



ENERGY

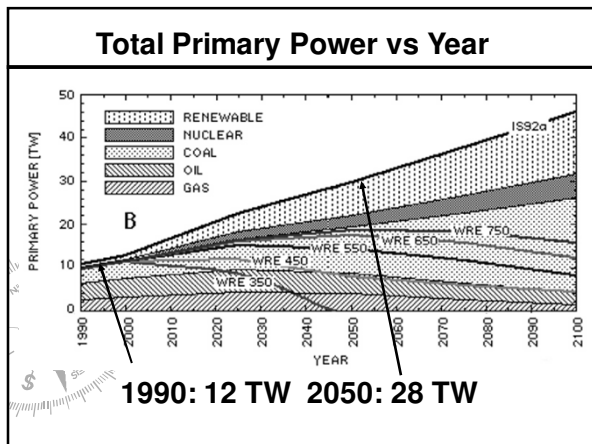
What are the facts?!

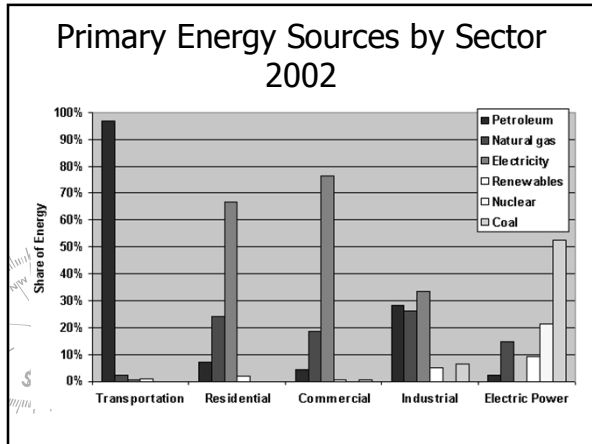


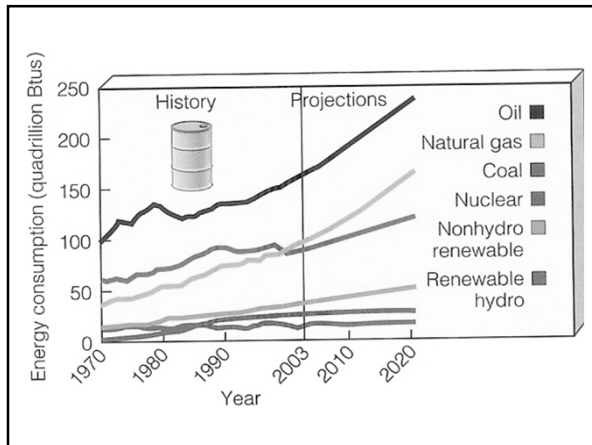
Some facts

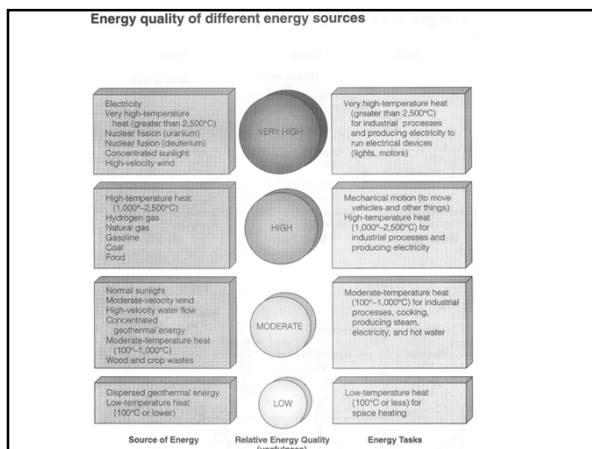
- ▶ Energy consumption has increased dramatically except for a brief dip in the 1980's





