Energy & the Environment

Environmental Problem Sources

- Philosophy
  - Lifestyles that emphasize consumption
  - Consumption vs. Quality
    - Yugo vs. Mercedes
    - Disposal ball point pens
    - Fast food packaging

Environmental Problem Sources

- Combustion & air pollutants
  - ***Incomplete*** combustion
    - Carbon monoxide
    - Volatile hydrocarbons
    - Soot and smoke

Environmental Problem Sources

- Combustion & air pollutants
  - ***Complete*** combustion products
    - Carbon dioxide (primary "Green house gas")
    - Nitrogen oxide
    - Sulpher dioxide
    - Heat

Environmental Problem Sources

- Use of Non-Renewable Resources
  - Example: Lead
    - It is a "valuable" pollutant
    - Finite quantity in earth
    - Dispersing of lead in air and water
    - Contamination
    - Unsalvageable

Environmental Problem Sources

- Affluence
  - Use beyond needs
    - "Why have two hats when you can wear only one at a time?"
  - Wasteful of resources
  - Not morally justifiable in a world of starvation

Air Pollution

- Primary pollutants
  - Discharge directly to air (SO_2)
- Secondary
  - Formed by reactions in atmosphere

    SO_2 causes Acid Rain

Air Pollution—Three Categories

- Contamination of local air
  - Automobile exhaust CO and O_3
- Regional air pollution
  - Low altitude ozone & acid rain

Air Pollution—Three Categories

- Global pollution
  - Stratospheric ozone destruction (CFCs)
    - ⇨ Fix: Floroflororcarbons (FFCs)?
  - Global warming

Global Warming

- "Greenhouse" effect
- Three major gases
  - Carbon Dioxide (CO_2)
  - Methane (CH_4)
  - Chloroflorocarbons (CFCs)
- Natural "disasters"

Heat Engines

- Thermal Efficiency

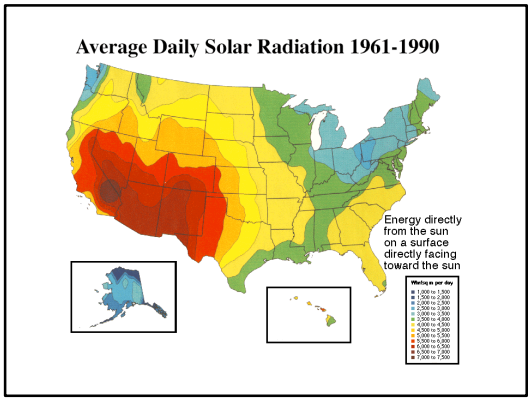
$$\eta_{thermal} = 1 - (T_L/T_H)$$

Where T_L & T_H are absolute temperatures (0°K = -273°C)

- Steam to Ice ➪ 26.8% max.

Forms of Solar Energy

- Fossil Fuels
  - Coal
  - Gas and Oil
- Biomass
- Geothermal
- Nuclear



Lighting

- Incandescents—75 Wt bulb
  - Inexpensive—75¢ each
  - Mostly HEAT
  - 16 Lumens/watt
  - Operating life: 1000 hours
  - Total cost for 10,000 hr: $78.89

Lighting

- Compact Florescent—20 Wt bulb
  - Expensive—$29 each
  - Mostly LIGHT
  - 60 Lumens/watt
  - Operating life: 10,000 hours
  - Total cost for 10,000 hr: $48.71

Solid Waste—

The 4 Step Path to Enlightenment

Hazardous Waste

- 300 Million tons/year in US
- Characteristics of "Hazardous Waste"
  - Flammable
  - Corrosive
  - Reactive
  - Toxic

Hazardous Waste

- Waste Minimization
  - High cost of disposal
- Land Ban
  - No more "dumping"
- Treatment
  - EPA specs (expensive)

CERCLA—"Superfund"

- Comprehensive Environmental Response, Compensation, and Liability Act
- Fixes responsibility and provides a source of funds
- Over 30,000 sites
- Estimated cost of cleanup is ***over 20% value of nation***

Local Dump Sites

- Bumpass Cove
  - Embreeville
- East Tennessee Chair
  - Elizabethton
- C&C Millwrights
  - Greeneville

L U S T—East Tennessee Style

- LUST—Leaking Underground Storage Tanks
- Region: approx. 4000 sites
  - 3 to 6 tanks per site
- Avg. cleanup cost: $125,000

Spaceship Earth. . .

it's all we have!