Green Building: Reducing Energy Use, Traditional Principles and Modern Implementations

16th Annual Region 9 Tribal EPA Conference

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October 22, 2008

Green Building

Environmental Impacts of Buildings

What Residents Can do to Reduce Energy Use

Green Building Principles and Vernacular Architecture

Culture Guiding Community Infrastructure and Economic Development

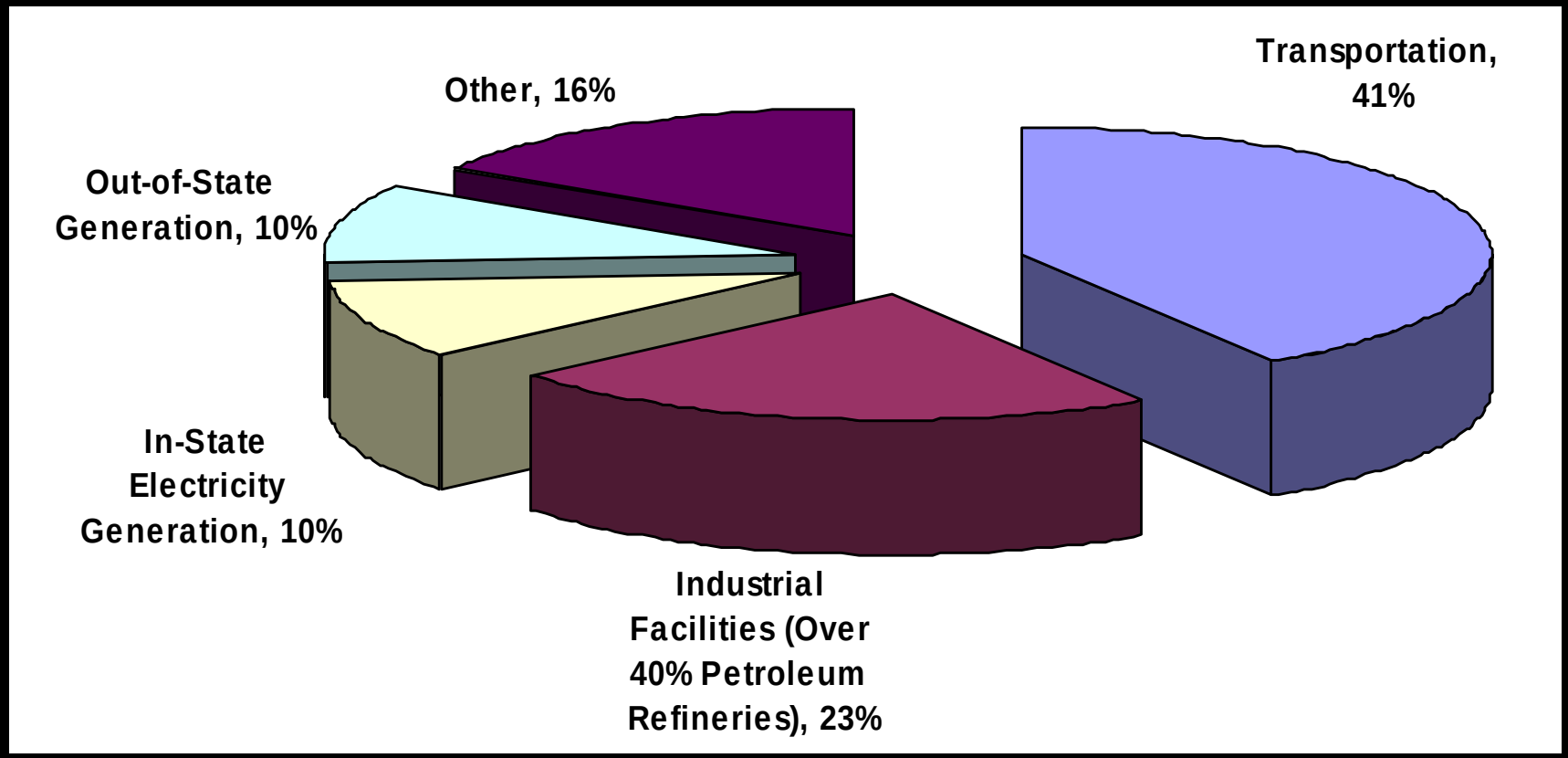
Conclusion: Resources and Handout

Environmental Impact of Buildings

In the US, buildings account for:

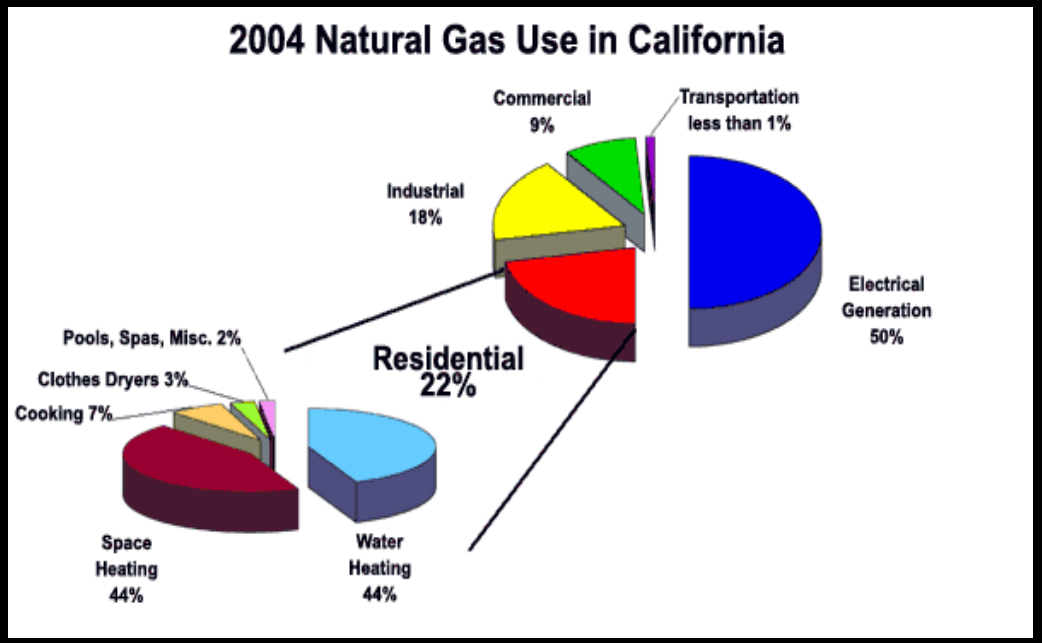
- 39 % of total energy use
- 12 % of the total water consumption
- 68 % of total electricity consumption
- 38 % of the CO2 emissions
- 25% of all water supplies
- 60% of all materials (excluding food and fuel)

California Greenhouse Gas Emissions Sources

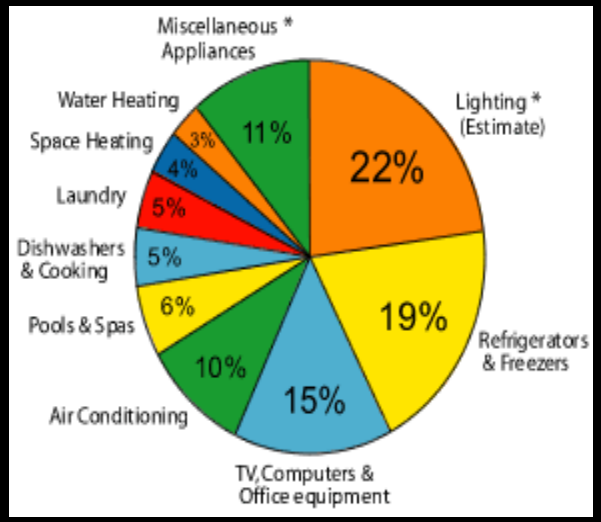


Source: California Energy Commission

Home Gas and Electricity Use in California



Space Heating
Water Heating



Annual Electricity Use Per California Household in 2004, CEC

Lighting
Refrigerators
TVs, computers
Appliances

www.energy.ca.gov

How I Reduced Energy Use at Home

- Space Heating
- Water Heating
- Lighting
- Refrigerator
- TVs, Computers,
- Appliances

