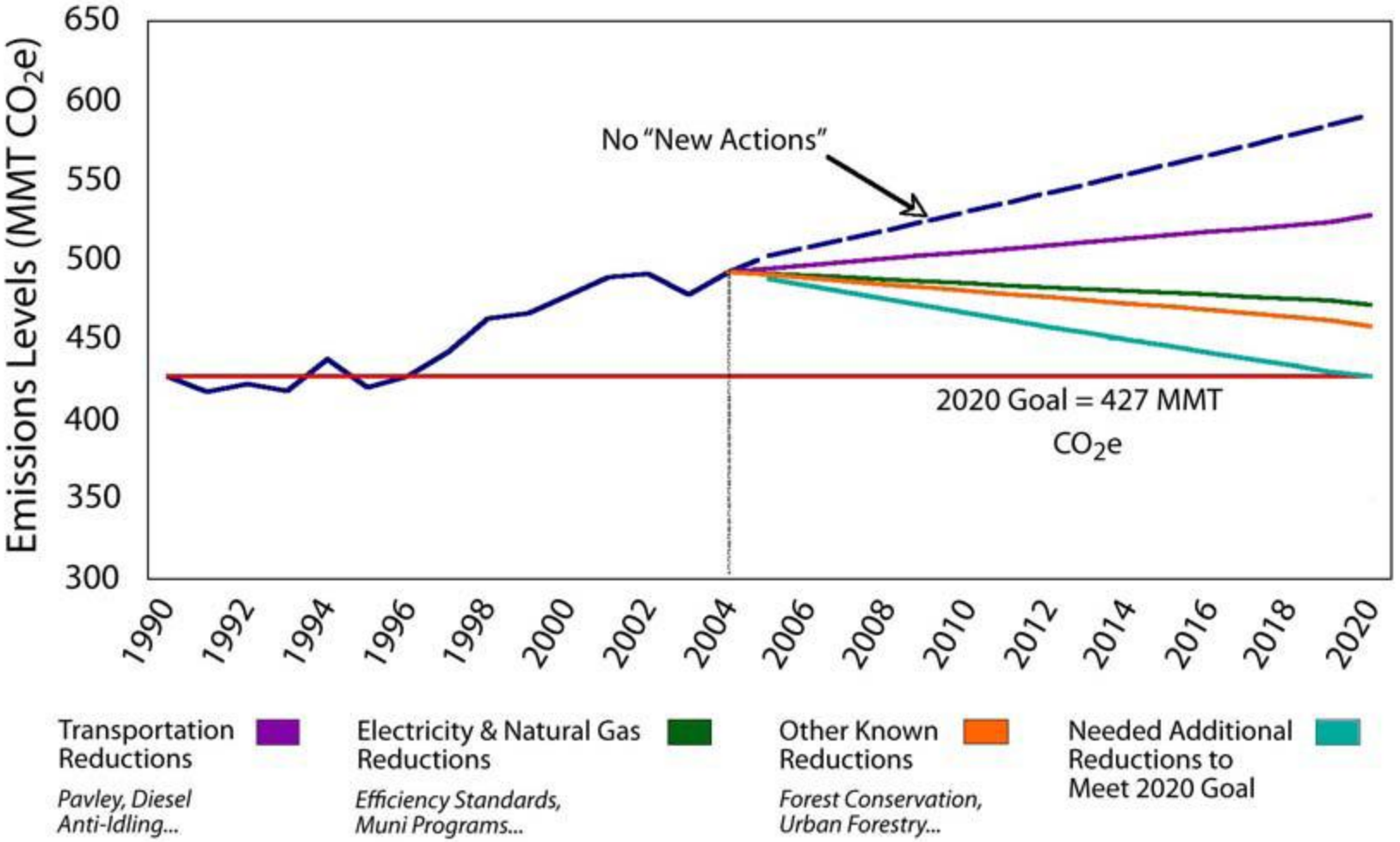


- **“ The debate is over.**
- **We know the science.**
- **We see the threat.**
- **And we know that the**
- **time for action is now.”**

- **Governor Arnold Schwarzenegger**

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Reaching for the AB 32 Target



Source: California Energy Commission, Climate Action Team

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Green Building - Definition



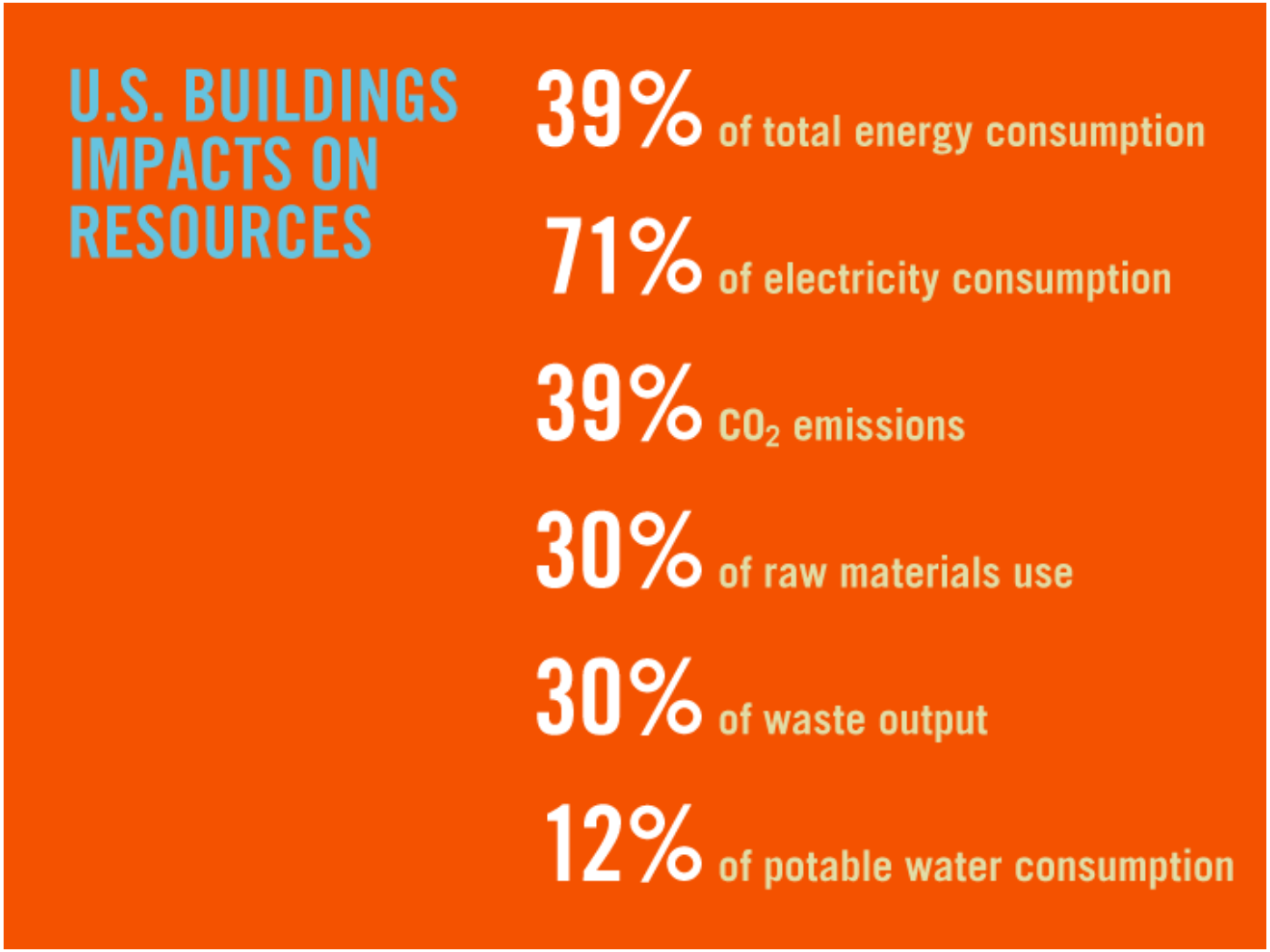
Green buildings are designed to:

