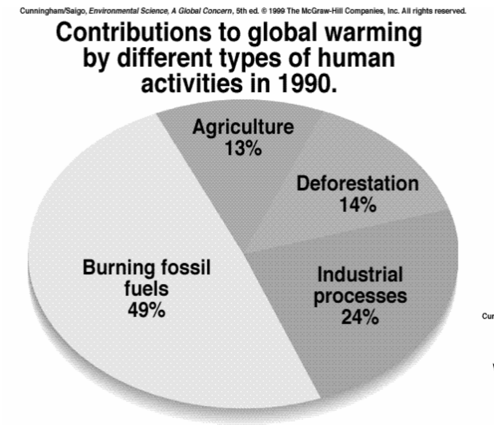
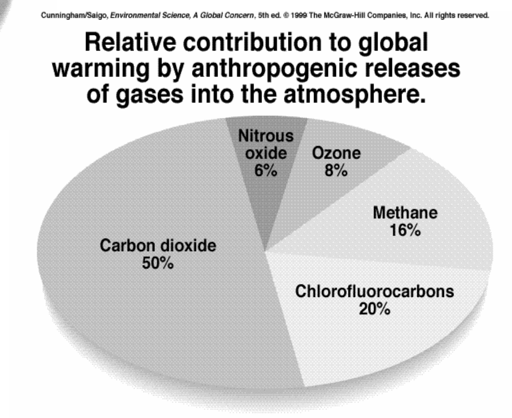

Cunningham/Saigo, Environmental Science, A Global Concern, 5th ed. © 1999 The McGraw-Hill Companies, Inc. All rights reserved.
Contributions to global warming by different types of human activities in 1990.
Agriculture 13%
Deforestation 14%
Burning fossil fuels 49%
Industrial processes 24%


Cunningham/Saigo, Environmental Science, A Global Concern, 5th ed. © 1999 The McGraw-Hill Companies, Inc. All rights reserved.
Relative contribution to global warming by anthropogenic releases of gases into the atmosphere.
Nitrous oxide 6%
Ozone 8%
Methane 16%
Carbon dioxide 50%
Chlorofluorocarbons 20%


1950
Belize
Honduras
Nicaragua
Guatemala
El Salvador
Costa Rica
Panama
1970
1985
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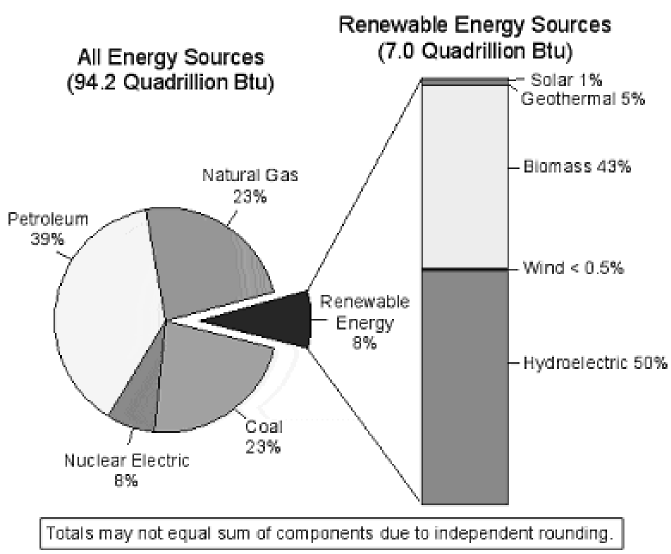
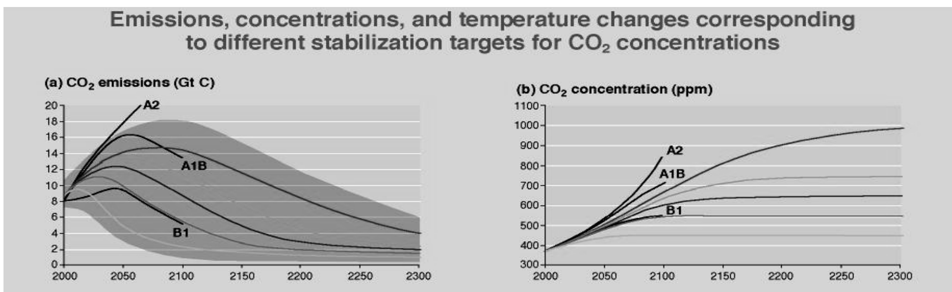
Renewable non-GG NRG sources

- solar, wind, hydro, nuclear, etc.