<u>Changes I made:</u>

- Changed 37 Light bulbs
- Sealed Air Leaks and Fireplace Flue
- Insulated attic and floors
- New ESTAR Fridge
- New ESTAR Clothes Washer
- 13 New Double Pane Windows

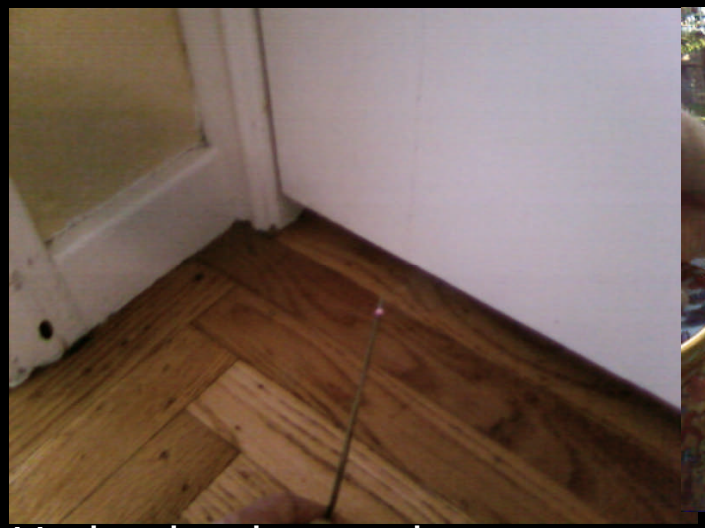
How I Reduced Energy Use at Home

Finding and Sealing Air Leaks

The fireplace chimney

The kitchen stove vent

Between the windows



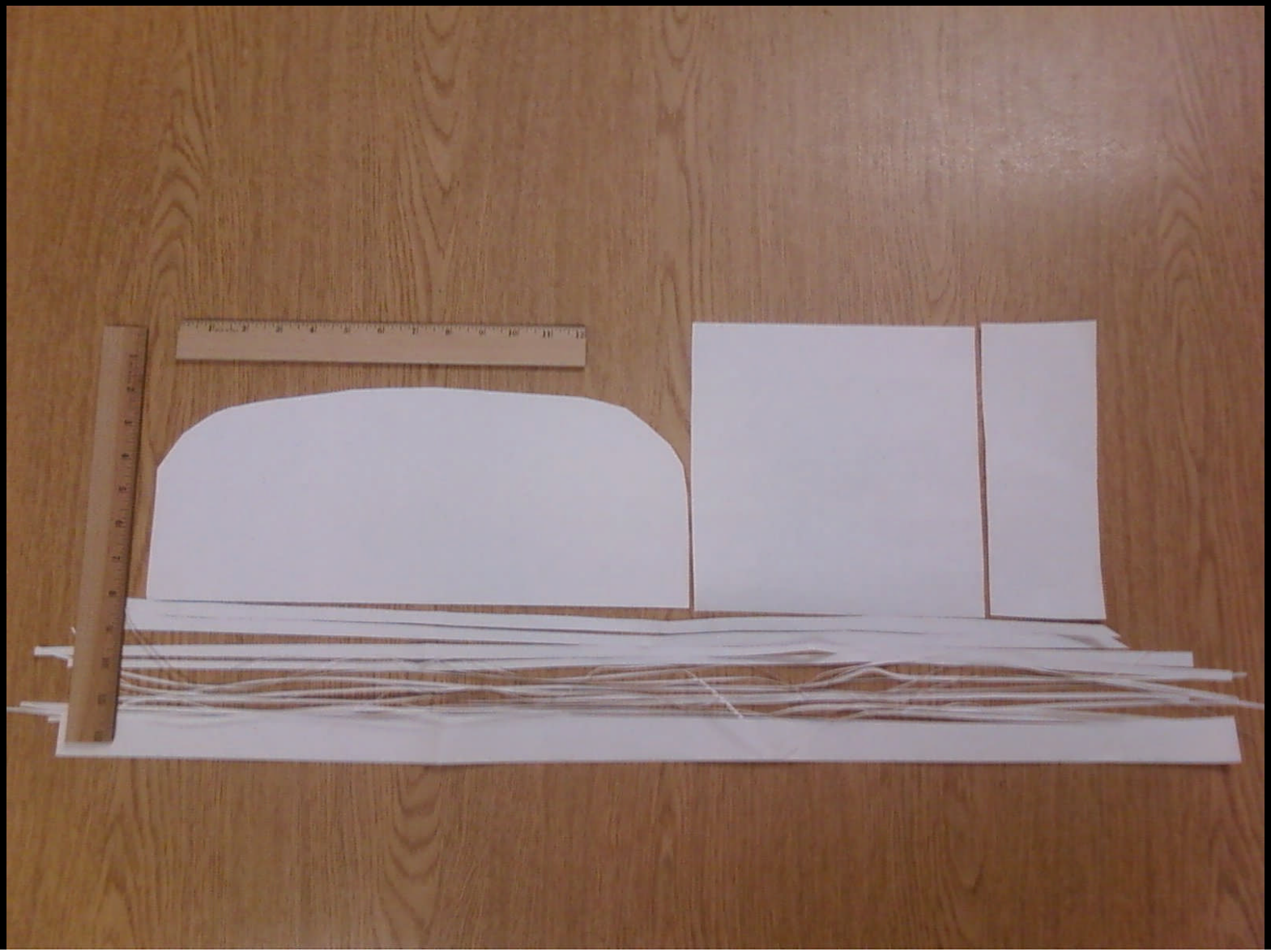
Under the door to the garage

The kitchen window

The mail slot

How I Reduced Energy Use at Home

Adding up the Air Leaks



How I Reduced Energy Use at Home

Weather-seal

How I Reduced Energy Use at Home

Weather-sealing a door on the inside

How I Reduced Energy Use at Home

Weather-sealing a door on the outside

How I Reduced Energy Use at Home

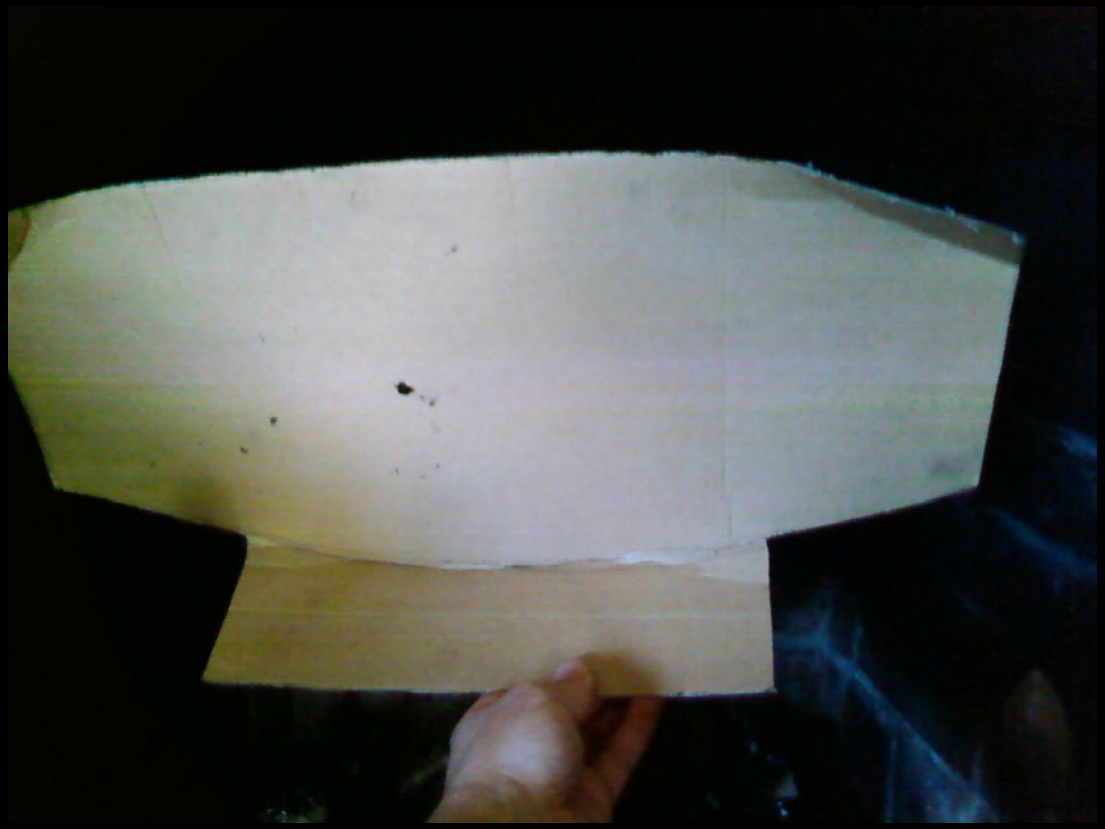
Double-Pane Windows

Old aluminum frame,
single-pane window

New, double-pane window

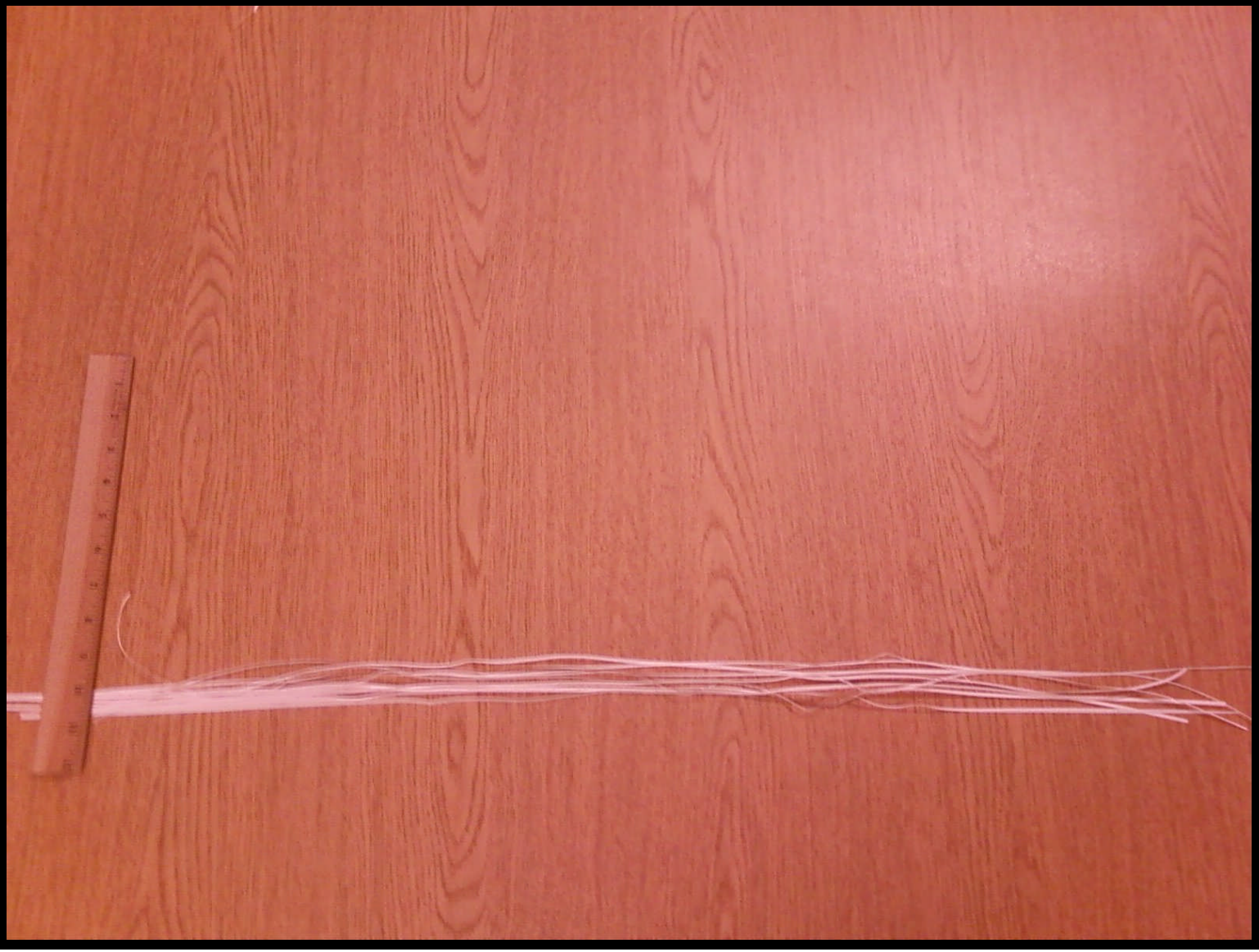
How I Reduced Energy Use at Home

Sealing the Fireplace



How I Reduced Energy Use at Home

Adding up the Air Leaks



How I Reduced Energy Use at Home

Installing Insulation

In the attic above the ceiling

Under the floor above the garage

How I Reduced Energy Use at Home

Changes I Made	**Cost**	**Savings per year**	**Pounds CO2 reduced**	**Pounds CO2/$**
Changed 37 Light bulbs	$75	$320	2,325	31
Seal Air Leaks and Fireplace Flue	$100	$100	700	7
Insulated attic and floors	$1,200	$400	2,800	2.3
New ESTAR Fridge	$600	$100	650	1.1
New ESTAR Clothes Washer	$650	$100	550	0.8
13 New Double Pane Windows	$6,000	$200	1,400	0.2
Grand Total	**$8,625**	**$1,120**	**8,600**	

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What is sustainable building design?

A truly sustainable project would be one that consumed resources in an amount less than or equal to the resources it created. Its waste must serve as fuel for some other process, so that there is, in effect, no waste at all…

…The concept of "green" design is a little less aggressive. It is about efficient use of resources, and a symbiotic relationship with the site. Vernacular architectural tradition offers many examples: the tipi, the igloo, the adobe house.

