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Tune Up Your HouseSM

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Residential Energy Efficiency for Existing Homes

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

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Today's Presentation

- Understanding Your Energy Use
- Most Cost-Effective Measures for the Average Home
- Palo Alto Resources
- Procedures for Performing Your Own Mini-Energy Audit



Why Increase Efficiency?



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

The average California home energy usage emits 10,600 lbs. (5.3 tons) CO₂ per year.

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



What's a Kilowatt?

- A watt is a unit of electrical power
 - a 100 watt incandescent bulb
- A kilowatt (kW) is equal to 1000 watts
 - 10 of the 100 watt bulbs burning at once

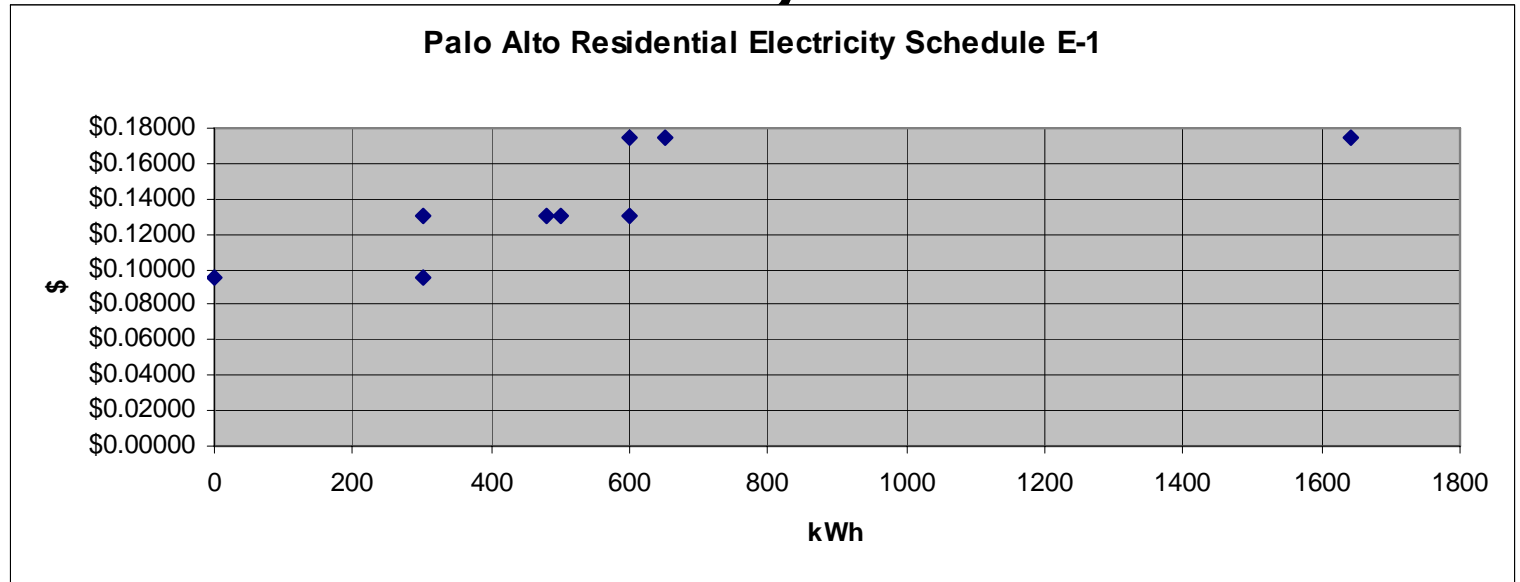


- A kilowatt-hour (kWh) is a unit of electric energy
 - 10 of the 100 w. bulbs burning for 1 hour = 1 kWh



Your Electricity Rate

Electricity rates depend on how much electricity you use.



Palo Alto Residential Rate Schedules, based on 30-day month, as of 7/1/2009

E-1: 1-300 kWh \$0.09524 301-600 \$0.13020 601+ \$0.17399

E-1-G: 1-300 kWh \$0.11024 301-600 \$0.14520 601+ \$0.18899

480.5 kWh/mo = Avg. San Mateo County Residence

491.1 kWh/mo = Avg Menlo Park Residence

500 kWh/mo = Avg. New CA 2000 sq. ft. Residence

651 kWh/mo = Avg. Palo Alto single-family Residence

1641 kWh/mo = Avg. Atherton Residence



Compared to 100 Neighbors

PAU's Home Energy Reports compare you energy use to 100 nearby homes of comparable size.



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We are pleased to provide this personalized report to you as part of an energy saving program.

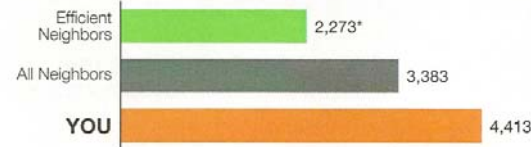
The purpose of this report is to:

- Provide information
- Track your progress
- Share energy efficiency tips



This information and more available at www.CityofPaloAlto.org/HomeEnergyReports

Last 2 Months Neighbor Comparison | You used **30% MORE** energy than your neighbors.



How you're doing:

You used more than average

Turn over for ways to save →

* This energy index combines electricity (kWh) and natural gas (therms) into a single measurement.

Who are your Neighbors?

■ All Neighbors

Approximately 100 occupied, nearby homes (avg 0.13 miles away) that have both electricity and natural gas service

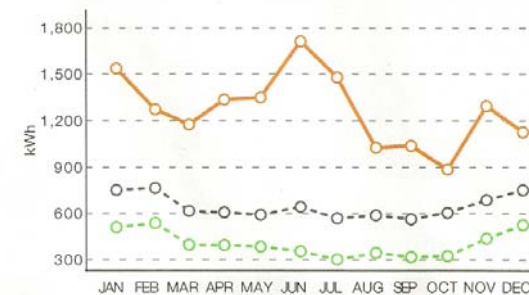
■ Efficient Neighbors

The most efficient 20 percent from the "All Neighbors" group

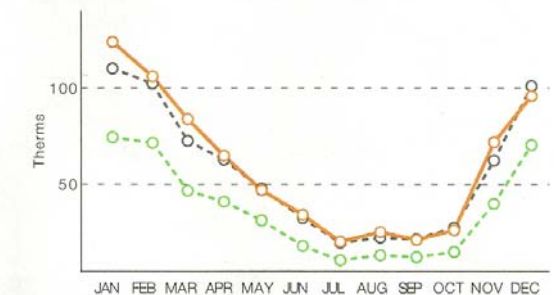
Last 12 Months Neighbor Comparison

You used **50% MORE** energy than your neighbors.
This costs you about **\$1,469 EXTRA** per year.

