



Emerson Environmental

Tune Up Your House™

# Tuning Up Your Home: Residential Energy Efficiency Retrofits and Modifications

“What can I do at my house to  
use less energy?”

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## Why Increase Efficiency?



- Save Money
- Reduce Greenhouse Gas Emissions
- Increase Property Value
- Bragging Rights

The average California home energy usage emits 10,600 lbs. (5.3 tons) CO<sub>2</sub> per year.

PG&E Climate Smart™ “Together we can fight climate change” (2007).

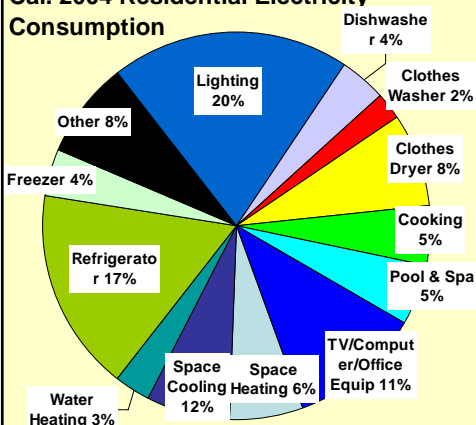


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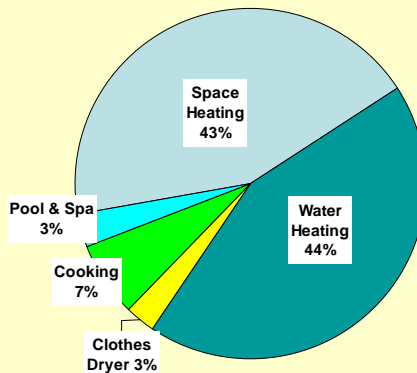
Residential Energy Efficiency Retrofits

# Current Energy Use

**Cal. 2004 Residential Electricity Consumption**



**Residential Gas Consumption**



Data: Rulo & North, Itron, for Cal. Energy Comm'n, Assessment of Long-Term Electronic Energy Efficiency Potential in California's Residential Sector, Fig. 7.3.3 (2007); David Johnson, What's Working, for Build It Green (2007)

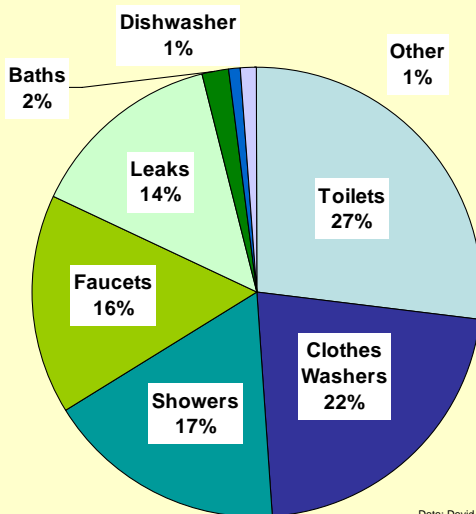
Data: David Johnson, What's Working, for Build It Green (2007), citing CA Energy Comm'n



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Residential Energy Efficiency Retrofits

# Current Residential Water Use



Data: David Johnson, What's Working, for Build It Green (2007)



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Residential Energy Efficiency Retrofits

## Free Measures to Save Money (and Energy)

- Turn down water heater thermostat to 120°F.
- Turn off lights when leaving a room.
- Set thermostats to 68°F in winter when you're home, and down to 55°F when you go to bed or when you're away (Programmable thermostats do this automatically.)
- Use energy-saving settings on washing machines, clothes dryers, dishwashers, and refrigerators.
- Wash clothes in cold water and only full loads.

R. Heede, *Homemade Money* (Rocky Mountain Inst. 1995)



## Free Measures to Save Money (and Energy) (cont.)

- Don't waste water, hot or cold, inside or outside your home.
- Clean your refrigerator's condenser coils once a year.
- Air-dry your clothes.
- Close heating vents in unused rooms.\*
- Repair leaky faucets and toilets.
- Close drapes and windows during sunny summer days and after sunset in the winter.