Mary Casey, American Institute of Architects http://www.naiop.org/developmentmag/pastissues/fall01/article1.htm

Vernacular Architecture

Vernacular architecture is a term used to categorize methods of construction which use locally available resources to address local needs. Vernacular architecture tends to evolve over time to reflect the environmental, cultural and historical context in which it exists.

http://en.wikipedia.org/wiki/Vernacular_architecture

http://www.kstrom.net/isk/maps/houses/housingmap.html

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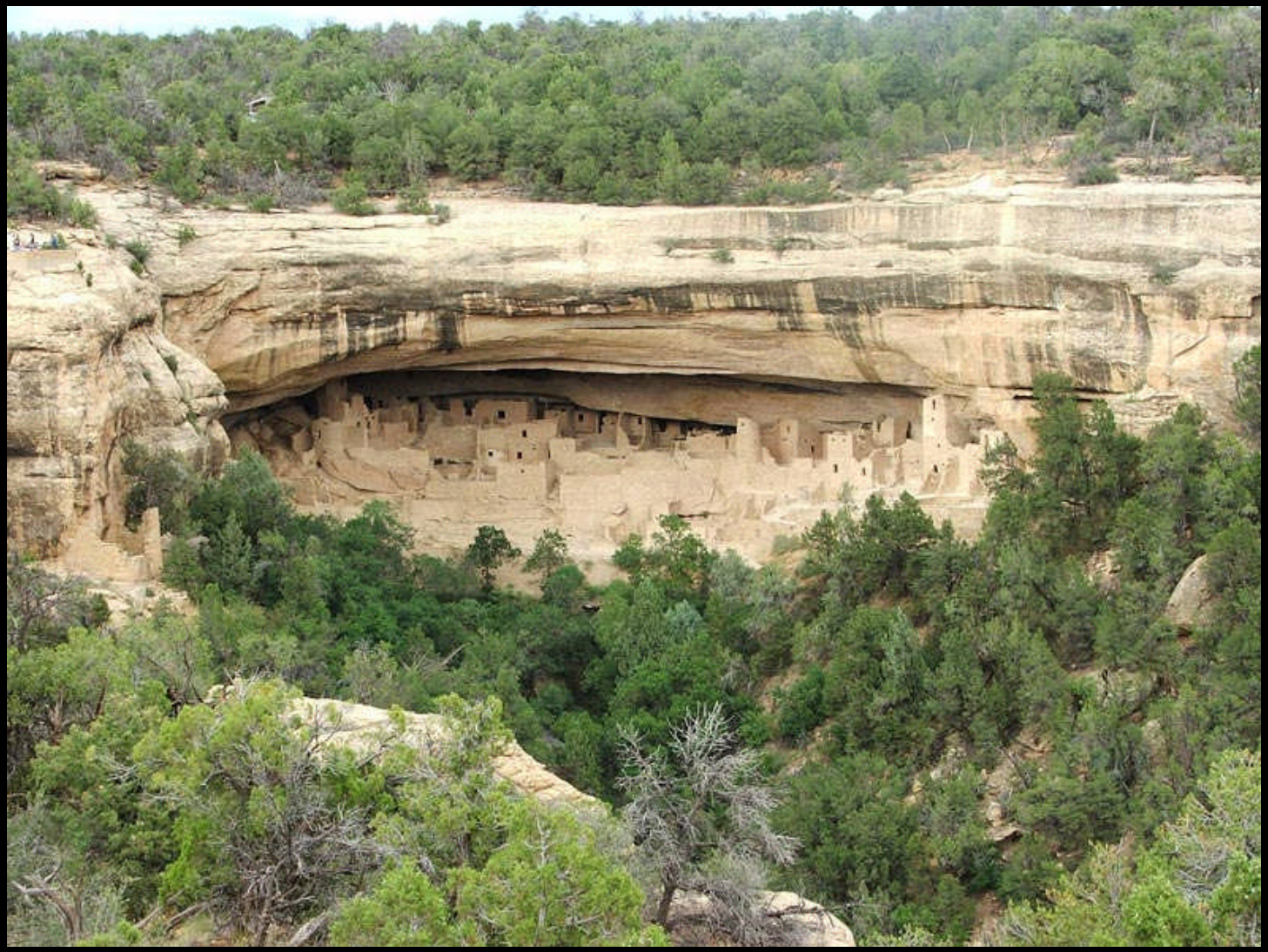
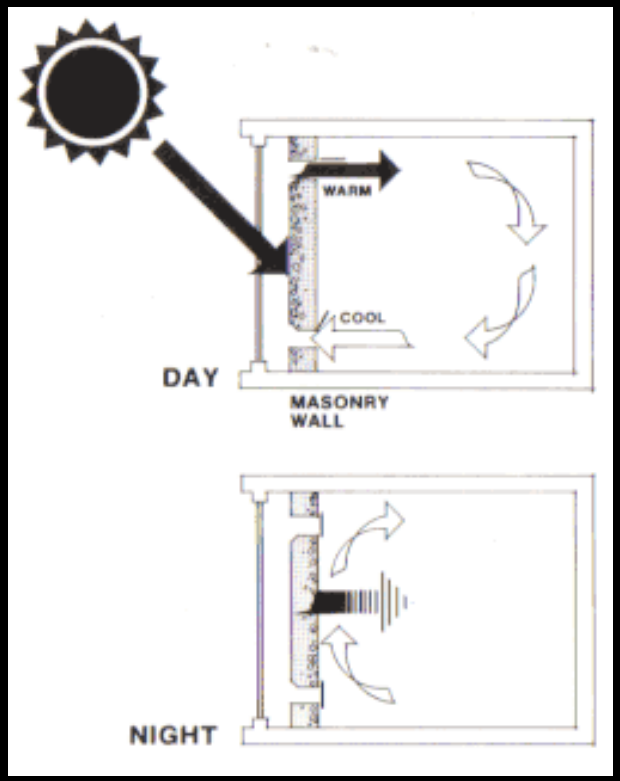
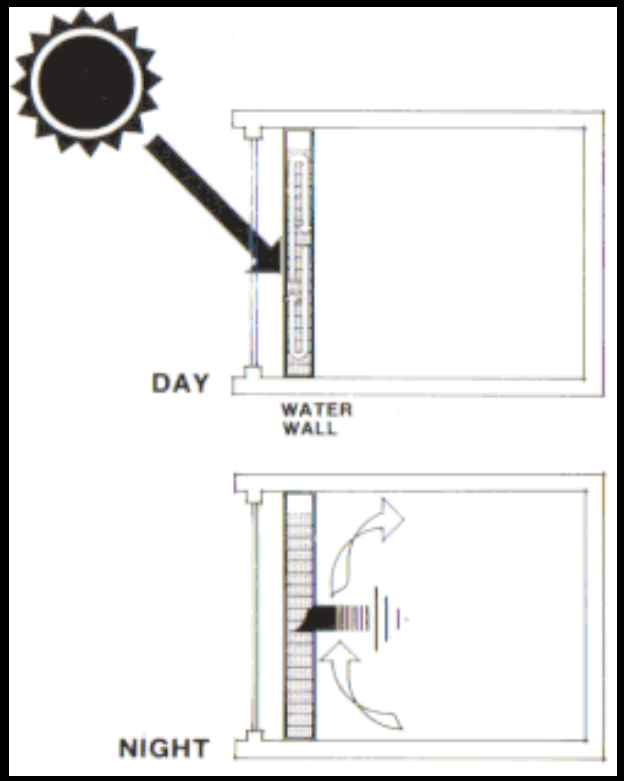
Mesa Verde: Thermal Mass-Passive Heating/Cooling