⚡ Electricity | 97% more electricity than your neighbors



🔥 Natural Gas | 6% more natural gas than your neighbors

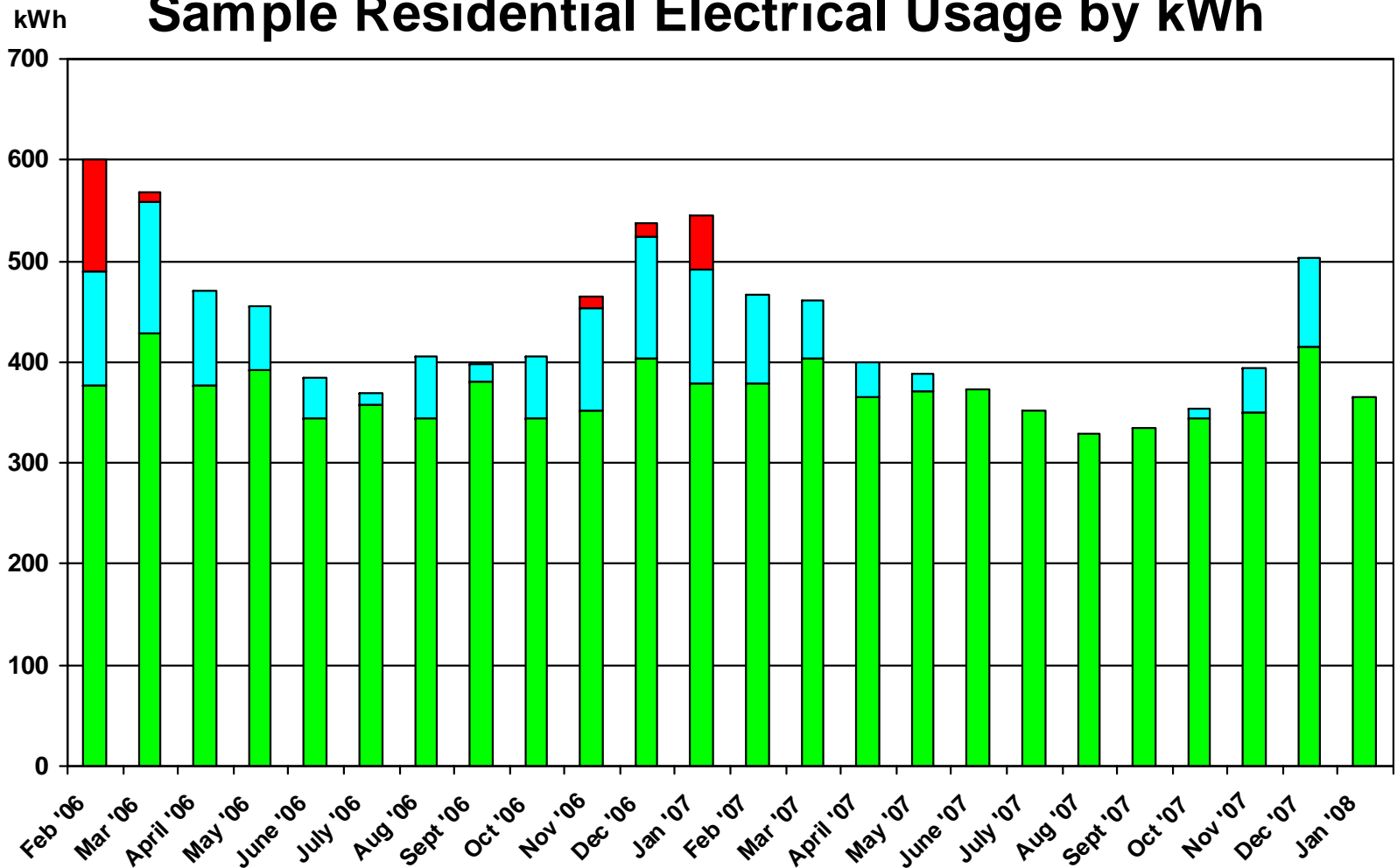


Key: ■ You ■ All Neighbors ■ Efficient Neighbors

Seasonal Electricity Use

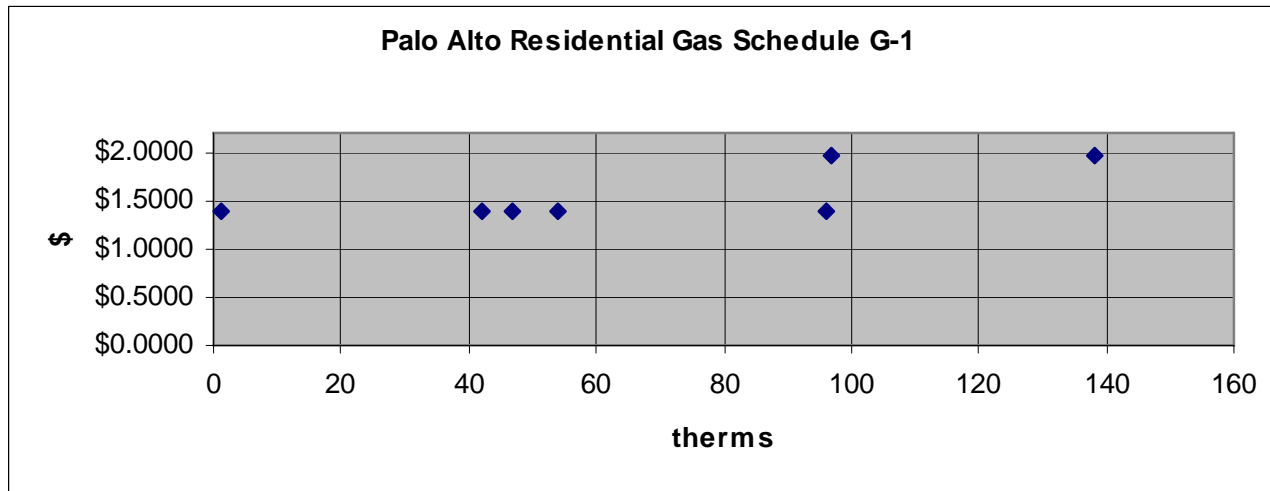
Sample Residential Electrical Usage by kWh

If you track your energy bills, you will likely see seasonal differences due to heating, cooling, and seasonal lighting loads.