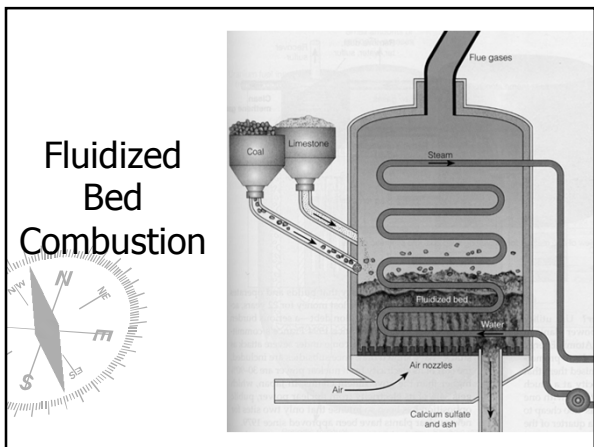


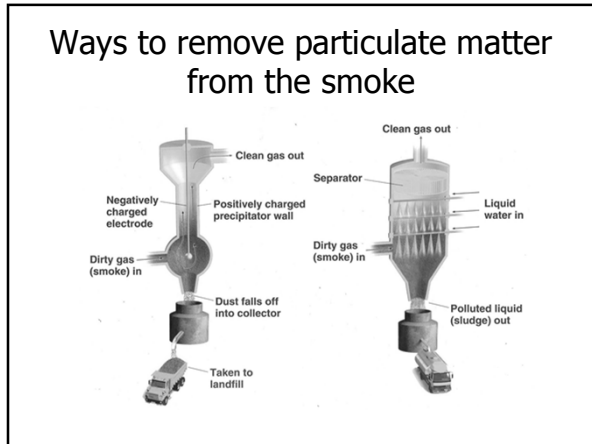


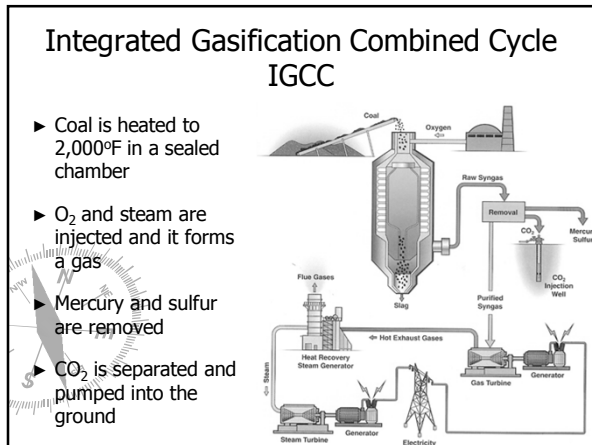


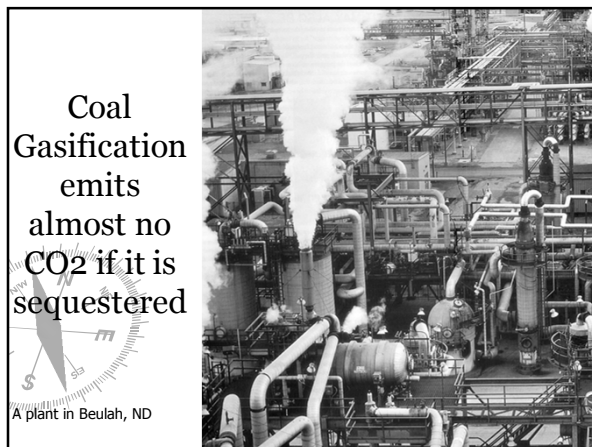
Coal

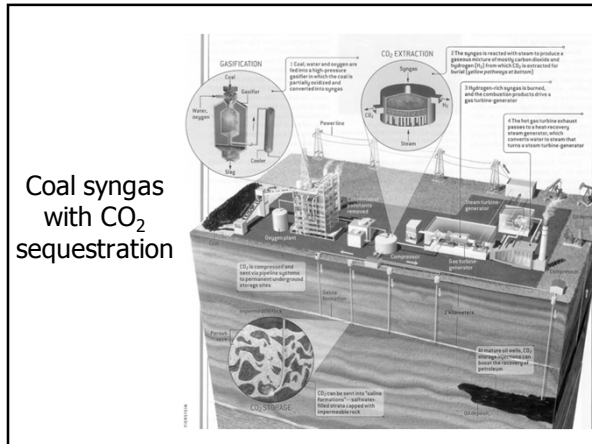
THE PROBLEM WITH COAL





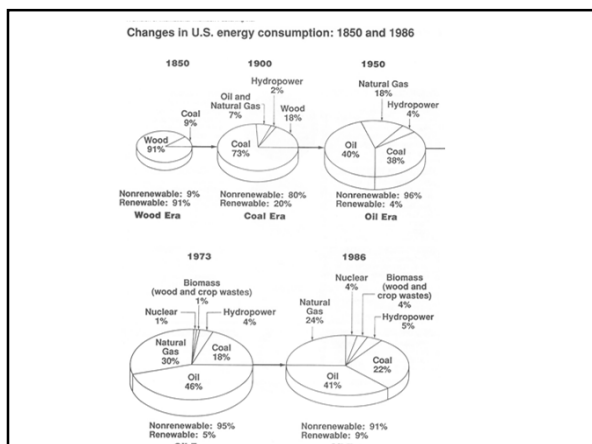


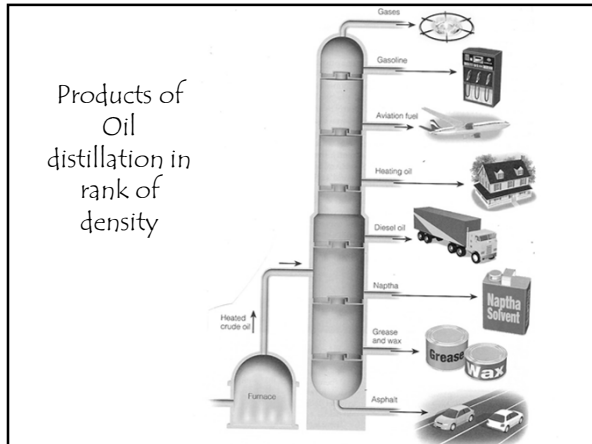


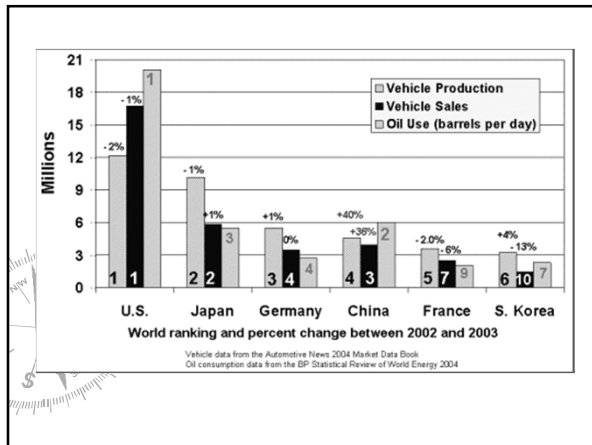


The Future of Coal

- U.S. expects to build 280 500 MW coal fired electricity plants between 2003 and 2030
- China is building the equivalent of one large coal-fired power station a week
- Over their 60 year life span the new plants constructed by 2030 could introduce as much CO₂ into the atmosphere as released since the dawn of the industrial revolution








Predicted oil reserves are expected to be

Arctic National Wildlife Refuge
ANWR

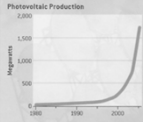
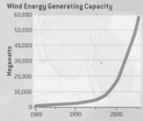
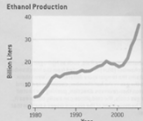
The Solution?
Corn based Ethanol




- ◎ \$1.4 billion annual subsidy to growers
- ◎ 1 gallon of corn based ethanol takes 131,000 BTU's to produce with an energy value of 77,000 BTU's
David Pimentel Cornell Professor
- ◎ It costs \$1.74 a gallon compared to \$.95 for gas
- ◎ 1 acre corn yields 328 gallons of ethanol, requires 140 gallons of fossil fuels, erodes soil 12x faster, and drains already depleted aquifers (Ogallala)

The production of corn based ethanol has a very low net energy efficiency so why are we pushing it?


THE RENEWABLE BOOM
Since 2000 the commercialization of renewable energy sources has accelerated dramatically. The annual global production of solar cells, also known as photovoltaics, jumped 45 percent in 2010. The construction of new wind farms, particularly in Europe, has boosted the worldwide generating capacity of wind power 10-fold over the past decade, and the production of ethanol, the most common biofuel, soared to 36.5 billion liters last year, with the lion's share distilled from American grown corn.