http://www.greatdreams.com/native/mesa-verde.jpg

Modern Implementation:
Thermal Mass-Passive Heating/Cooling

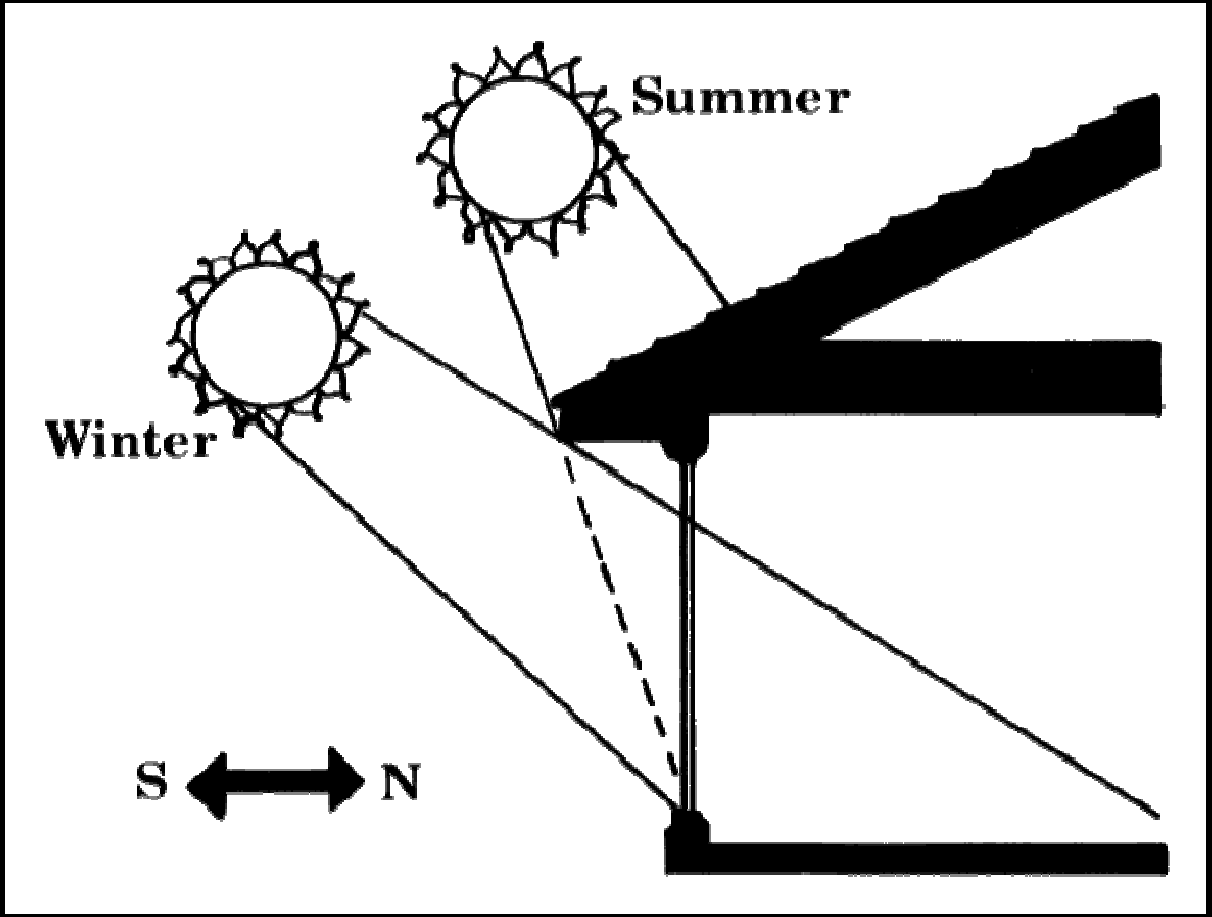




Modern Implementation:
Thermal Mass-Passive Heating/Cooling

Winter Sun Shadow at Mesa Verde

http://www.greenhomebuilding.com/weblog/archive/2006_04_01_archive.htm



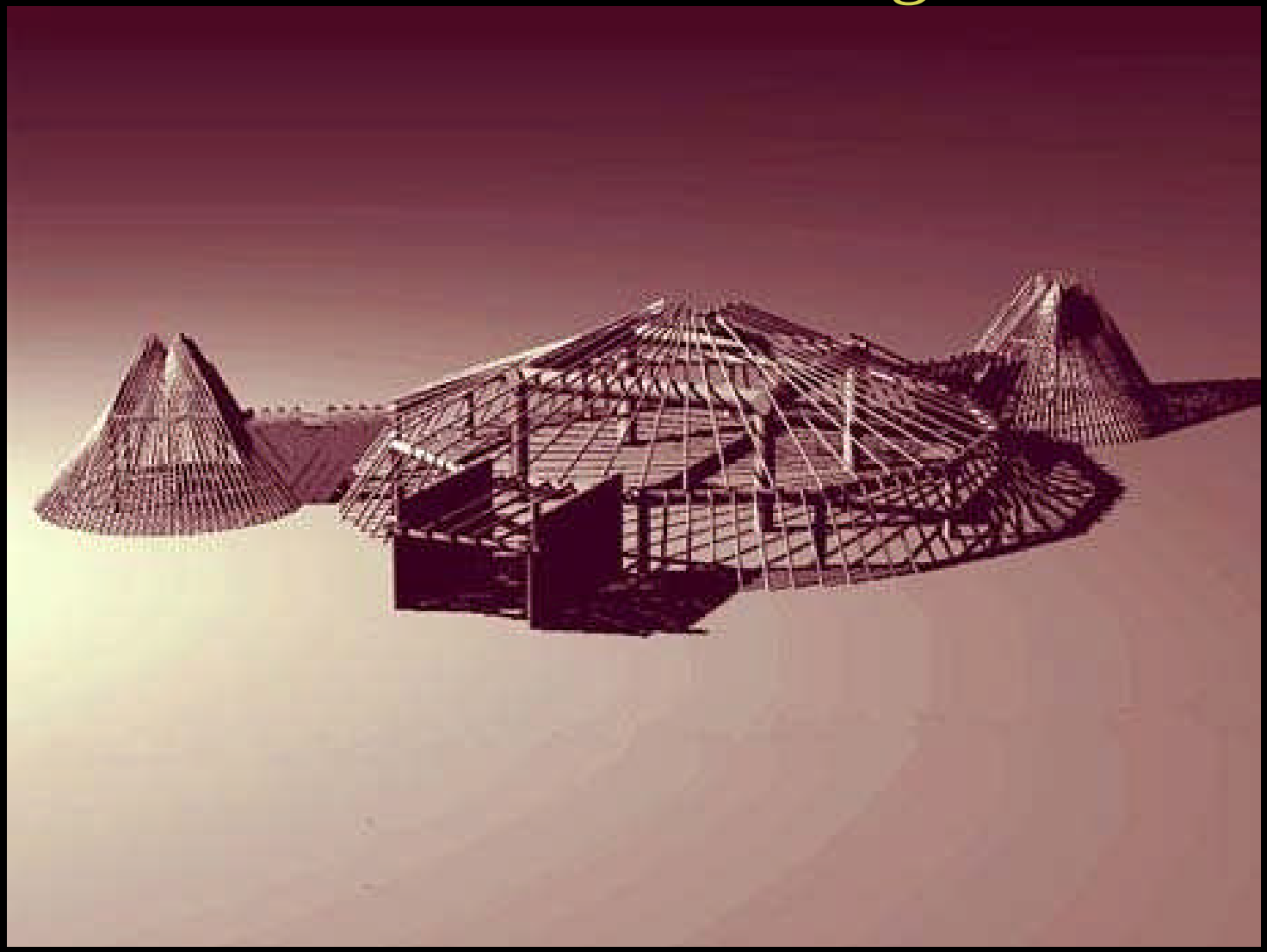
Passive Solar Design

http://www.greatdreams.com/native/mesa-verde.jpg