Your Gas Rate

Gas rates generally depend on how much gas you use.

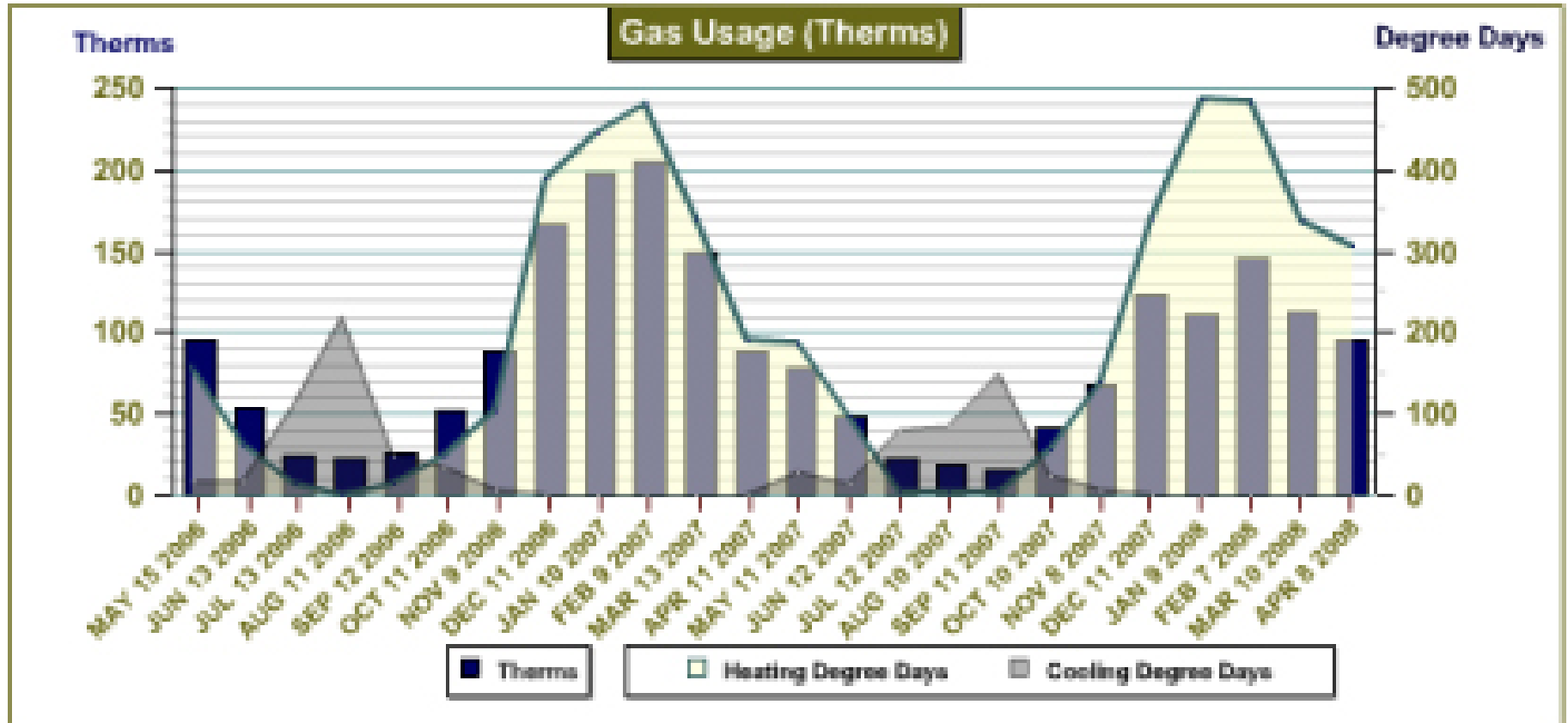


© Emerson Environmental, LLC

Palo Alto Residential Rate Schedule G-1: $\$5.25 +$
1-96 winter [1-20 in summer] therms $\$1.3872$
96+ winter [20+ in summer] therms $\$1.9592$
42 therms/mo = Avg. New CA 2000 sq. ft. Residence
47 therms/mo = Avg. Menlo Park Residence
54 therms/mo = Avg. Palo Alto single-family Residence
138 therms/mo = Avg. Atherton Residence