- Efficiently using energy, water, and other resources
- Protecting occupant health and improving employee productivity
- Reducing waste, pollution and environmental degradation

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US Buildings Impacts



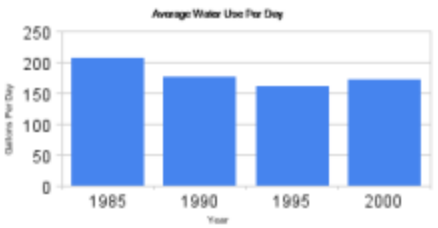


Source:
USGBC

My House – on 2008 Build It Green Home Tour



Goal Water Usage Reduction – Heine house



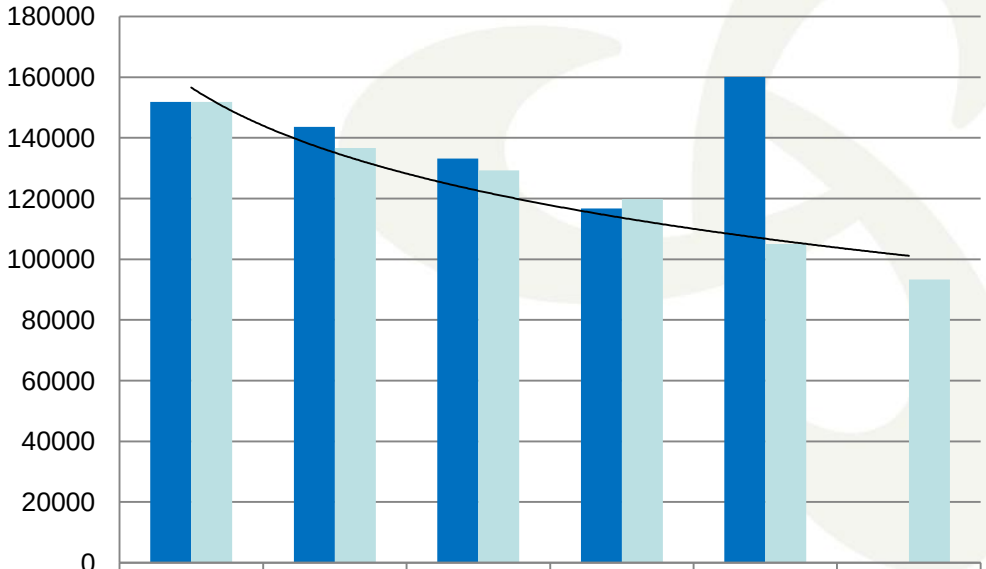
Average water usage per resident per day in Santa Clara County: 172 Gallon







GAL/YR



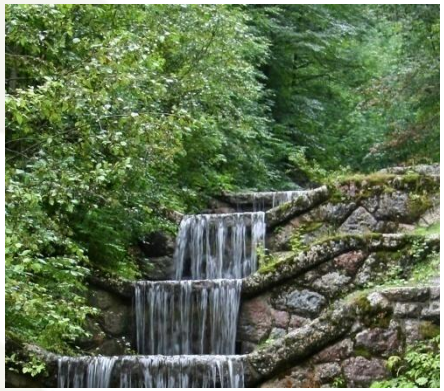
	2004	2005	2006	2007	2008	2009
GAL/YR Actual	151844	143616	133144	116688	160072	
GAL/YR Goal	151844	136660	129254	119830	105019	93350

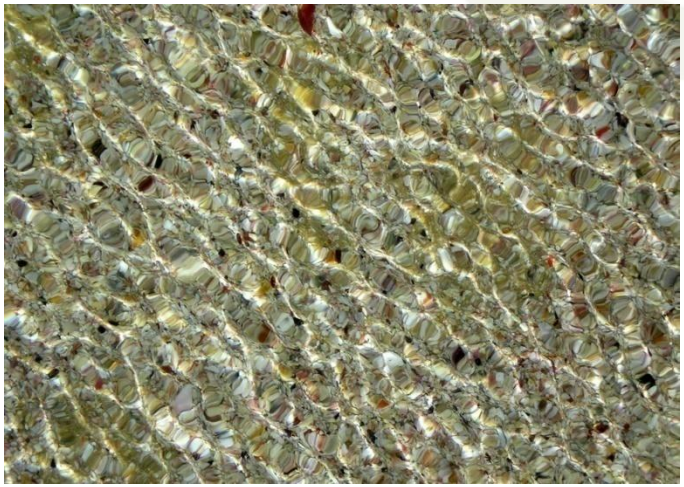
Average Water Usage per person per day at Heine Residence 2007: 64 Gallons