Passive Solar Design

Earthlodge: Natural Insulation

Earthlodge Framing: Sustainable Land Management



Earth House

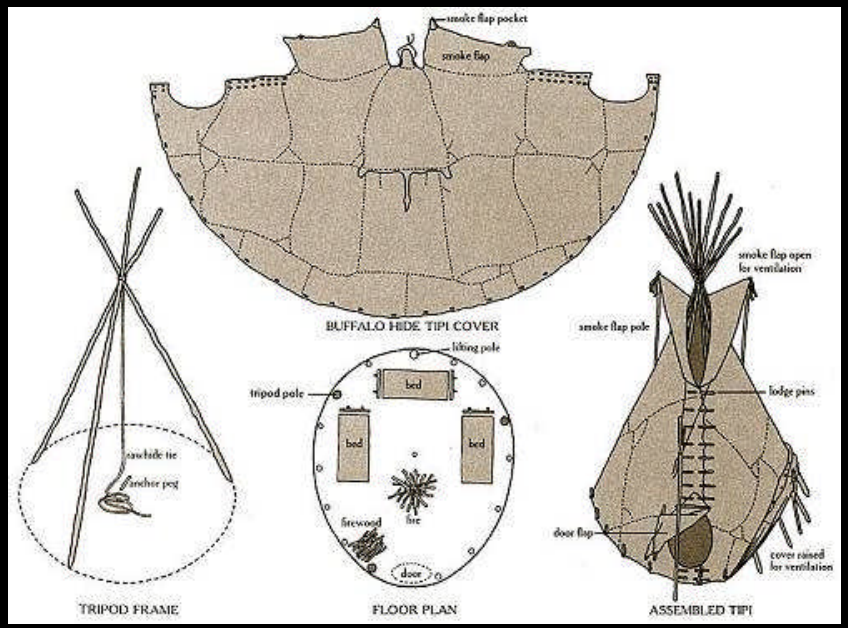
Adobe: Passive Heating-Cooling

Earthships: Recovered Material and More

Hualapai

Taos

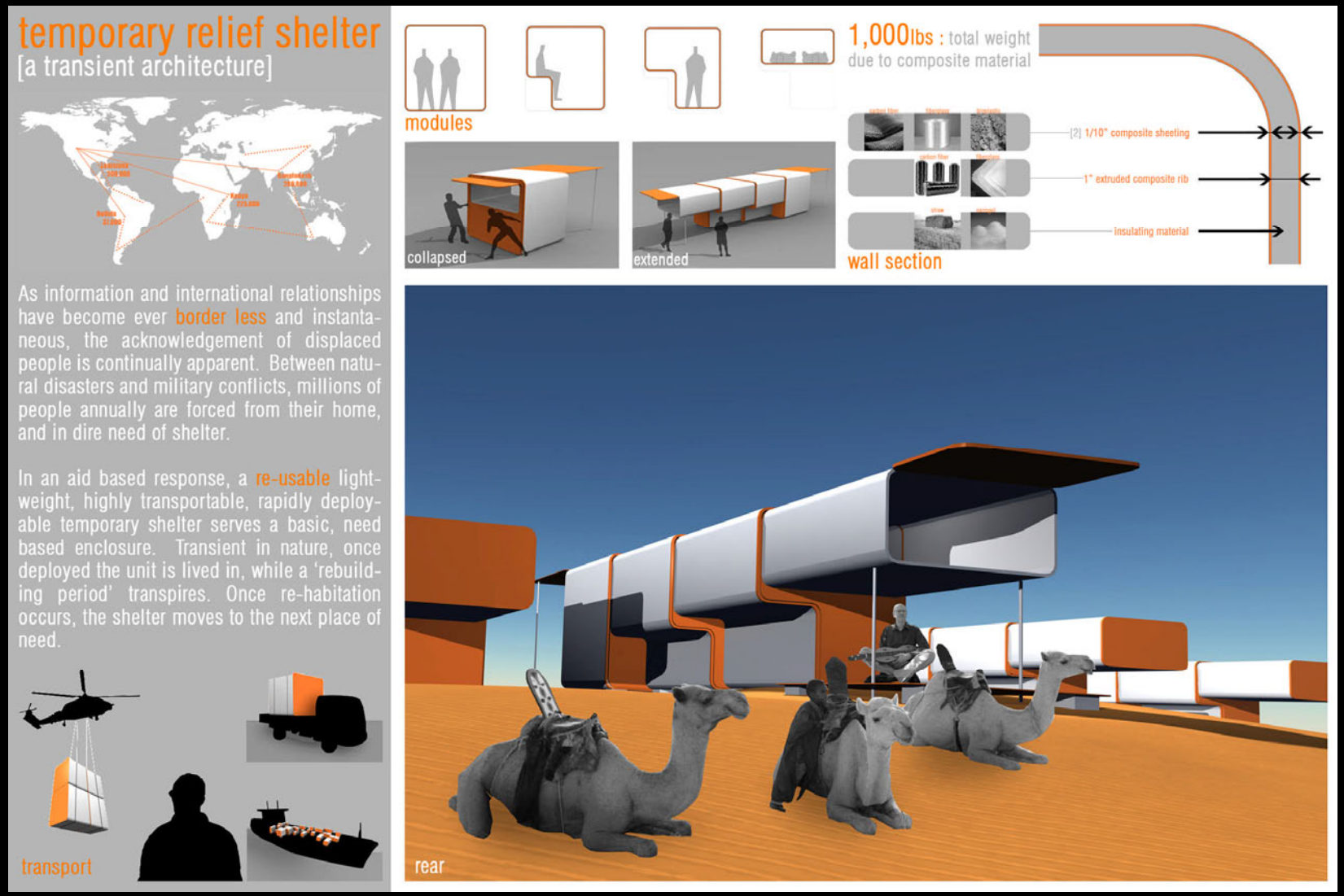
Tepee: Natural Ventilation; Mobility



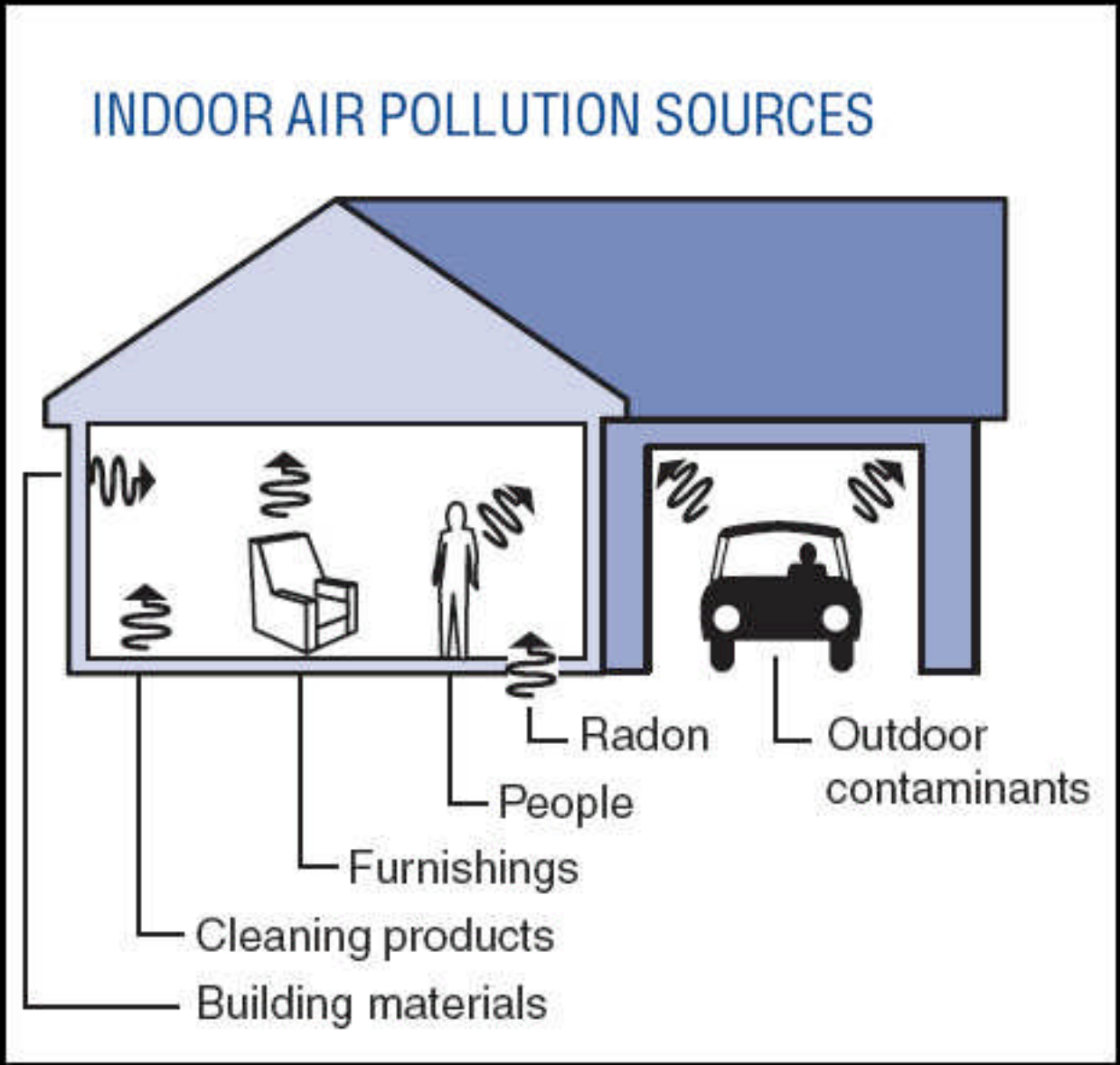
http://upload.wikimedia.org/wikipedia/en/9/9b/Tipi_Inside.png

