The background is a light green gradient with several white butterfly silhouettes scattered across it. The butterflies are of various sizes and orientations, some appearing to fly towards the center.

# **Energy Efficiency and Conservation and How Do You Weatherize a House?**

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# Why Do Any of This?

- Why Do Energy Efficiency, Conservation and...
- Why weatherize?
- It is an easy and cost effective way to save money on your heating and cooling bills and be much more comfortable
- Most important **BEFORE** investing in renewable energy
  - Reduce your carbon footprint first

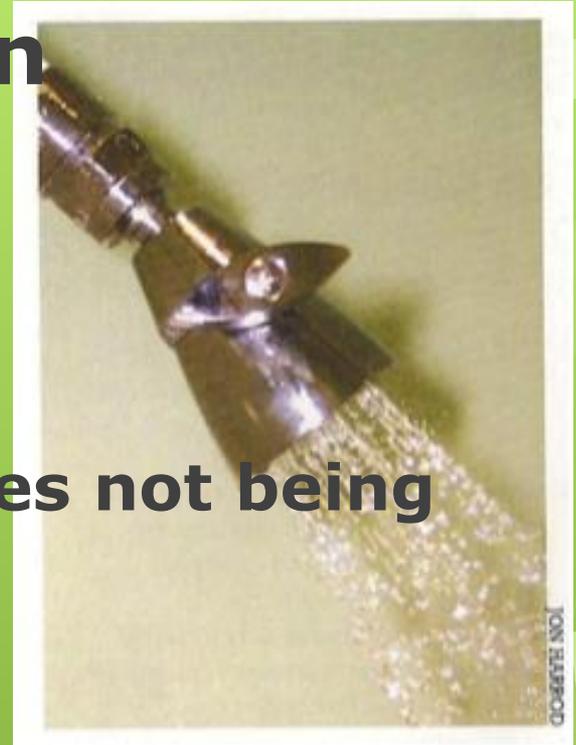


# **Start with Energy Efficiency and Conservation**

- Start with FREE, cheap and easy and move toward higher priced items and retrofits**
- Turn down your thermostat but stay comfortable**
- Programmable thermostat**
  - Turn down your water heater**
  - Use cold to wash**
- Turn off heat cycle in dish washer**

# More Energy Efficiency and Conservation

- Low flow showerheads
- Low flow toilets
- Turn off lights and appliances not being used
- Do I use electric or gas?
- Power strips to reduce or eliminate Phantom Loads



# Phantom Loads

- **Cost the US**

- **3 billion dollars/year**

- **10 power plants**

- **18 million tons of CO<sub>2</sub>**

- **More pollution than 6 million cars**

- **TV's and VCR's alone cost the US 1 billion dollars/year in lost electricity**

# Tools

- **Kill-O-Watt meter or equivalent**
- **Fridge thermometer**
- **Others?**

# Refrigeration

- One of the largest loads in a typical residential PV system
- About 5 times less efficient before 1993
- Fridge challenge and 30% improvement in 2001
- Energy Star added another 10%
- Side by side approx 10% more energy
- Auto ice-makers approx 15% more energy
- Do you know how to read the label on an appliance?

# Labels

Based on standard U.S. Government tests

## ENERGYGUIDE

Refrigerator-Freezer  
With Automatic Defrost  
With Top-Mounted Freezer  
Without Through-the-Door Ice Service

Models: B7S18KBP, G7S18KCP,  
B7S18WCP, B7S18GP

Capacity: 17.8 Cubic Feet

**Compare the Energy Use of this Refrigerator  
with Others Before You Buy.**

<b>This Model Uses</b>	
482 kWh/year	
<b>Energy use (kWh/year) range of all similar models</b>	
<b>Uses Least Energy</b>	<b>Uses Most Energy</b>
381	484

kWh/year (kilowatt-hours per year) is a measure of energy (electricity) use. Your utility company uses it to compute your bill. Only models with 16.5 to 18.4 cubic feet and the above features are used in this scale.

**Refrigerators using more energy cost more to operate.  
This model's estimated yearly operating cost is:**

**\$44**

Based on a 2006 U.S. Government national average cost of 9.0¢ per kWh for electricity. Your actual operating cost will vary depending on your local utility rates and your use of the product.

Important: Removal of this label before consumer purchase violates the Federal Trade Commission's Appliance Labeling Rule (16 CFR Part 305).