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Water Conservation

- Low flow fixtures
- High efficiency toilets (<1.3gpf)
- Energy Star Appliances
- Hot Water Management
- Native Landscaping
- Limited or no lawn



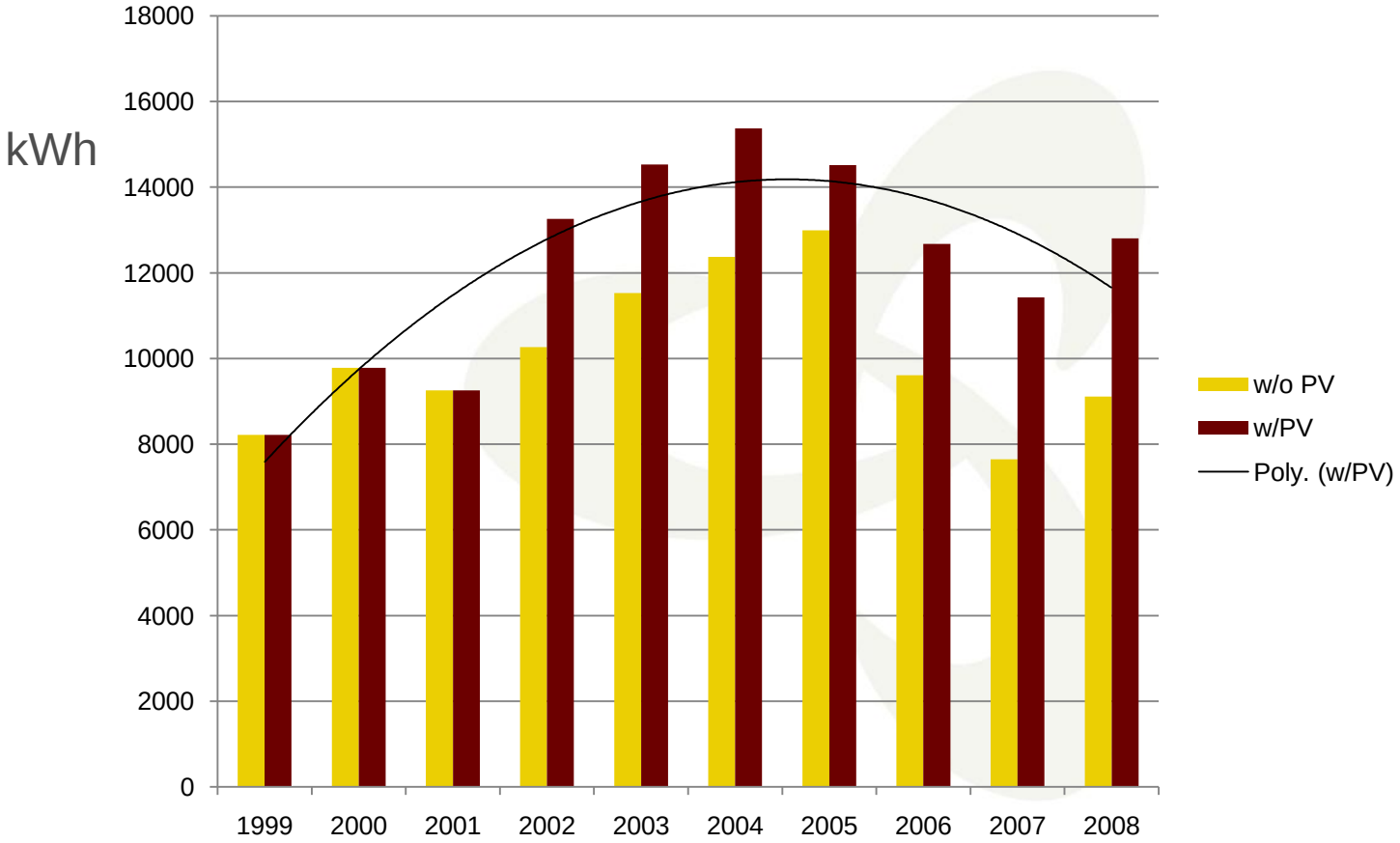


- Weather-based irrigation controller
- Subsoil Irrigation
- Greywater Plumbing
- Rainwater Collection
- etc.

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Electricity Usage – Heine House

> Solar PV added in February 2002



8/2000 2nd child → 2001 Remodel 1,500sqft to 2,300sqft → 2/2002 Solar PV life 3.6kW → 4/2002 3rd child → Fall 2004 Inverter breaks down → June 2005 Inverter replaced → July 2005 Solar Array re-wired → June 2007 String 18 replaced

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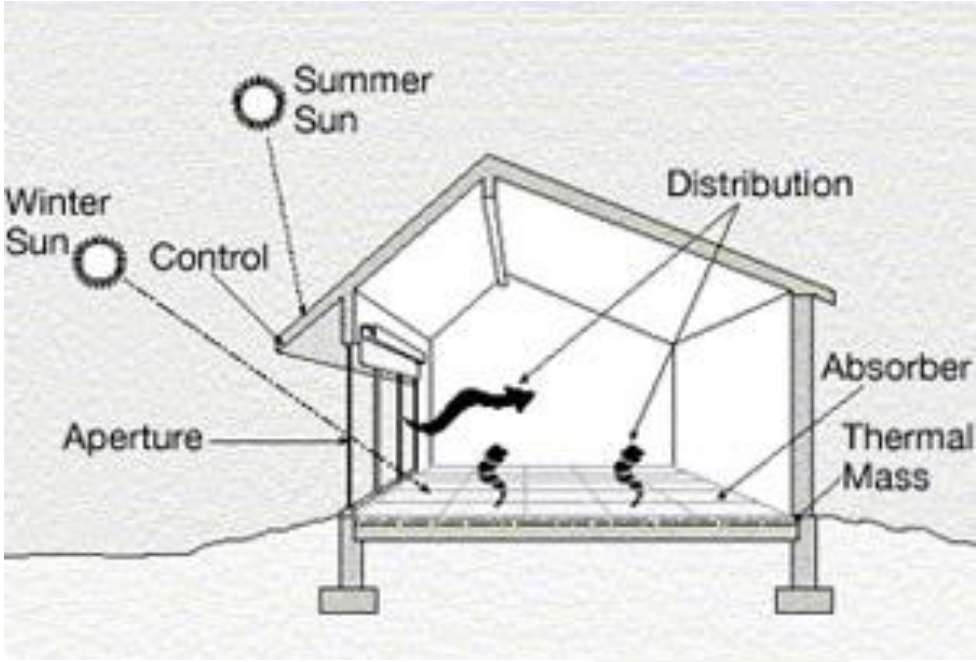
Energy



- Energy Audit
- Home Performance Testing
- Passive Solar Home
- Tight, well insulated house
- Efficient lighting (day lighting, CFL's, LED's)
- Energy Star Appliances
- Efficient HVAC Systems (load calculations required)
- Tight Ducts
- Cool Roofs
- Renewables (solar, wind, geothermal, hydro, …)
- etc.