http://coloradoyurt.com/tipis/index.php#

Lifecycle Building Challenge 2008: Temporary Relief Shelter, Mobility

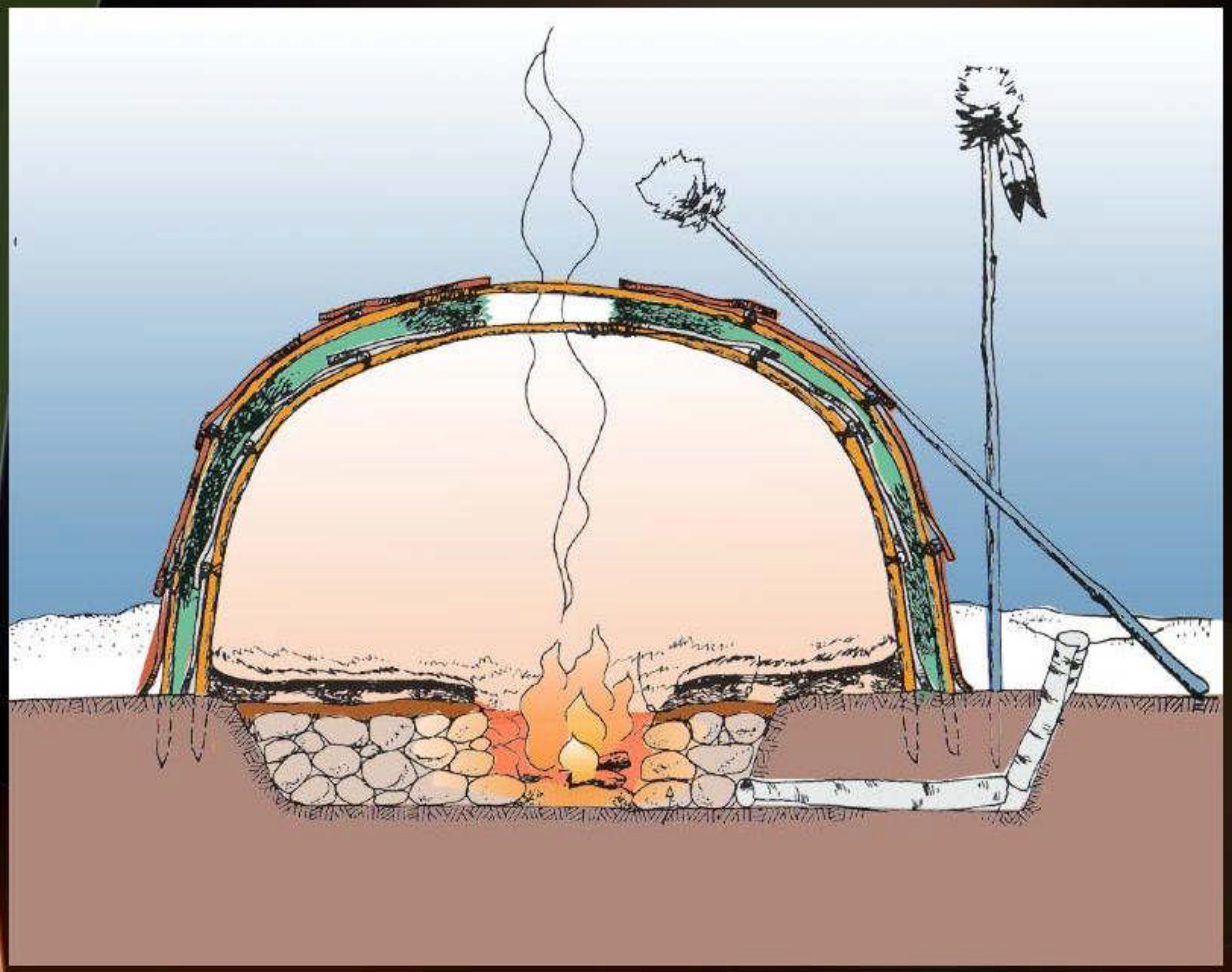


http://submit.lifecyclebuilding.org/storage/images/34/swindel_lifecycles%20comp%201.jpg



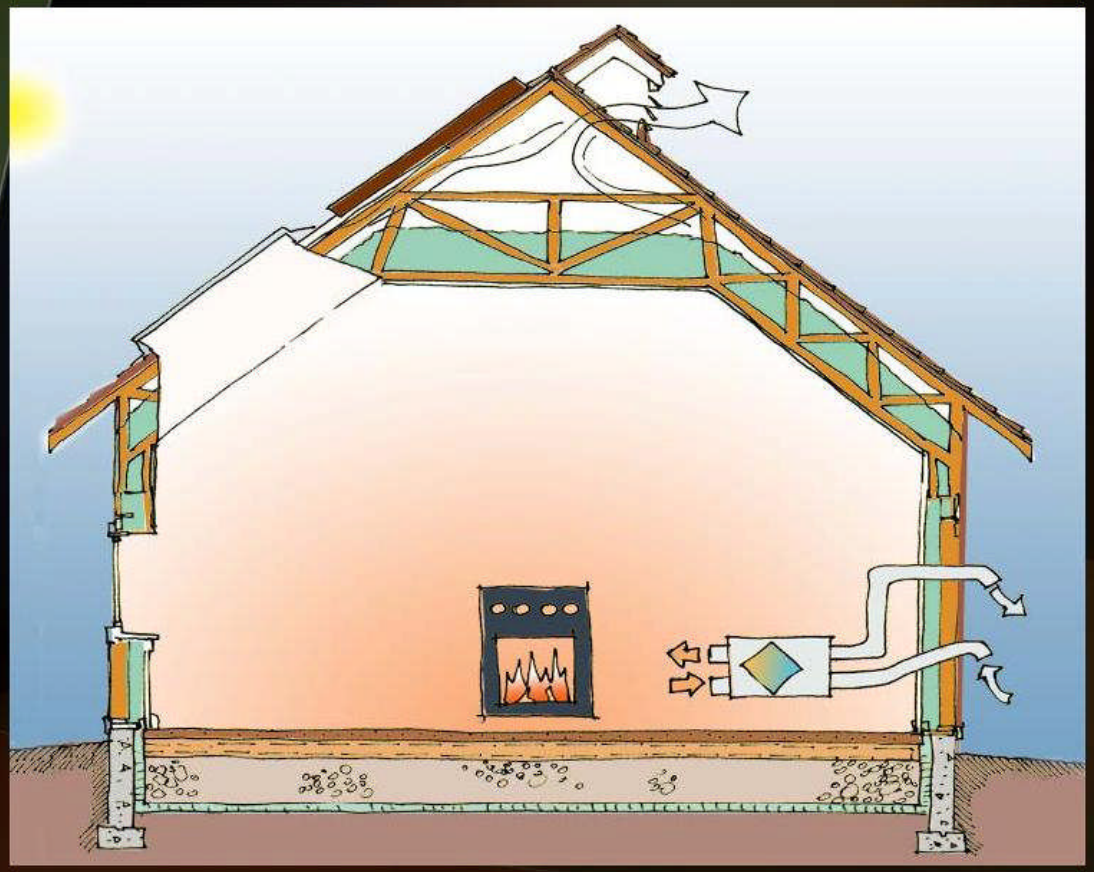
http://construction.com/CE/articles/0705edit-1.asp