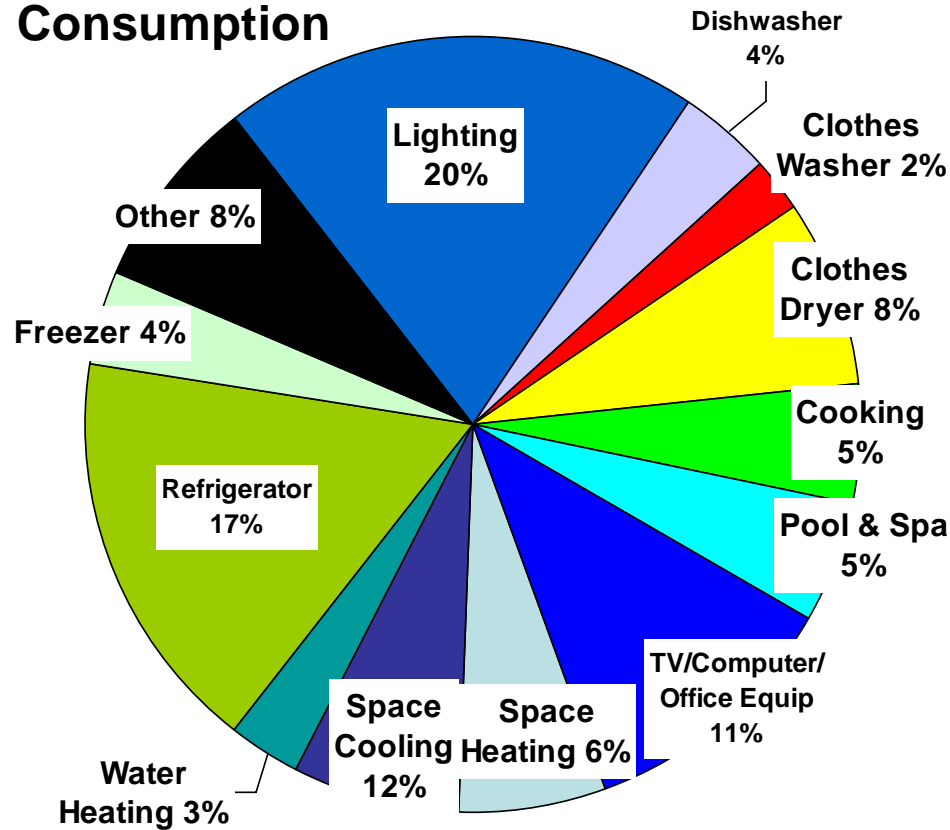
Your Gas Use



Graphics: PG&E

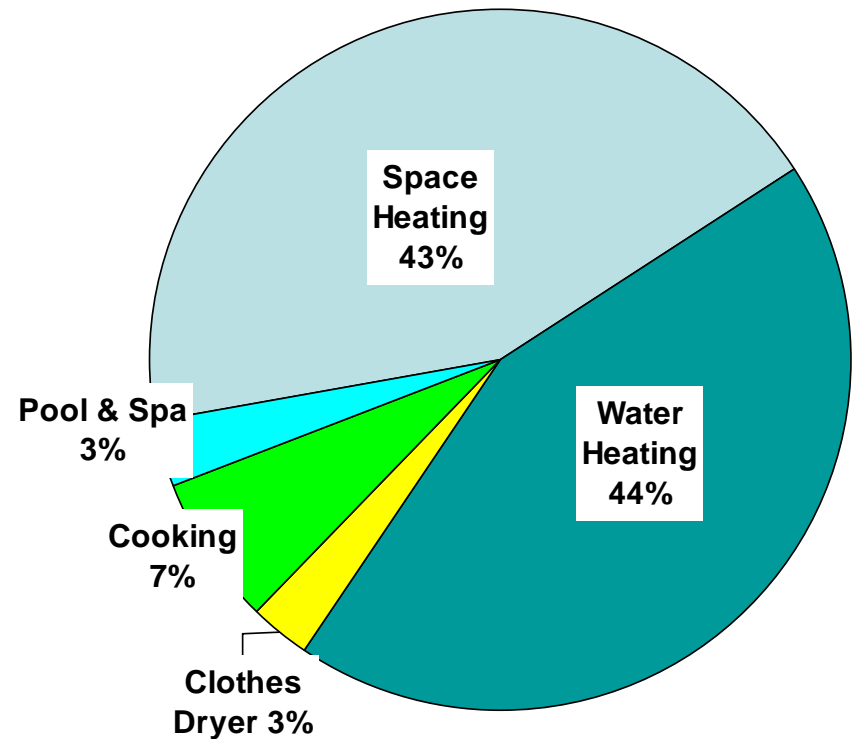
Current Energy Use

Cal. 2004 Residential Electricity Consumption



Data: Rufo & 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)

Residential Gas Consumption



Data: David Johnson, *What's Working*, for Build It Green (2007), citing CA Energy Comm'n; graphics © Emerson Environmental, LLC