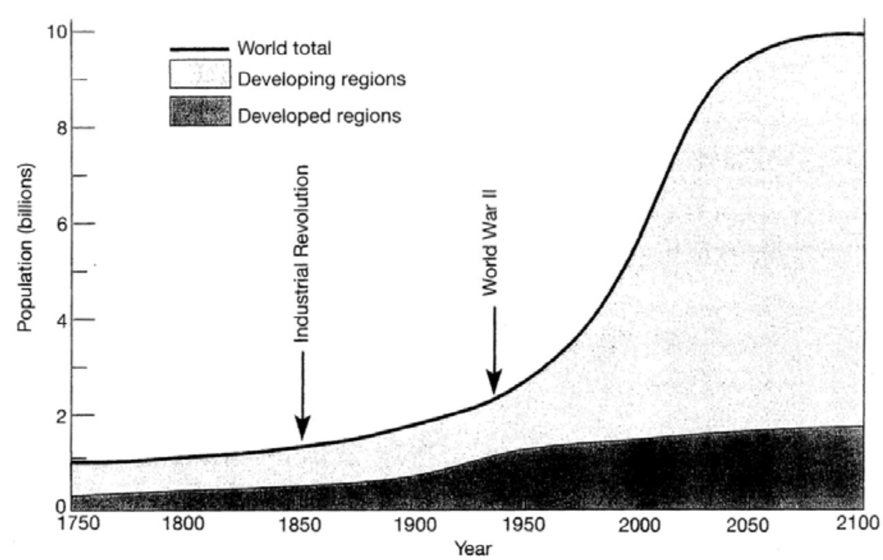
Global Energy Usage



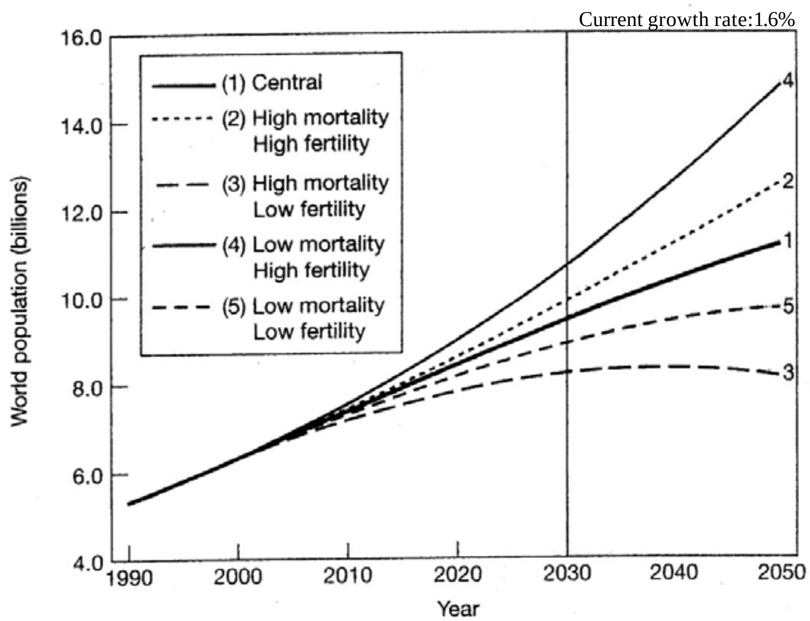
Stabilizing, Reducing CO_2 emissions



World Population

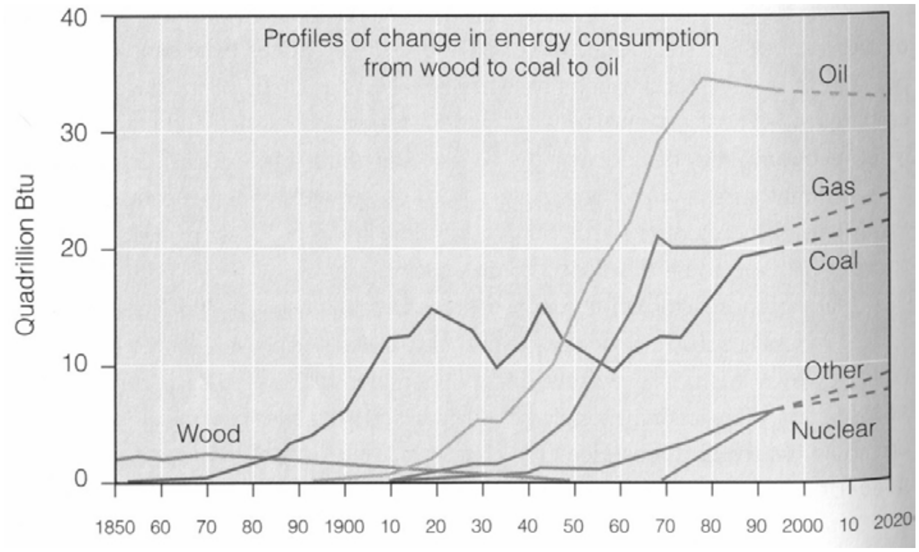


World Population: Projections



What can *you* do to slow/stabilize climate change?