COMPETING ENERGY SOURCES
Fraction of global electricity generation



Breakdown of nonhydrogen renewables



THE CHALLENGE AHEAD
Suppliers of renewable energy must overcome several technological, economic, and political hurdles to rival the market share of the fossil-fuel providers. To compete with coal-fired power plants, for example, the price of solar cells must continue to fall. The developers of wind farms must tackle environmental concerns and local opposition. Other promising renewable sources include generators driven by streams from geothermal vents and biomass power plants fueled by wood and agricultural wastes.

Oil Sand- the new source!

Radiation

- ▶ **Electromagnetic radiation**- TV, radio, microwave
- ▶ **Ionizing radiation**- consists of three particles



Radioactive Decay- the release of energy from an unstable "radioactive" isotope until it reaches a stable form, expressed in terms of a half-life.

Table 3-1 Half-Lives of Selected Radioisotopes

Isotope	Radiation Half-Life	Emitted
Potassium-42	12.4 hours	Alpha, beta
Iodine-131	8 days	Beta, gamma
Cobalt-60	5.27 years	Beta, gamma
Hydrogen-3 (tritium)	12.5 years	Beta
Strontium-90	28 years	Beta
Carbon-14	5,370 years	Beta
Plutonium-239	24,000 years	Alpha, gamma
Uranium-235	710 million years	Alpha, gamma
Uranium-238	4.5 billion years	Alpha, gamma

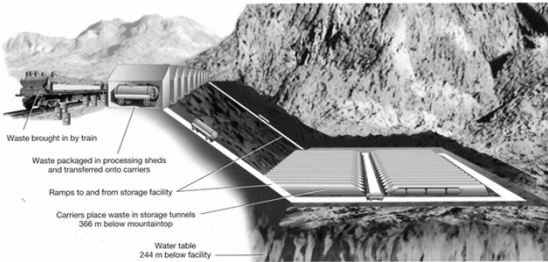
Chernobyl Meltdown

April 26, 1986 1:23 am



- ▶ Accident was not reported for 72 hours
- ▶ Amount of radiation released equal to 30-40 Hiroshima atomic bombs

Yucca Mountain



Waste brought in by train


Waste packaged in processing sheds and transferred onto carriers

Ramps to and from storage facility

Carriers place waste in storage tunnels 366 m below mountaintop

Water table 244 m below facility

Methane Hydrates



- Known deposits
- Suspected deposits

Even the cleanest fossil fuel releases CO₂, what about renewable energy?

► Why does the federal government spend so much on Nuclear and so little on renewable energy and efficiency?

THE FEDS' FAVORITE ENERGY SOURCE

\$47.9 billion	Nuclear fission and fusion
\$20 billion	Fossil fuels
\$12.4 billion	Renewable energy
\$11.7 billion	Efficiency

FEDERAL FUNDING FOR ENERGY RESEARCH AND DEVELOPMENT 1974-2005 (\$2005 dollars)

Type of Renewable energy Used

Total = 7.37 quadrillion btu units (= 7.6% of U.S. energy use) 1999

Is there a relationship between federal funding and the cost of the electricity source?

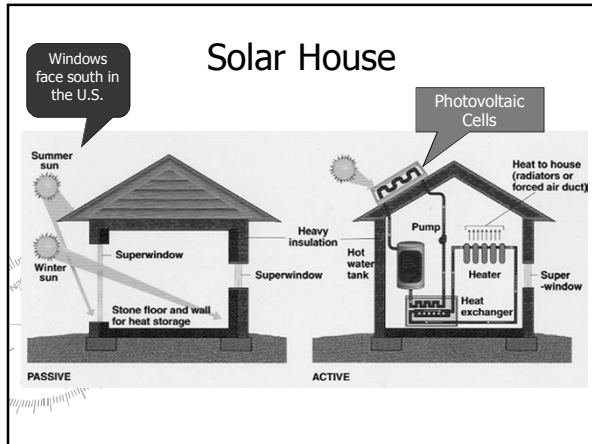
BANK ON IT

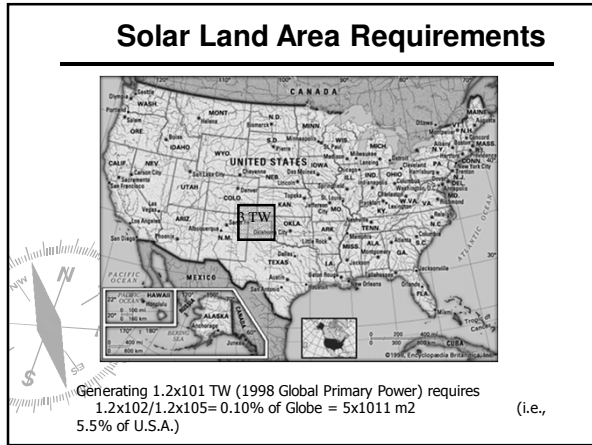
ELECTRICITY COST per kilowatt-hour, in cents (2004)