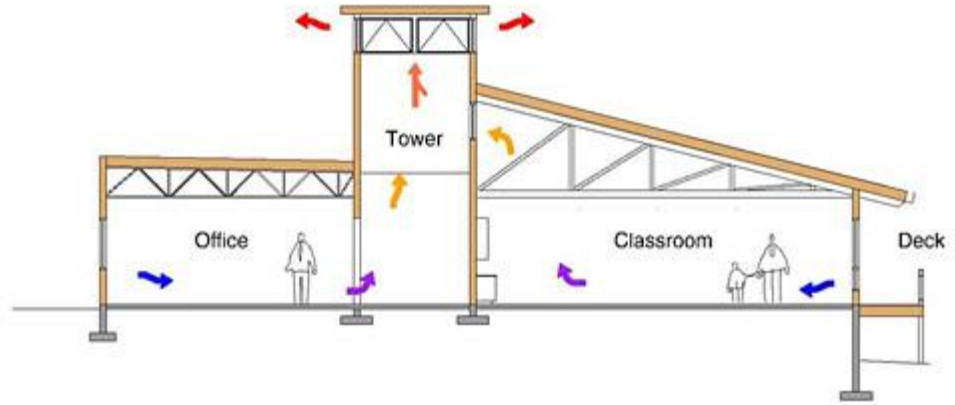
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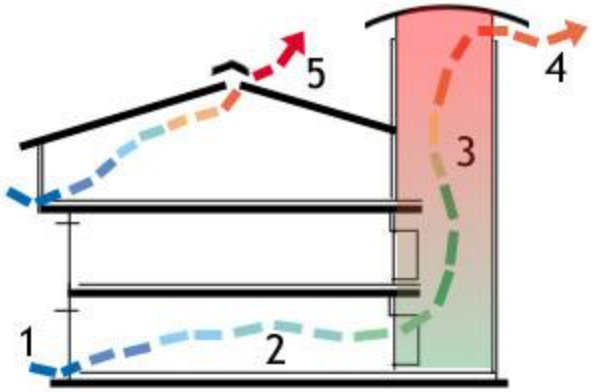
Passive Solar Design