R. Heede, *Homemade Money* (Rocky Mountain Inst. 1995)



## Simple & Inexpensive Ways to Lower Your Energy Bill in 1 Year

- Install a water-saving 2.5-gallon-per-minute showerhead. (\$5-15)
- Install water-efficient faucet heads for your kitchen and bathroom sinks. (\$2 each)
- Install a programmable thermostat.\* (\$25-75)
- In the attic and basement, seal the air leaks a cat could crawl through, and replace and reputty broken windowpanes. (~\$40)

R. Heede, *Homemade Money* (Rocky Mountain Inst. 1995)

## Simple & Inexpensive Ways to Lower Your Energy Bill in 1 Year (cont.)

- Clean or change the air filter on your warm-air heating system during winter and on air conditioning units in the summer. (\$4-15)
- Install an R-7 or R-11 water heater wrap.\* (\$15-25)
- Insulate the first three feet of hot and inlet cold water pipes. (\$6)

R. Heede, *Homemade Money* (Rocky Mountain Inst. 1995)

## Simple & Inexpensive Ways to Lower Your Energy Bill in 1 Year

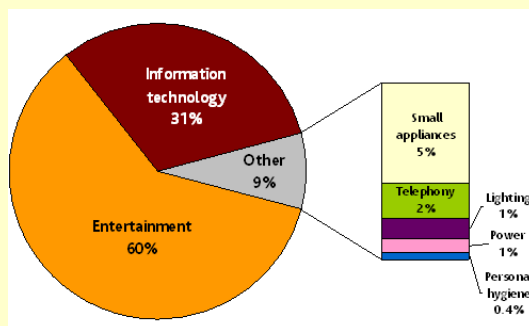
(cont.)

- Install compact fluorescent light bulbs in the fixtures you use most. (\$6-30)

R. Heede, *Homemade Money*  
(Rocky Mountain Inst. 1995)

	100w Incandescent	23w CFL
Watts	100 w	23 w
Hours used	8000 hrs	8000 hrs
# of bulbs required	8	1
Cost per bulb	\$0.63	\$2.00
Total bulb cost	\$5.04	\$2.00
Energy used	800 kWh	184 kWh
Energy cost per kWh	\$0.12	\$0.12
Energy cost total	\$96.00	\$24.08
Total Cost	\$101.04	\$24.08
Savings with CFL		\$77.86

## Plug Loads



- Electronic products use **1,069 to 1,207 kWh** in a typical home, costing each homeowner approx. **\$150** per year to operate.
- Plug loads account for more than **15%** of the energy consumption for a typical California home.
- Entertainment products and information technology account for **over 90% of the electricity used by plug load devices in a typical home**. These two categories of products also represent the largest opportunities for energy savings through the use of more efficient products.

Data and Figure: Ecos Consulting, <http://www.efficientproducts.org/plugload/> (2006)

## Getting Serious: Measures that Cost More, with 1-3 year Pay Back

Get a comprehensive energy audit, including a blower door test, to identify sources of air leaks.

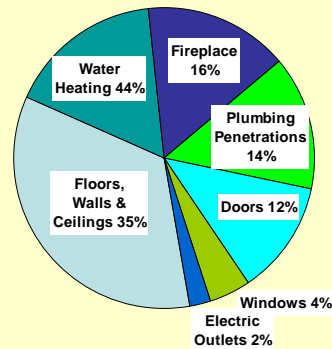
R. Heede, *Homemade Money* (Rocky Mountain Inst. 1995)



## Getting Serious: Measures that Cost More, with 1-3 year Pay Back

- Caulk and weatherize all leaks identified by the test. Start with the attic and basement first (especially around plumbing and electrical penetrations, and around the framing that rests on the foundation), then weatherize windows and doors.
- Seal and insulate warm-air heating (or cooling) ducts.

**Primary Air Infiltration Locations**



R. Heede, *Homemade Money* (Rocky Mountain Inst. 1995)

Data: David Johnson, *What's Working*, for Build It Green (2007)

## **Getting Serious: Measures that Cost More, with 1-3 year Pay Back (cont.)**

- Have heating and cooling systems tuned up every year or two and determine if a replacement is needed.
- Install additional faucet aerators, efficient showerheads, and programmable thermostats.
- Make insulating shades for your windows, or add insulating storm windows or, in a southern climate, shade sunny windows or add solar gain control films.
- Insulate hot water pipes in unheated basements, crawlspaces, or garage.\*

R. Heede, *Homemade Money* (Rocky Mountain Inst. 1995)



## **Going All the Way: Expensive Measures Taking 3-15 Years for Pay-Back**

- Foundation: insulate inside rim joist and down the foundation wall to below frostline to at least R-19 in cold climates and to R-11 or better in moderate climates.\* Remember to caulk first.
- Basement: insulate the ceiling above crawlspaces or unheated basements to at least R-19 in cold climates. If your basement is heated, insulate the inside of basement walls instead to R-19 or more above grade and to R-11 or more below grade. Basement or foundation insulation is usually not needed in hot climates.
- Attic: increase attic insulation to R-50 in cold climates, R-38 in milder climates, and R-30 plus a radiant barrier in hot climates.