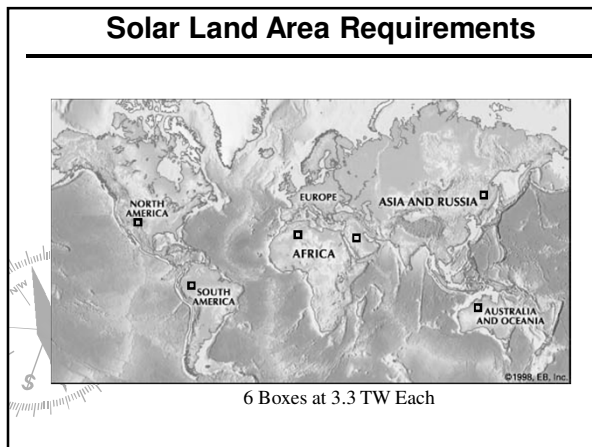
3.13
ENERGY EFFICIENCY

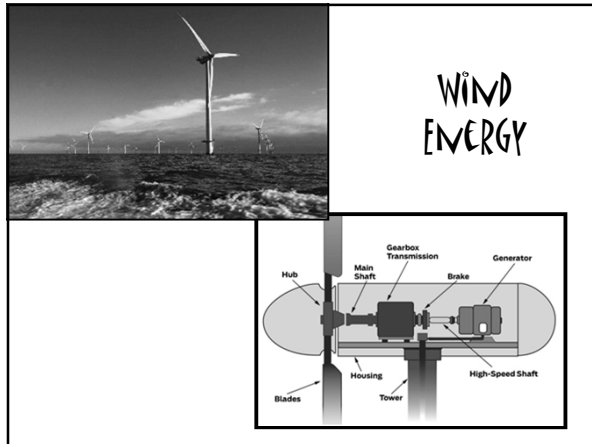
◀ A kilowatt-hour saved is far better than a kilowatt-hour burned. Whether you're a homeowner interested in lowering monthly bills or a utility looking to avoid the cost of generating new energy, investments in energy efficiency measures are winners, economically and environmentally.

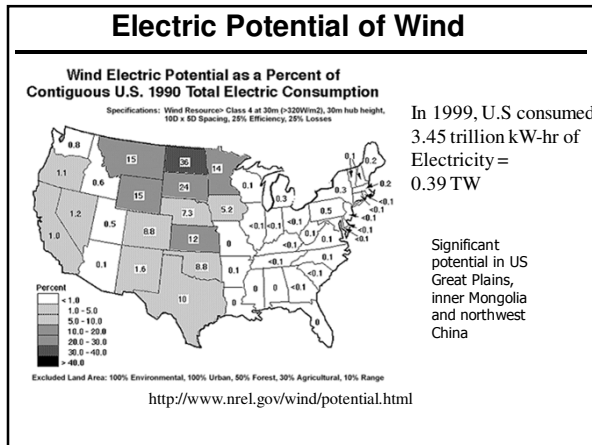
4.5-5.4c	4.7-6.3c	4.8c	4.9-8.5c	5.2-6.5c	5.5-6.4c	12.4-26c
Coal	Wind	Geothermal	Hydroelectric	Natural gas	Biomass	Solar