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Natural Ventilation





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Daylighting and Lighting

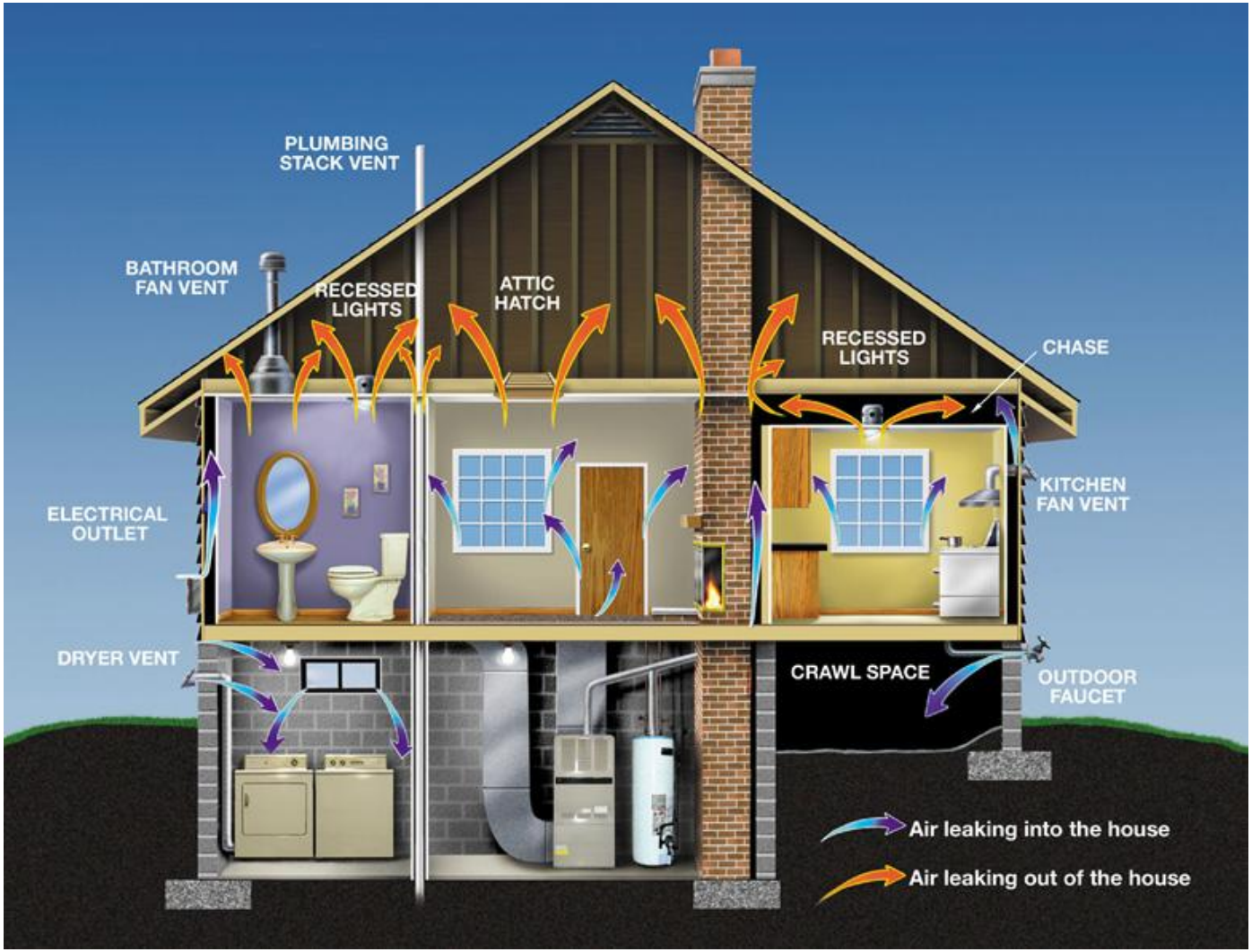








Air Sealing



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Proper Insulation

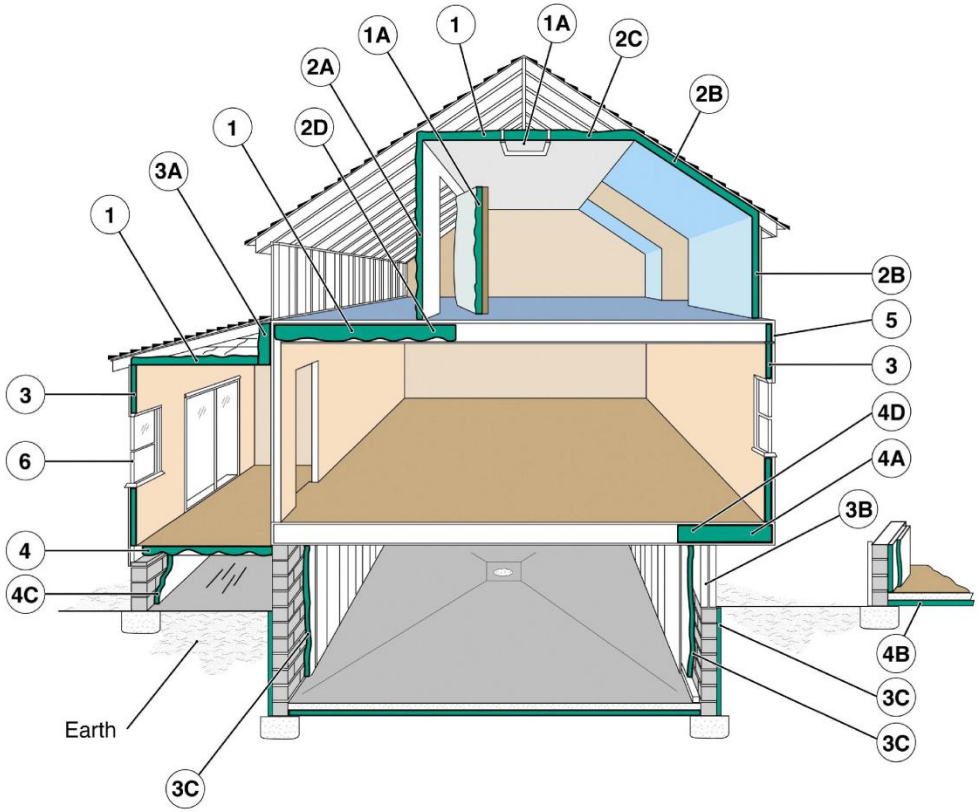


Figure 1. **Examples of Where to Insulate**

1. In unfinished attic spaces, insulate between and over the floor joists to seal off living spaces below.
   - 1A attic access door
2. In finished attic rooms with or without dormer, insulate...
   - 2A between the studs of "knee" walls;
   - 2B between the studs and rafters of exterior walls and roof;
   - 2C ceilings with cold spaces above;
   - 2D extend insulation into joist space to reduce air flows.
3. All exterior walls, including...
   - 3A walls between living spaces and unheated garages, shed roofs, or storage areas;
   - 3B foundation walls above ground level;
   - 3C foundation walls in heated basements, full wall either interior or exterior.
4. Floors above cold spaces, such as vented crawl spaces and unheated garages. Also insulate...
   - 4A any portion of the floor in a room that is cantilevered beyond the exterior wall below;
   - 4B slab floors built directly on the ground;
   - 4C as an alternative to floor insulation, foundation walls of unvented crawl spaces;
   - 4D extend insulation into joist space to reduce air flows.
5. Band joists.
6. Replacement or storm windows and caulk and seal around all windows and doors.

ORNL 96-5415R2/abh

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Indoor Air Quality

Toxic Air Contaminants Emitted From Building and Finishing Materials

Carpet and Cushion	Paint	Vinyl Flooring
Toluene	*m,p-Xylene*	*Toluene*
m,p-Xylene	*Ethylene glycol*	*m,p-Xylene*
o-Xylene	*2-(2-Butoxyethoxy)ethanol*	*o-Xylene*
Styrene	Formaldehyde	Styrene
Ethylene glycol	Acetaldehyde	1,2,4-Trimethyl benzene
Formaldehyde		Naphtalene
Acetaldehyde		Acetophenone
Acetophenone		Phenol
2-(2-Butoxy)ethanol		Formaldehyde
Tetrachloroethane		Acetaldehyde
Naphthalene		
Phenol		

Source: ARB, Hodgson (1999) identified 17 toxic air contaminants in the emissions from new carpet assembly, vinyl flooring, and latex paint.

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Material Selection

What if …

we would design our products
to become “food” for their next application?

“Cars” would not only be a mode
of transportation, but provide nutrients and water
to the soil.

Just think what would be possible!

	EMBODIED ENERGY	
MATERIAL	MJ/kg	MJ/m3
Aggregate	0.10	150
Straw bale	0.24	31
Soil-cement	0.42	819
Stone (local)	0.79	2030
Concrete block	0.94	2350
Concrete (30 Mpa)	1.3	3180
Concrete precast	2.0	2780
Lumber	2.5	1380
Brick	2.5	5170
Cellulose insulation	3.3	112
Gypsum wallboard	6.1	5890
Particle board	8.0	4400
Aluminum (recycled)	8.1	21870
Steel (recycled)	8.9	37210
Shingles (asphalt)	9.0	4930
Plywood	10.4	5720
Mineral wool insulation	14.6	139
Glass	15.9	37550
Fiberglass insulation	30.3	970
Steel	32.0	251200
Zinc	51.0	371280
Brass	62.0	519560
PVC	70.0	93620
Copper	70.6	631164
Paint	93.3	117500
Linoleum	116	150930
Polystyrene Insulation	117	3770
Carpet (synthetic)	148	84900
Aluminum	227	515700
NOTE: Embodied energy values based on several international sources - local values may vary.		

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Doesn't a green home cost more?

How Much Does a LEED Home Cost?