R. Heede, *Homemade Money* (Rocky Mountain Inst. 1995)



## Going All the Way: Expensive Measures Taking 3-15 Years for Pay-Back (cont.)

- Walls: adding wall insulation is more difficult and expensive, but may be cost-effective if your house is uncomfortable.
- Install more compact fluorescent bulbs. Put them in your most frequently used fixtures. Consider installing occupancy sensors with these lights to automatically turn lights off when the room is unoccupied.
- Replace exterior incandescent lights with compact fluorescents and put them on a timer or motion sensor if they're on more than a couple of hours a night.
- Convert to solar water heating, and perhaps also supplementary solar space heating.

R. Heede, *Homemade Money* (Rocky Mountain Inst. 1995)

## Going All the Way: Expensive Measures Taking 3-15 Years for Pay-Back (cont.)

- Upgrade your water heater, furnace/boiler, air conditioners, and appliances to more efficient models. Newer units are far more efficient. Upgrading is often cost-effective, and definitely so if you need to replace failing units anyway. Also, if you've weatherized and insulated, you'll be able to downsize the heating and cooling system.
- Upgrade to superinsulating or at least low-emissivity windows in cold climates, or low solar transmittance windows in hot climates, if replacement is needed.



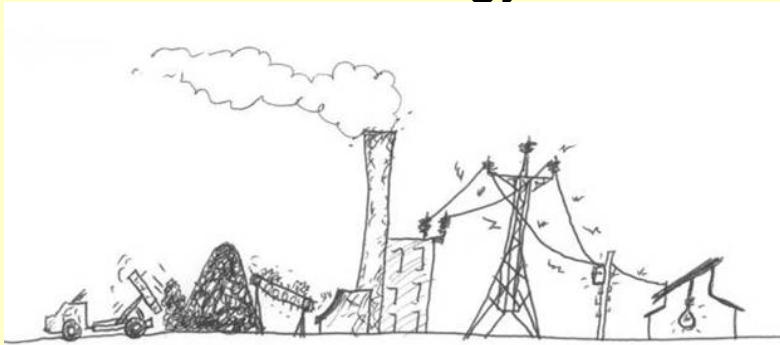
R. Heede, *Homemade Money* (Rocky Mountain Inst. 1995)

## Going All the Way: Expensive Measures Taking 3-15 Years for Pay-Back (cont.)

- Replace high-flow toilets with modern water-efficient toilets that use 50–80 percent less water.\*
- Install awnings or build removable trellises over windows that overheat your home in the summer.
- Plant a tree to shade your largest west window in summer. You won't save any money for years, but you'll get an A+ for long-range vision.

R. Heede, *Homemade Money* (Rocky Mountain Inst. 1995)

## Home-Based Energy Production



Mining    Transportation    Refinement    Generation    Transmission    Transform    Use  
 ???% X    50%    x    90%    x    60%    x    90%    x    95%    x    5% = 1.6%

Efficiencies multiply . . . Net energy is less than 1.6%!

Data and Figure: David Johnson, *What's Working*, for Build It Green (2007)

## Indoor Air Quality

- Beware of back-drafting burners, including older gas furnaces, stoves, and water heaters – be sure to properly ventilate
- Install a UL 2034 and CSA 6.19 certified Carbon Monoxide detector
- Avoid indoor toxics – formaldehyde off-gassing from cabinetry, furniture, or fiberglass insulation; housecleaning products; ozone-generating “air treatment” equipment; citrus or pine cleaning products
- If it smells like a beach ball, throw it away
- Eliminate and avoid mold growth and excess moisture

## Resources

- PG&E on-line audit: SmartEnergy Analyzer™  
[http://www.pge.com/res/energy\\_tools\\_resources/energy\\_tools.html](http://www.pge.com/res/energy_tools_resources/energy_tools.html)
- Home Energy Saver on-line audit:  
<http://hes.lbl.gov/>
- Dept. of Energy Do-it-Yourself Energy Audit:  
[http://www.eere.energy.gov/consumer/your\\_home/energy\\_audits/index.cfm/mytopic=11170](http://www.eere.energy.gov/consumer/your_home/energy_audits/index.cfm/mytopic=11170)
- Professional Energy Auditors, such as Suzanne Emerson, EmersonEnvironmental.com
- On-line Resources, inc. ENERGY STAR
- Books:
  - Richard Heede, *Homemade Money*
  - Krigger & Dorsi, *Residential Energy*