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Based on standard U.S. Government tests

## ENERGYGUIDE

Refrigerator-Freezer  
With Automatic Defrost  
With Top-Mounted Freezer  
Without Through-The-Door Ice Service  
Capacity: 18.2 Cubic Feet

Whirlpool Corporation  
Model: ET8FTE\*M\*O\*

**Compare the Energy Use of this Refrigerator  
with Others Before You Buy.**

<b>This Model Uses</b>		<b>ENERGY STAR®</b> A symbol of energy efficiency
412kWh/year		
<b>Energy use (kWh/year) range of all similar models</b>		
<b>Uses Least Energy</b>		<b>Uses Most Energy</b>
414		489

The Estimated Annual Energy Consumption of this model was not available at the time the range was published.

kWh/year (kilowatt-hours per year) is a measure of energy (electricity) use. Your utility company uses it to compute your bill. Only models with 16.5 to 18.4 cubic feet and the above features are used in this scale.

**Refrigerators using more energy cost more to operate.  
This model's estimated yearly operating cost is:**

**\$34**

Based on a 2001 U.S. Government national average cost of 8.29¢ per kWh for electricity. Your actual operating cost will vary depending on your local utility rates and your use of the product.

Important: Removal of this label before consumer purchase violates the Federal Trade Commission's Appliance Labeling Rule (16 CFR Part 305).

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# Comparison of 3 Refrigerator Models

- Inefficient Model (16 cu. Ft) 475 watts x 13 hours/day = 6175 Wh/day
- Sunfrost (16 cu. Ft.) 112 watts x 7 hours/day = 784 Wh/day
- Energy Star such as Kenmore (16.5 cu. Ft) 134 watts x 8 hours/day = 1072 Wh/day

# Lighting Efficiency

- **Lamp efficiency is measured in lumens/watt**
- **Lumens are a measure of the light output**
- **If a lamp produces more lumens from each watt of input, it is more efficient**

# How Much Light is Enough?

- **Lumens (foot-candle)**

- **1 foot-candle is the amount of light cast by a candle at one foot distance on a one square foot surface**

- **Lighting through history**

- **1800's = 1 lumen**

- **1930's < 50 lumens**

- **1990's = 100 lumens or more**

- **Moonlight = 0.03 lumens**

- **Sunlight = 10,000 lumens**

# Incandescent Lamps

- Electricity is conducted through a filament which resists the flow of electricity, heats up and glows
- Advantages
  - Most common
  - Least expensive
  - Pleasing light
- Disadvantages
  - Low efficiency
  - Short life < 750 hours



# **Incandescent Inefficiencies**

- From the power plant to your home, incandescent bulbs are less than 2% efficient**

# Quartz-Halogen Lamps

- Works the same as an incandescent, but the filament is run at a higher temperature. The bulb is also filled with halogen gas which prevents the bulb from blackening and extends its life.
- More efficient type of incandescent (10-15% more)
- Produces a brighter, whiter light than incandescent
- Longer life than incandescent
- Mostly used for projectors, spotlights, reading lamps and display lighting



# Fluorescent Lamps



- Fluorescent lights typically last ten times longer and use only one-fourth the energy of standard incandescent lights
- Uses less wattage than an incandescent lamp while producing the same amount of lumens (75% less energy)
- Has a much longer life than incandescent ( approx. 10,000 hours)
- May have difficulty starting in cold environments
- Contain a small amount of mercury (can be thrown in the trash)

# **Light Emitting Diodes (LEDs)**

## **○ Advantages**

- Extremely efficient**
- Long life (50,000 hours)**
- Rugged (can withstand moisture, vibration and shock)**