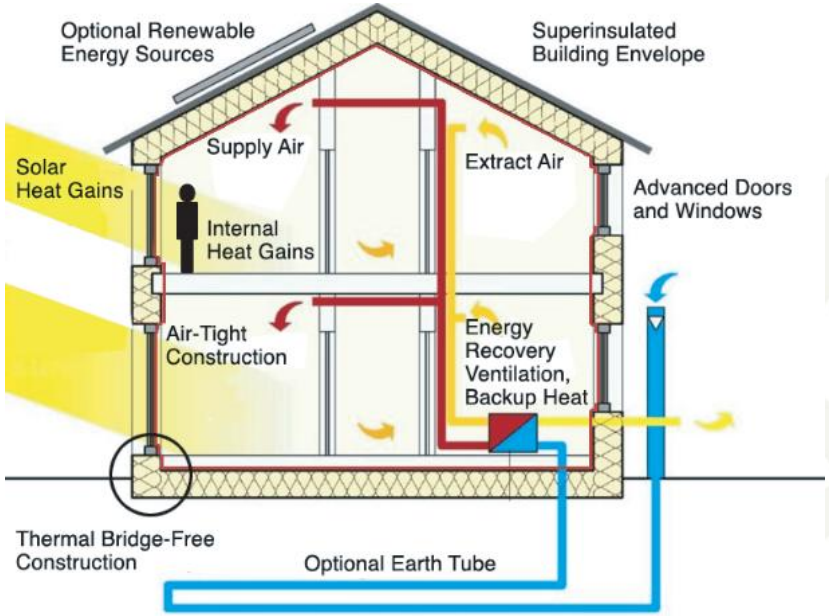
An Example

Comparison Criteria	Code Home	LEED Home	Difference	
			($.Month)	($/Day)
Sticker Price	$300,000	$308,500		
Mortgage Payment	$1,890	$1,945	+ $55	+ $1.80
Energy Bill	$150	$105	- $45	- $1.50
Water Bill	$30	$20	- $10	- $0.30
Net Cost of Ownership	$2,070	$2,070	- $0	- $0

Source: USGBC

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The Passive House

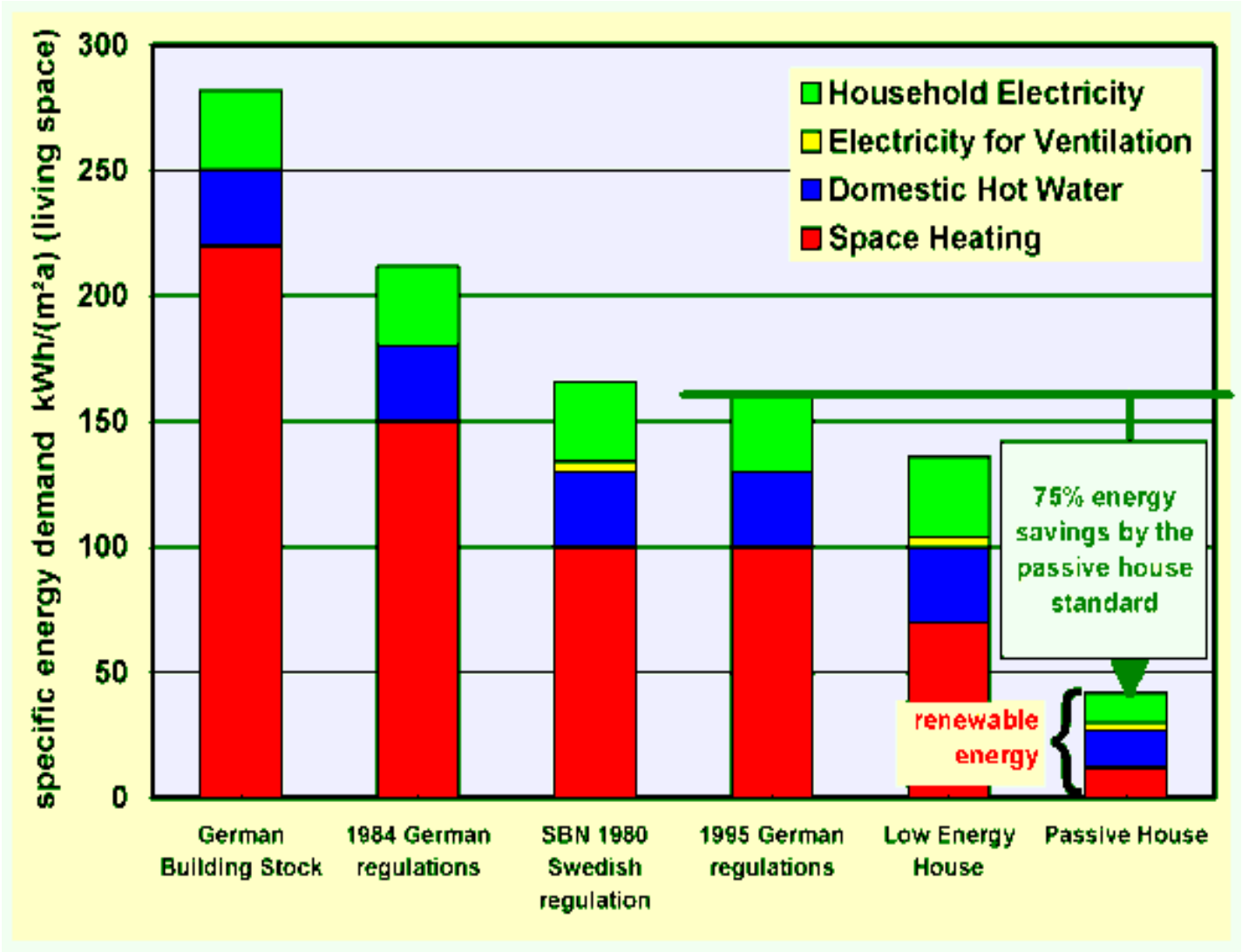






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The Passive House



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The Thousand Home Challenge

- Reduce the energy consumption of existing homes by 70-90% (total use, not just space conditioning)
- Develop indicators of home energy performance
- Exemplify the performance-based systems design approach
- Assemble local / regional centers of excellence
- Stimulate collaboration, creative problem-solving, and innovative products and approaches

Source: Select ACI Initiatives

http://www.affordablecomfort.org/initiatives.php?PageID=16

Deep Energy Reduction Resources
ACI White Paper – One Year Later
Thousand Home Challenge

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The 2030 Challenge (Ed Mazria)



- **All new buildings, developments and major renovations shall be designed to meet a fossil fuel, GHG-emitting, energy consumption performance standard of 50% of the regional (or country) average for that building type.**

- **At a minimum, an equal amount of existing building area shall be renovated annually to meet a fossil fuel, GHG-emitting, energy consumption performance standard of 50% of the regional (or country) average for that building type.**

- **The fossil fuel reduction standard for all new buildings shall be increased to:**

  60% in 2010
  70% in 2015
  80% in 2020
  90% in 2025
  Carbon-neutral in 2030 (using no fossil fuel GHG emitting energy to operate).