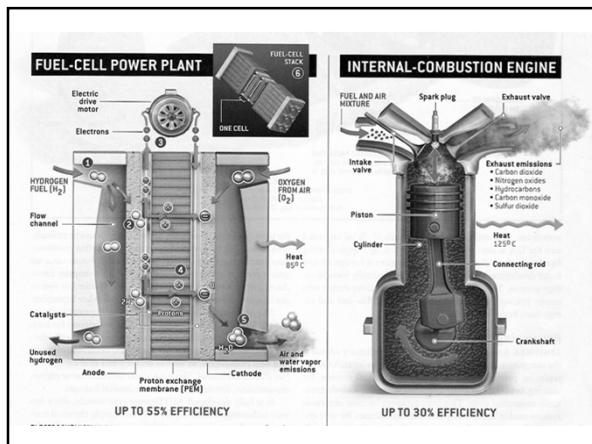












BANK ON IT

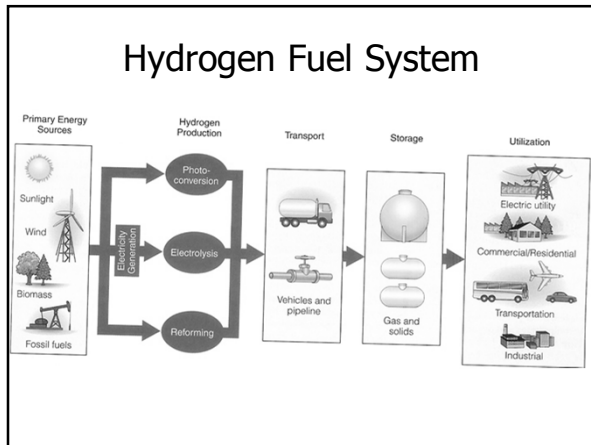
ELECTRICITY COST
per kilowatt-hour, in cents (2004)

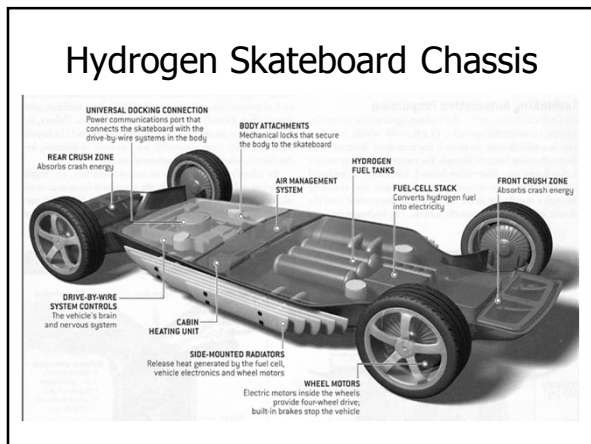
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4.5-5.4¢ Coal	4.7-6.3¢ Wind	4.8¢ Geothermal	4.9-8.5¢ Hydroelectric	5.2-6.5¢ Natural gas	5.5-6.4¢ Biomass	12.4-26¢ Solar
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Which power source is subsidized by the government?
Does that affect the overall cost to the consumer?



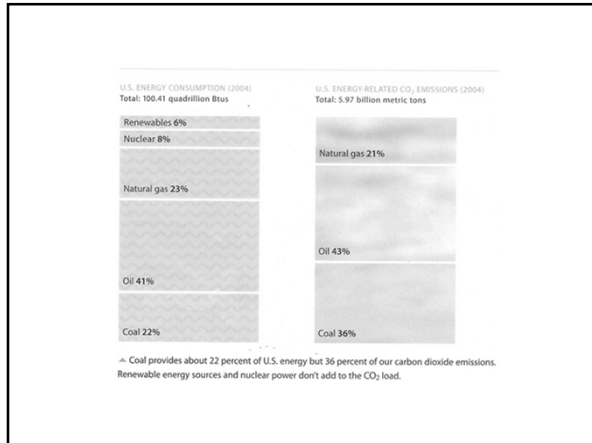


Observations of Climate Change

Evaporation & rainfall are increasing;

- ▶ More of the rainfall is occurring in downpours
- ▶ Corals are bleaching
- ▶ Glaciers are retreating
- ▶ Sea ice is shrinking
- ▶ Sea level is rising
- ▶ Wildfires are increasing
- ▶ Storm & flood damages are much larger
- ▶ Incidence of disease vectors are shifting global positions





An Efficient Solution

- ▶ Wasting less energy is the quickest least expensive way to cut carbon emissions
- ▶ 65% of the primary energy is lost during conversion to useful energy
- ▶ Almost 35% of greenhouse gas emissions come from building
- ▶ How to make a building more efficient