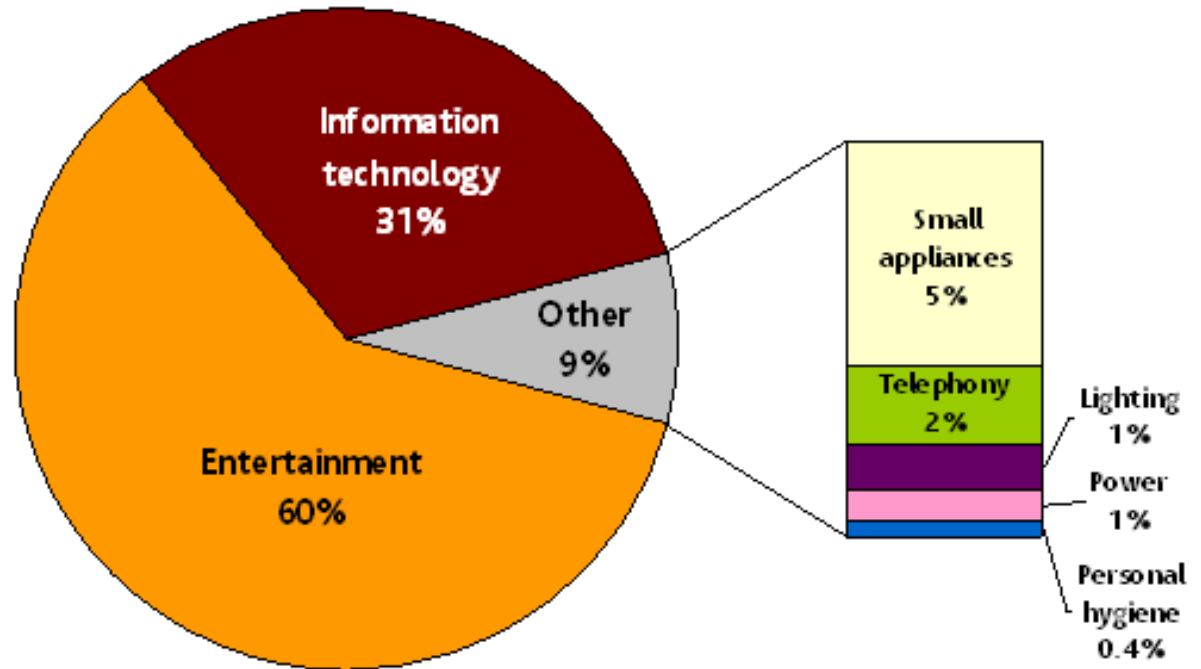


Plug Loads – Typical CA Home

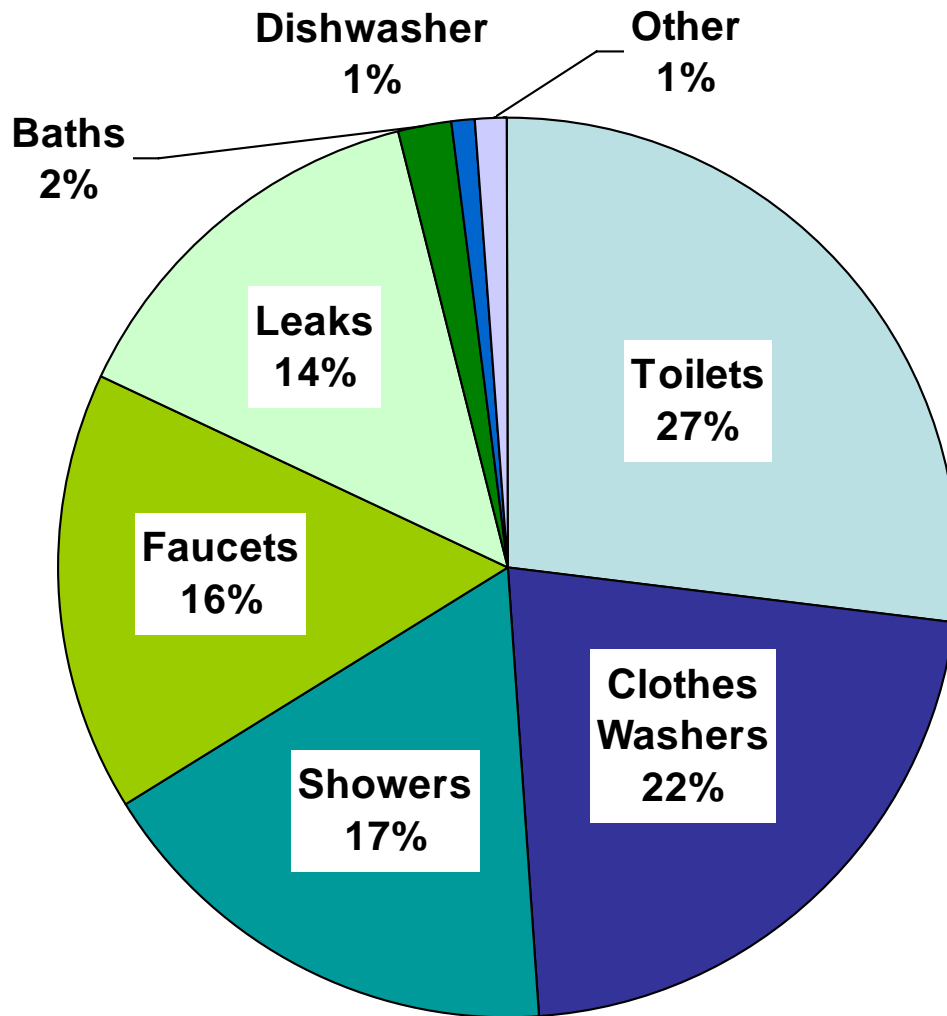
- Electronic products cost approx. **\$150** per year to power.
- Plug loads account for more than **15%** of the energy used by the home.
- Entertainment and information technology account for **over 90%** of the electricity used by plug load devices.

PRODUCT	NATIONAL ANNUAL COST	PG&E Tier 5 ANNUAL COST
20-cu.-ft. refrigerator (a newer top-freezer)	\$50	170
25-cu.-ft. refrigerator (a newer side-by-side)	65	220
32-inch picture-tube	40	140
36-inch picture-tube	50	170
37-inch LCD	50	170
40-inch LCD	55	180
56-inch rear-projection	65	220
42-inch plasma, 720p	70	240
52-inch LCD	80	270
50-inch plasma, 720p	80	270
50-inch plasma, 1080p	110	380

Based on Consumer Reports, "Power Play: What it Costs to Run a Big Screen TV" (March 2008) (national cost: Dept. of Energy 2007 nat'l avg price 10.65¢/kwh).



Current Residential Water Use



- Energy is used in water supply and conveyance, pre-use treatment, distribution and system pressurization, heating and cooling, and wastewater treatment.
- Water-related energy use consumes 19% of the California's electricity and 30% of its natural gas.

Data: David Johnson, What's Working, for Build It Green (2007); graphics © Emerson Environmental, LLC

California Energy Commission, "California's Water-Energy Relationship" at 1, 8 (Nov. 2005) (2001 data).

Free Measures to Save Money (and Energy)

- Turn off lights and electronics when leaving a room.
- Turn down water heater thermostat to 120°F.
- 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. But – if you have to choose between a shorter nighttime set-back or a larger furnace, go with the smaller furnace.



Free Measures to Save Money (and Energy)

Use energy-saving settings on washing machines, clothes dryers, dishwashers, and refrigerators.

- Wash clothes in cold water and only full loads.
- Clean your refrigerator's condenser coils once a year.



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

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

- Air-dry your clothes.
- Repair leaky faucets and toilets.
- Close drapes and windows during sunny summer days and after sunset in the winter.



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

- Install a standard, water-saving 2.5-gallon-per-minute (or less) showerhead. (\$5-15)
- Install water-efficient faucet heads for your kitchen and bathroom sinks. (\$2 each)

Water Conservation: Replacing Inefficient Fixtures

Product	Inefficient Product (gpm) ¹	Standard Product (gpm)	Gallons of Water Saved per		
			per Minute	per Day ²	per Year ³
Kitchen Aerator	3.5	2.5	1	8.1	2,957
Sink Aerator	3.5	2.2	1.3	10.53	3,843
Showerhead	5	2.2	2.8	14.84	5,417
Total:				33	12,217

Water Conservation: Replacing Standard Fixtures with Low-Flow Fixtures

Product	Standard Product (gpm) ¹	Low-Flow Product (gpm)	Gallons of Water Saved per		
			per Minute	per Day ²	per Year ³
Kitchen Aerator	2.5	2	0.5	4.05	1,478
Sink Aerator	2.2	1	1.2	9.72	3,548
Showerhead	2.2	1.75	0.45	2.39	871
Total:				16	5,897

¹gpm – gallons per minute

²based on a total household use of 5.3 minutes per capita per day for showers and 8.1 minutes per capita per day for kitchen and sink aerators

³based on use for 365 days per year

Based on Metropolitan North Georgia Water Planning District (2006)



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



- Install a programmable thermostat and use it.*
- In the attic and basement, seal the air leaks a cat could crawl through, and replace and reputty broken windowpanes.