- **These targets may be accomplished by implementing innovative sustainable design strategies, generating on-site renewable power and/or purchasing (20% maximum) renewable energy and/or certified renewable energy credits.**

- **Source: http://www.architecture2030.org/home.html**

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Selected Green Building Resources



> Build It Green	http://www.builditgreen.org/
> USGBC	http://www.usgbc-ncc.org/
> Building Green	http://www.buildinggreen.com/
> Building Science	http://www.buildingscience.com/
> The 2030 Challenge	http://www.architecture2030.org/
> Building Science	http://www.buildingscience.com/
> H2OUSE Water Saver	http://www.h2ouse.org/
> Passive House Institute	http://www.passiv.de/
> Passive House California	http://www.passivehouseca.org/
> 1000 Home Challenge	http://www.affordablecomfort.org/
> Energy Star	http://www.energystar.gov/
> CHEERS	http://www.cheers.org/
> CBPCA	http://www.cbpca.org/
> Cradle to Cradle	http://www.mcdonough.com/
> Make it right	http://www.makeitrightnola.org/
> ecoEdge Consulting	http://www.ecoedgetech.com/

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Further info on Careers in Green Building

- ADPSR www.adpsr.org
- Build It Green www.builditgreen.org
- California Straw Bale Association www.strawbuilding.org
- Ecological Design Institute www.ecodesign.org
- Building Education Center www.bldgeductr.org
- Cal-Earth Institute www.calearth.org
- Laney College www.peralta.cc.ca.us/laney
- Merritt College www.merritt.edu
- New College of California www.ecodwelling.org
- De Anza College http://kirschcenter.deanza.fhda.edu/home.html
- Seven Generations Natural Builders www.sgnb.com
- Solar Living Institute www.solarliving.org
- CSU Sonoma www.sonoma.edu/ensp/etc
- Humboldt State University www.humboldt.edu/humboldt/programs/nrpi.html
- UCLA Berkeley http://arch.ced.berkeley.edu
- UCLA Santa Barbara http://www.bren.ucsb.edu/brenhall/default.html
- UCLA Merced http://www.ucmerced.edu/
- CSU Chico http://www.csuchico.edu/fms/
- Presidio School of Management http://www.presidiomba.org/
- San Francisco Institute of Architecture http://www.sfia.net/
- The Wallace Research Group http://www.wallaceresearch.net/educationNorthAmerica.html
- California Polytechnic State University http://www.caed.calpoly.edu/

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Questions?



Backup



HR 1 “Stimulus Bill - Energy Efficiency (partial list)

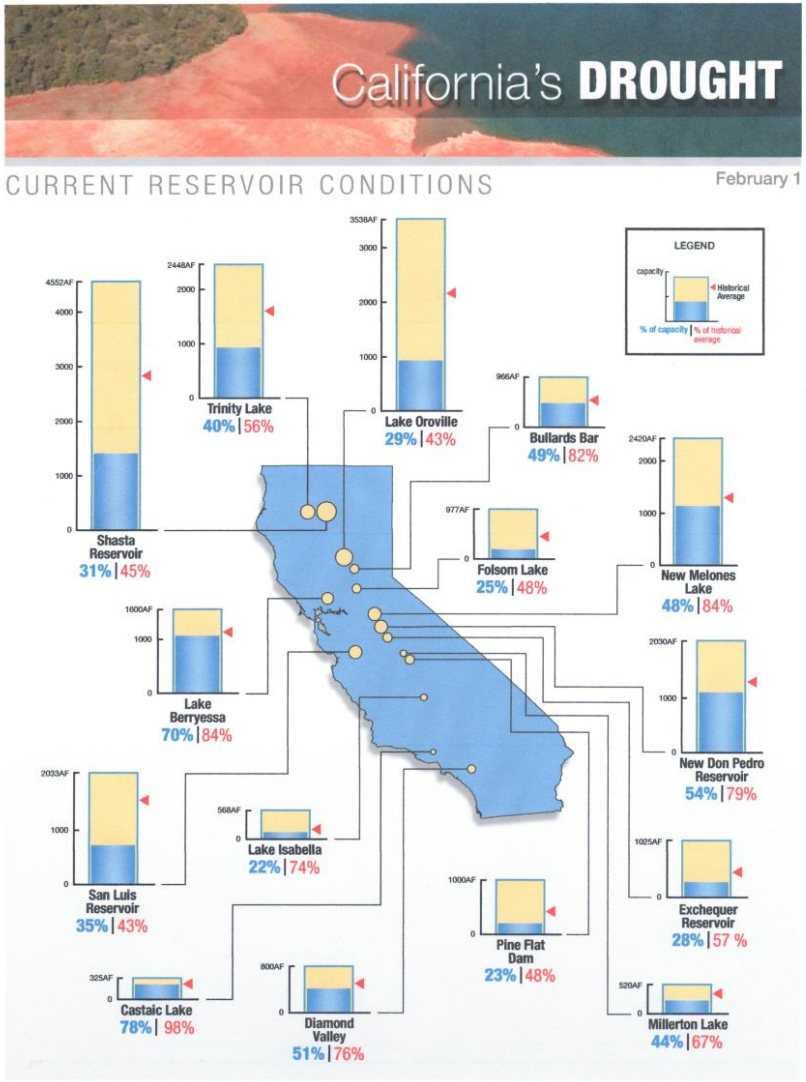


- $2.5 billion for energy efficiency and renewable energy research
- $1 billion energy efficiency programs including energy-efficient appliances and trucks and buses that run on alternative fuel
- $4.5 billion to boost the energy efficiency of federal buildings
- $6.3 billion for energy efficiency and conservation grants
- $5 billion to weatherize old buildings
- $2.3 billion in tax credits for energy efficiency technology manufacturers

The $21.6 billion being set aside for efficiency measures works out to about 3% of the $787 total package.