## **○ Disadvantages**

- Expensive**
- Not the same spread or coverage as other types of lighting**

# Lighting Controls

## ○ Switches

- Turns lights on and off

## ○ Timers

- Turns lights off after a set time

## ○ Dimmers

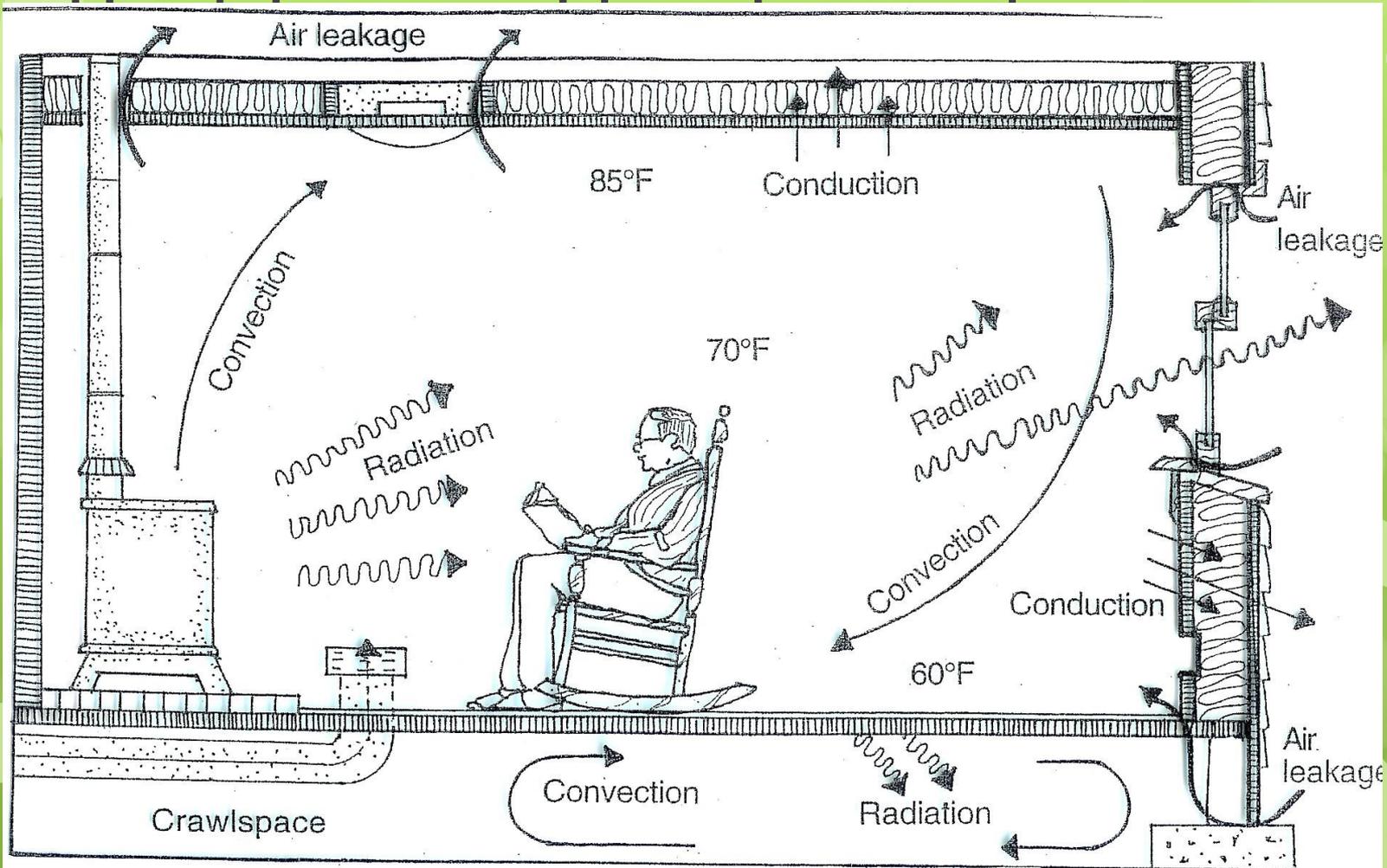
- Allows full range of brightness (can't be used with most compact fluorescent lights)

## ○ Photocells

- For outdoor lights. Turns light on and off depending on amount of natural light

## ○ Motion Sensors

- Turns light on when motion is sensed



# How Heat Moves

- **Conduction**
- **Convection**
- **Infiltration**
- **Radiation**
- **Air changes per hour?**

# **Caulking and Weatherstripping**

- One is permanent and one is not**
- Can you make a house too tight?**

# Caulking

- Comes in many forms: butyl, latex, silicone, siliconized latex and there are others
- Read the label of what type should be used where
- Use adequate ventilation
- ROT is if is less than 1/4" caulk, if larger use foam
- Foam is urethane and it expands three times its size

# Places to Caulk

- Windows and doors
- Floor meets baseboard
- Small plumbing penetrations
- Chimney meets house
- Any penetration  $\frac{1}{4}$ " or smaller
- Use high temperature caulk where appropriate



# Weatherstripping

- **Used on operable doors and windows, but applied to the non-operable part such as the door or window jamb**
- **Many different types of weatherstripping**
- **What are some you know?**

# **Plastic, Storm Windows or New Windows?**

- Depends if you rent or own.**
- Doesn't matter what material you use, it is the air space that insulates**

# Insulation

- Material used to slow down conductive heat flow.
- Many types of insulation.
- Fiberglass
- Cellulose
- Unfinished fiberglass
- Rigid insulation
  - Polystyrene vs. Polyisocyanuarate
- Vermiculite
- If you insulate in your attic you must ventilate.

# Places to Insulate

- **Ceiling joists**
- **Rim joists**
- **Crawlspace**
- **Water heaters (if you can)**
- **Reduce standby losses**
- **Ducts**

# Questions?