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. But don't use an "ultra pure" filter, as it may negatively impact your furnace's efficiency.
- Install an R-7 or R-11 water heater wrap if your water heater isn't pre-insulated.
- Insulate the first three feet of hot and inlet cold water pipes.

Based on 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)

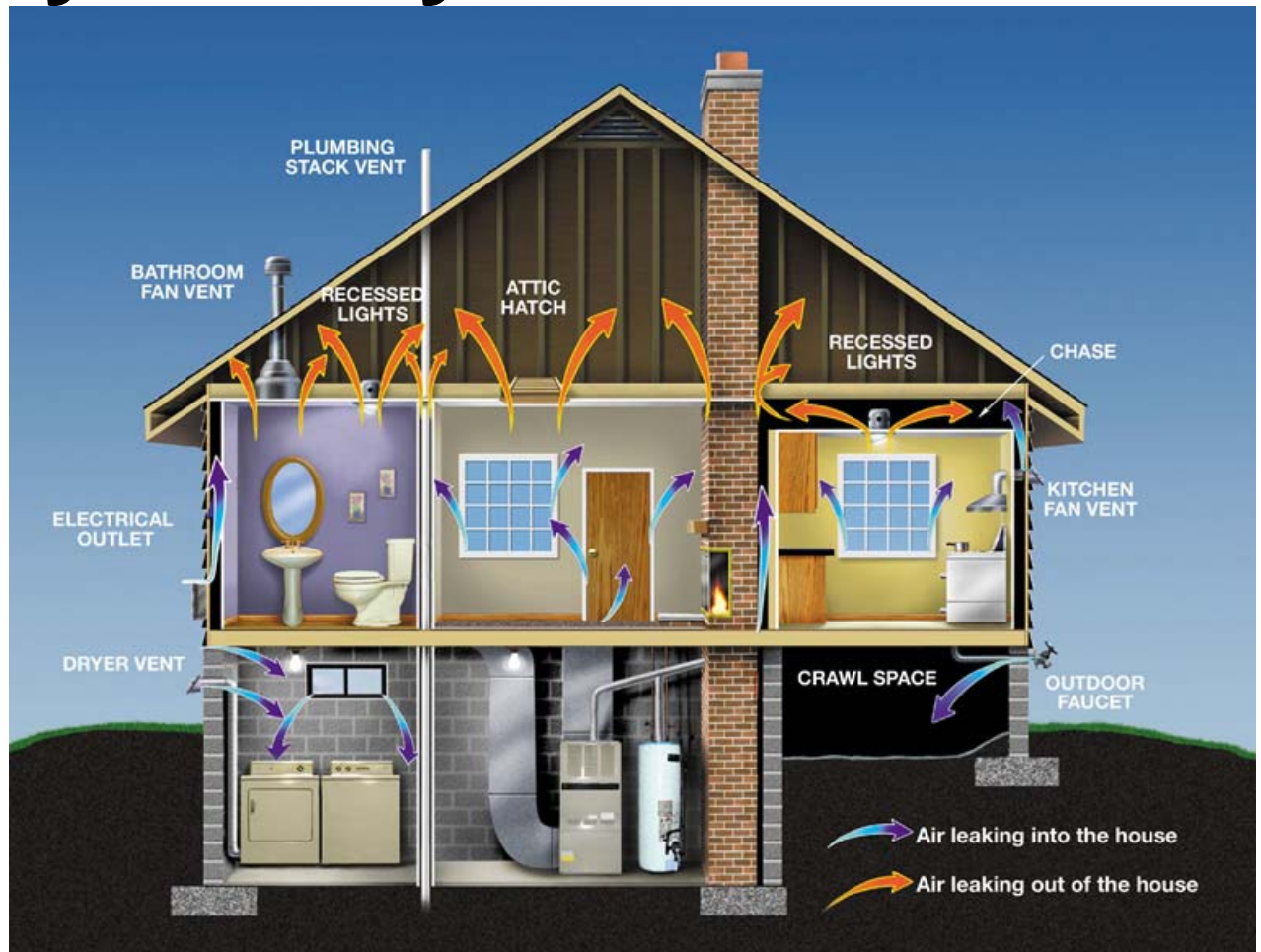
R. Heede, *Homemade Money*
(Rocky Mountain Inst. 1995)

	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	\$22.08
Total Cost	\$101.04	\$24.08
Savings with CFL		\$76.96

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.

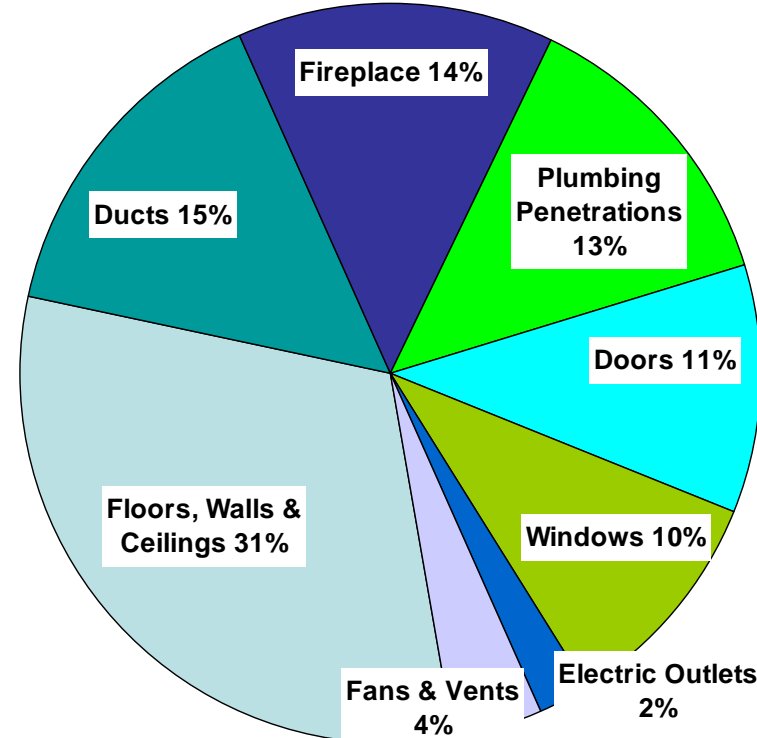
Text R. Heede, *Homemade Money* (Rocky Mountain Inst. 1995); graphics Energy Star



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 air ducts.