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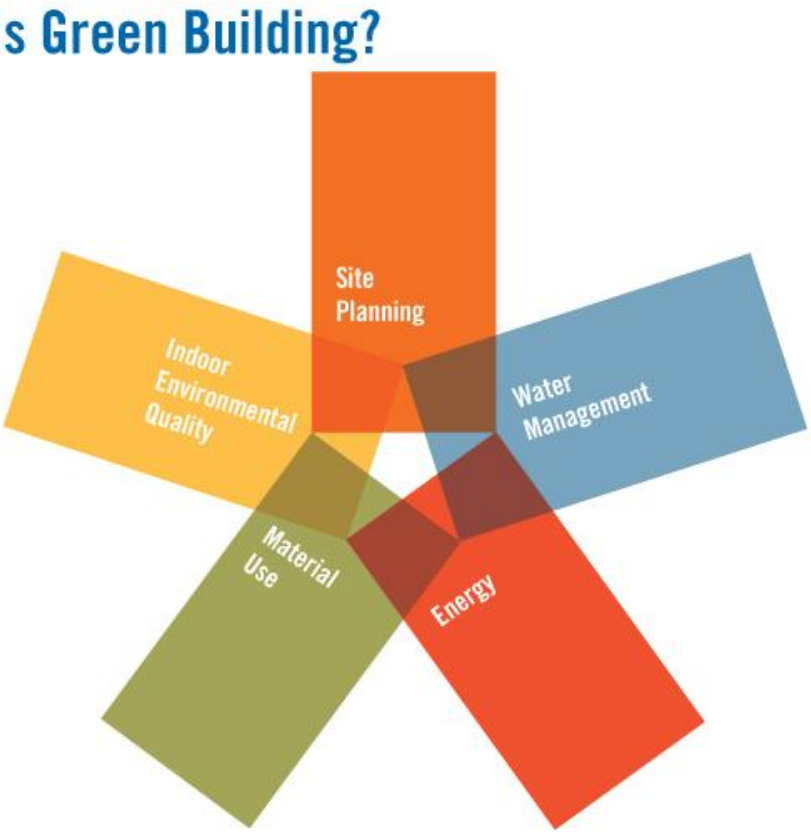
California's Drought



For more information about these or other reservoirs, please click http://cdec.water.ca.gov/reservoir.html

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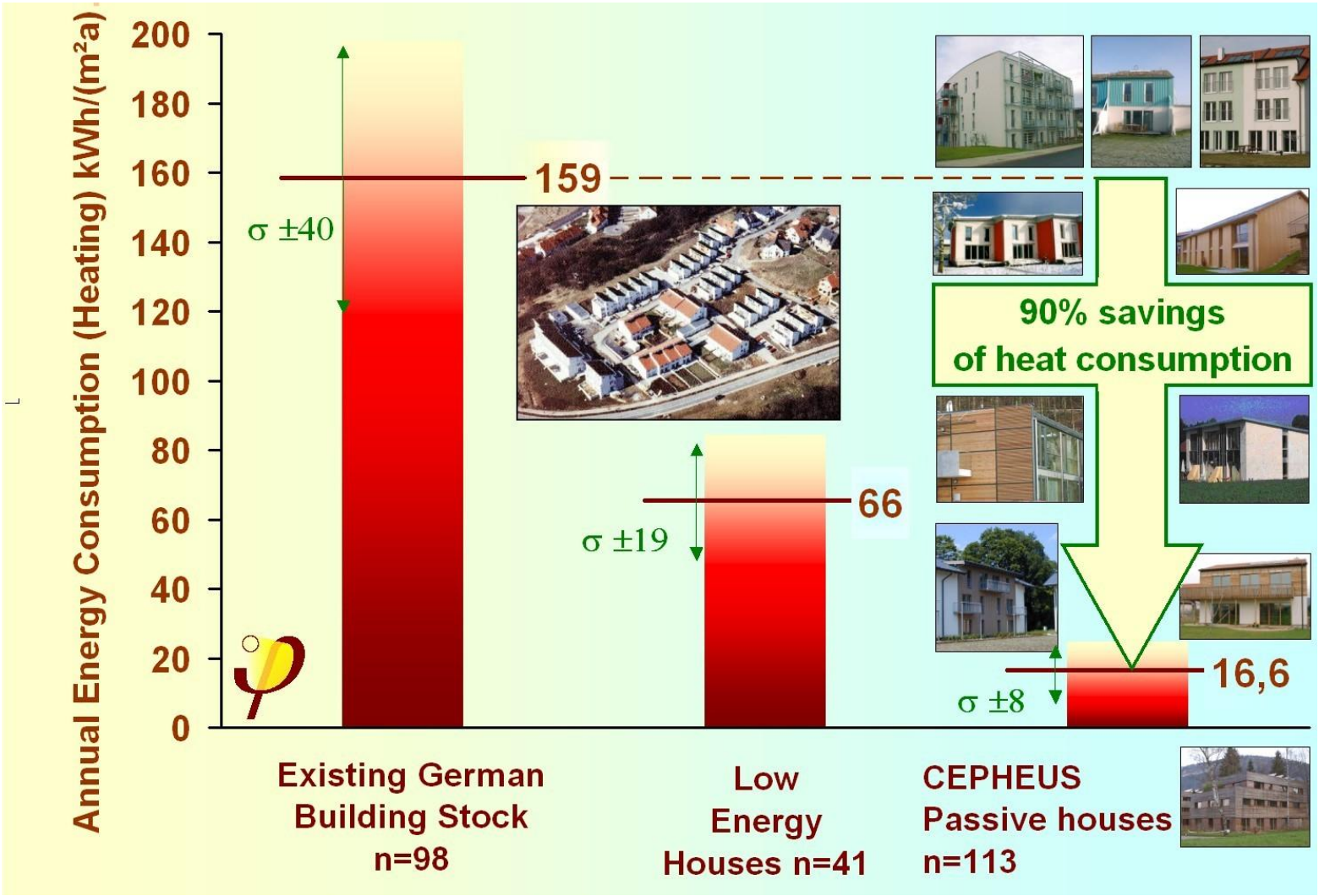
Green Building





The Conde Nast Building at Four Times Square (4 Times Square)

CEPHEUS PROJECT



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