Wigwam: Natural Ventilation; Insulation; Thermal mass; Heat



Source: "Native American Architecture", Easton & Nabokov 1990
Kelly, Host-Jablonski, Thering presentation at www.sustainabledevelopmentinstitute.org

Passive Solar Home: Natural Ventilation; Insulation; Thermal mass; Heat, Glass and Solar



Source: Kelly, Host-Jablonski, Thering presentation www.sustainabledevelopmentinstitute.org

Igloo: Insulation, Ventilation and Lighting

http://img-tbhl.theonering.net/yabbfiles/Attachments/igloo.jpg

http://www.ri.net/schools/Narragansett/NES/Classrooms/Batchelder99/igloo.jpg

Ice Hotel: Creating a Local Economy

http://www.icehotel.com/winter/book/accommodation/

Potawot Health Village: Integrating Medicine and Culture

http://www.humboldt1.com/~water/images/UIHSsiteplan.jpg

Potawot Health Village: Integrating Medicine and Culture

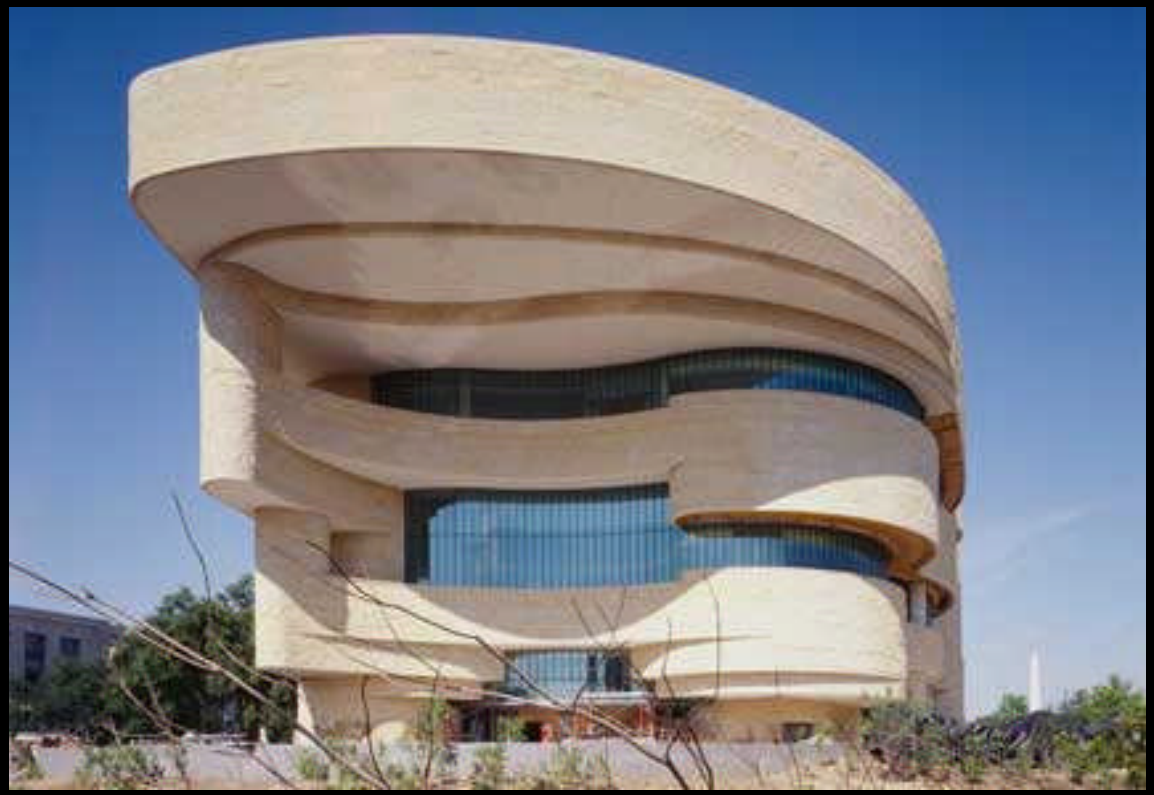
http://www.concretedecor.net/Abstracts/CD603-Potawat_Profile.cfm

Ramona Reservation Renewable Energy Housing and Ecotourism Power System Project

First “off grid” reservation with full renewable energy power for all facilities on the reservation.

Native American owned facility that will train other rural/remote tribes to adapt this model to their residential and economic development needs.

National Museum of American Indian



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Tax Incentives and Rebates

•Site-built homes qualify for a $2,000 credit if they reduce energy consumption by 50% relative to the International Energy Conservation Code standard.

• Manufactured homes qualify for a $1,000 or $2,000 credit depending on the level of energy savings achieved.

•Energy Efficient Homes Credit in the 2005 National Energy Policy Act
http://www.irs.gov/pub/irs-drop/n-06-27.pdf

• The tax credit for solar water heaters and solar panels was extended under the October 3, 2008 "Emergency Economic Stabilisation Act of 2008."

• For more on Federal Tax Credits for Energy Efficiency go to:
http://www.energystar.gov/index.cfm?c=products.pr_tax_credits

Resources

- California Integrated Waste Management Board

  http://www.ciwmb.ca.gov/GreenBuilding/

- Building and Buying Green in Indian Country: A Practical Guide for California Tribes

  http://www.ciwmb.ca.gov/Publications/default.asp?pubid=1069

- U.S. Green Building Council

  http://www.usgbc.org/

- Rural Information Center

  http://ric.nal.usda.gov/nal_display/index.php?info_center=5&tax_level=2&tax_subject=211&topic_id=1164

- Department of Energy: Tribal Energy Program

  http://www.eere.energy.gov/tribalenergy/

- U.S. Housing and Urban Development Office of Native American Programs

  http://www.hud.gov/offices/pih/ih/index.cfm

- California Coalition for Rural Housing

  http://www.calruralhousing.org/rural-housing-toolbox/native-american-housing-resources

Resources

- Sustainable Development Institute
  http://www.sustainabledevelopmentinstitute.org/TribalGreen.asp
- Red Feather Development Group
  http://www.redfeather.org/
- Native American Indian Housing Council
  http://www.naihc.net/
- Housing Assistance Council
  http://www.ruralhome.org/
- Build it Green
  http://www.builditgreen.org/
- The Adobe Alliance
  http://www.adobealliance.org/
- Builders Without Borders
  http://builderswithoutborders.org/
- Flex Your Power
  http://fypower.org/