Primary Air
Infiltration Locations



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

Data: David Johnson, *What's Working*, for Build It Green (2007);
graphics © Emerson Environmental, LLC

Residential Energy Efficiency



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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. Don't oversize.
- Install additional faucet aerators, efficient showerheads, and programmable thermostats.
- Make insulating shades for your windows, or add insulating storm windows; shade sunny windows or add solar gain control films.
- Insulate hot water pipes wherever they are accessible.

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



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

- Attic: increase attic insulation to R-38 in mild climates. (Better yet, go all the way to R-50.)
- 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 all your frequently used fixtures.
- Consider installing occupancy sensors with these lights to automatically turn lights off when the room is unoccupied.

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

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

- 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, especially if you do not have natural gas as a heating source.
- Remodel utilizing passive solar design elements.

Based on 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 may be far more efficient. Also, if you've weatherized and insulated, you'll be able to downsize the heating and cooling system.
- Upgrade to double-pane, low-emissivity windows, if replacement is needed.



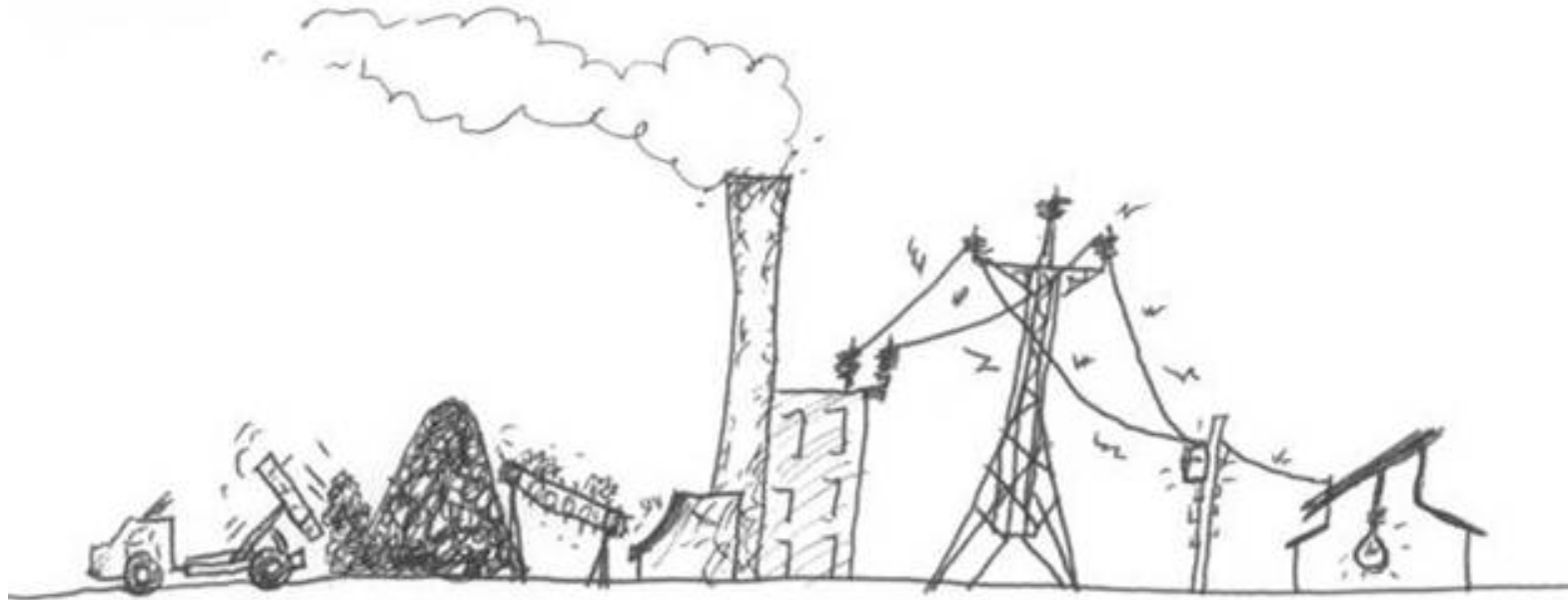
Based on R. Heede, *Homemade Money* (Rocky Mountain Inst. 1995)

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

- Replace high-flow toilets with modern water-efficient toilets.
- Install awnings or build removable trellises over windows that overheat your home in the summer, especially on west or south windows.
- 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.

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

Home-Based Energy Production

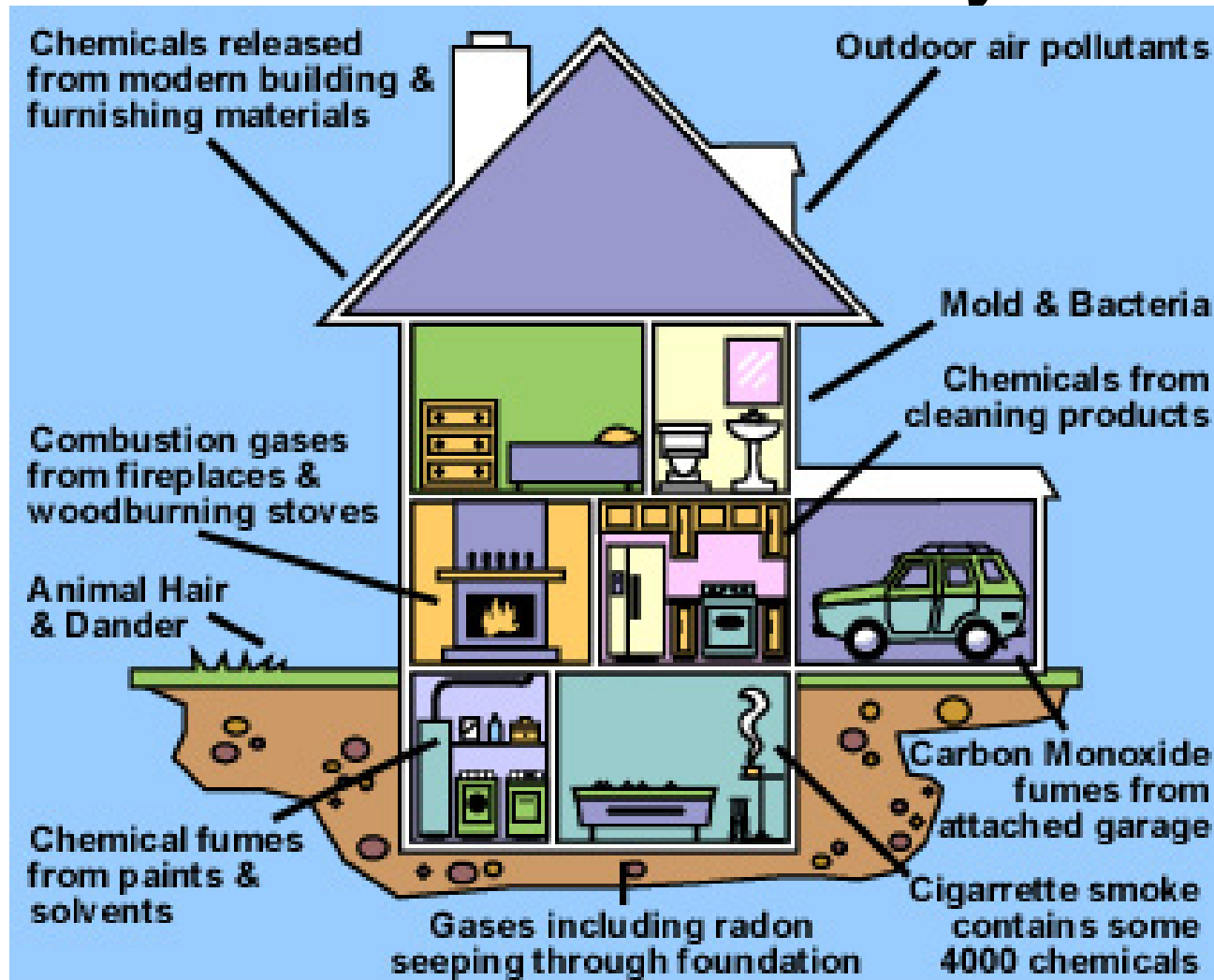


Mining Transportation Refinement Generation Transmission Transform Use
??% X 50% x 90% x 60% x 90% x 95% x 5% = 1.6%

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



Graphics: U.S. Environmental Protection Agency, Air Pollution Control Orientation Course, Indoor Air Pollution



Indoor Air Quality

- Beware of back-drafting burners, including older gas furnaces, stoves, and water heaters – be sure to properly ventilate
- Install a Carbon Monoxide detector in sleeping areas
- 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

Palo Alto Resources

City Programs

<http://www.cityofpaloalto.org/depts/utl/residential/default.asp>

- **Water-Wise House Call Program**

Free indoor & outdoor water survey of your house or apartment. Surveyors will review your water use, provide low-flow showerheads, faucet aerators, and toilet flappers (if needed) free of charge, and make site-specific recommendations for water efficiency including suggested changes to your landscape irrigation schedule. (800) 548-1882 or <http://www.valleywater.org/Programs/WaterWiseHouseCallRequest.aspx>

Palo Alto Resources

- **“Home Energy Kit”** – Free CFL, furnace whistle, refrigerator thermometer, shower timer -- with completion of on-line survey:
<http://www.cityofpaloalto.org/forms/utilities/home-energy-kit.lasso>
- **Low Income Households: Residential Energy Assistance Program:** Our Energy Free in-home Home Energy Analysis; if eligible, free installation of weather stripping, window caulking, attic insulation, showerheads, faucet aerators, compact fluorescent lighting, and more.
(650) 329-2333
<http://www.cityofpaloalto.org/depts/utl/news/details.asp?NewsID=1142&TargetID=11>

Palo Alto Resources

- **Rebates:**
<http://www.cityofpaloalto.org/depts/utl/news/details.asp?NewsID=65&TargetID=12>
 - Refrigerator
 - Dishwasher Washing Machine
 - Smart Power Strips
 - Furnace
 - Boiler
 - Air conditioner
 - Solar Attic Fan
 - Water heater
 - Pool pump
 - Insulation for attic, roof and/or walls
- **Solar Photovoltaic Incentives:**
<http://www.cityofpaloalto.org/depts/utl/news/details.asp?NewsID=622&TargetID=12>
- **Solar Thermal (Hot Water) Incentives:**
<http://www.cityofpaloalto.org/depts/utl/news/details.asp?NewsID=1032&TargetID=12>
- Palo Alto Utility Account Representative: Andrea Hart (650) 329-2434

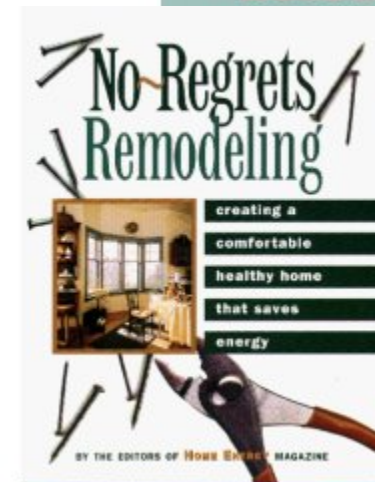
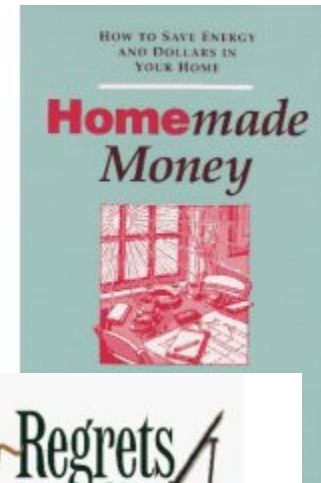


Resources

- Acterra “Green@Home” HouseCalls Trained volunteers meet with residents in their homes to install simple energy-saving devices and create home energy conservations plans.
<http://www.acterra.org/programs/greenathome/index.html> 650-962-9876 x316
- Home Energy Saver on-line audit:
<http://hes.lbl.gov/consumer/>
- Alliance to Save Energy Do-it-Yourself Energy Audit: <http://ase.org/resources/home-energy-audit>

Resources

- Web sites, including Energy Star
- Books:
 - Richard Heede, *Homemade Money*
 - *No-Regrets Remodeling: Creating a Comfortable, Healthy Home That Saves Energy*
- Professional Energy Auditors, such as
 - Suzanne Emerson, Emerson Environmental





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Questions?

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