Energy Consumption Through Time

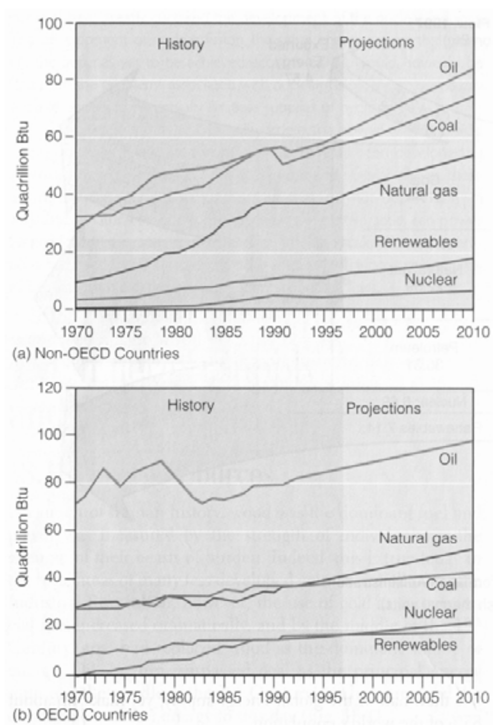


Energy: Future Use

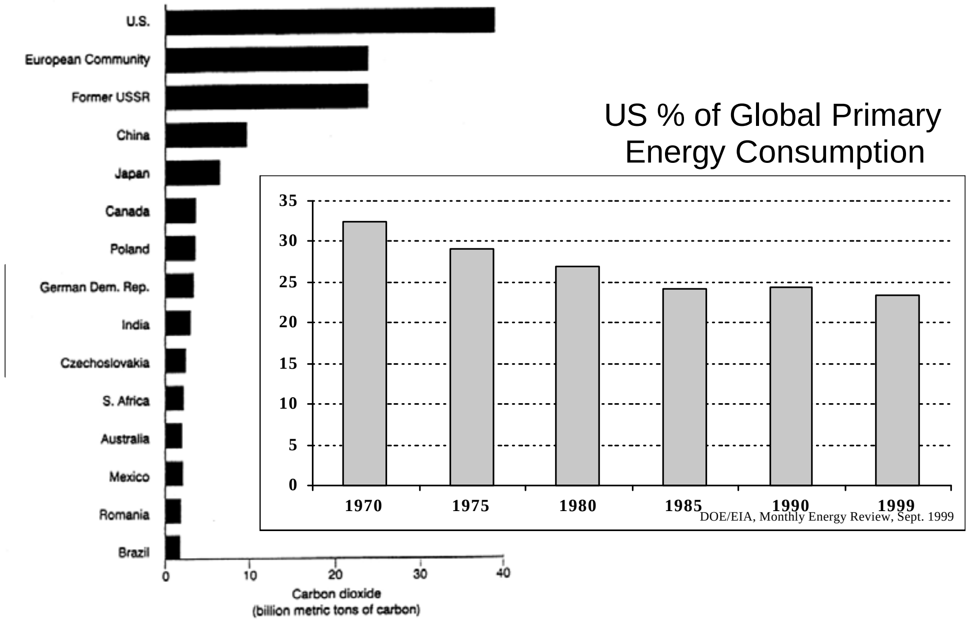
- nonrenewable
- reserves vs. resources

Geopolitics

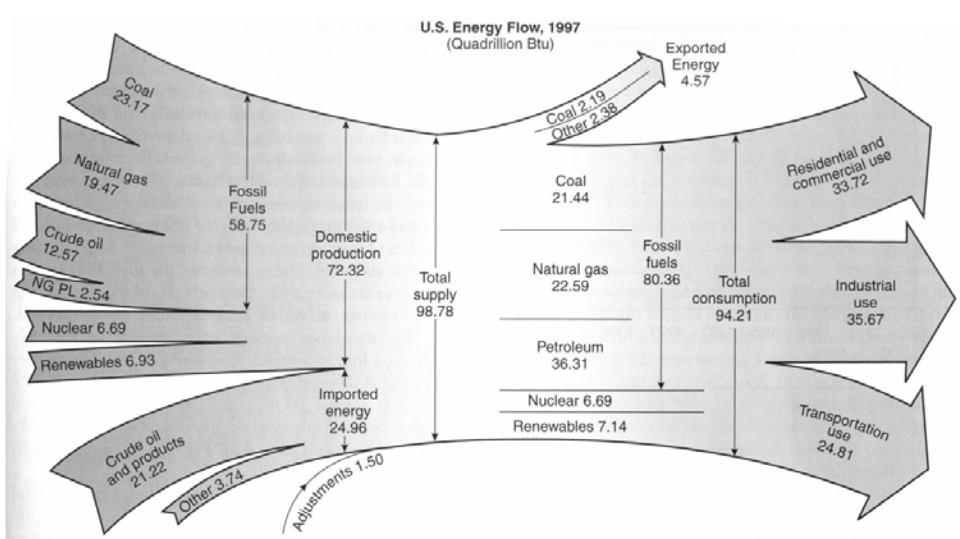
- geol setting
- 70% nat gas in ME, Sov. rep
- 60% oil near PG
- most tar sands in CAN



Organization for Economic Cooperation & Development



What is this energy used for?



The Grid: Transmission, Storage, Merit Order

http://www.osha.gov/

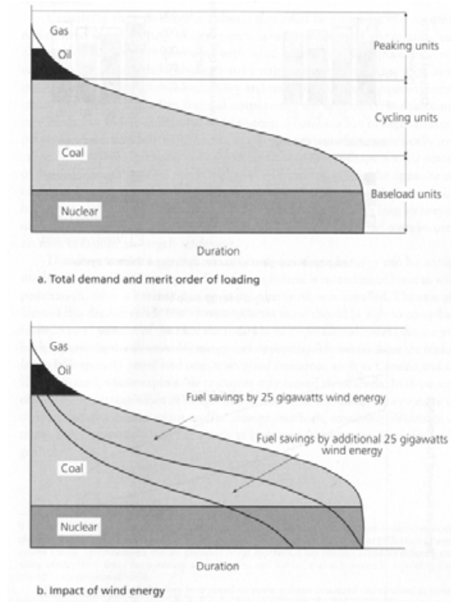
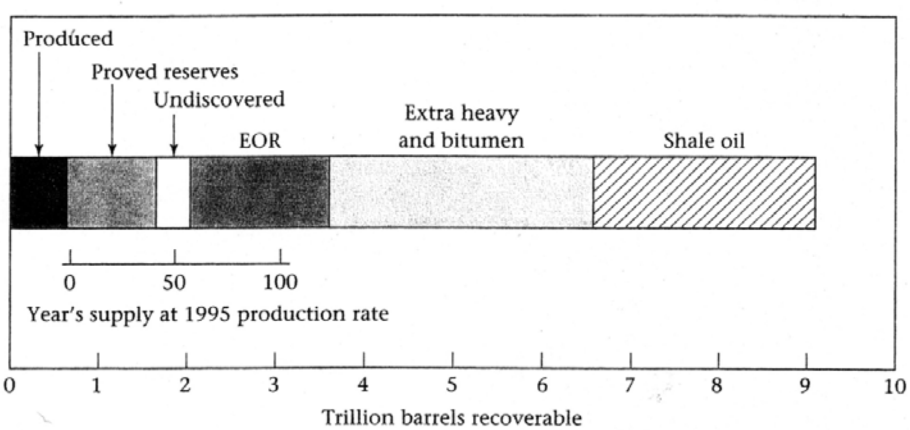


FIGURE 12: Load duration and fuel-saving impacts of wind energy at increasing penetrations are presented in the form of a so-called "load duration curve." The curve shows the duration for which load exceeds a given power level. Conventional plants are loaded under the curve in their "merit order" of operation, and the shaded areas represent energy supplied by each thermal plant type. By subtracting wind energy from the demand, and looking at the residual distribution (the "net load duration curve") it is easy to see the potential fuel savings from the wind energy, and the way in which it reduces the operating time of a thermal plant on the system.

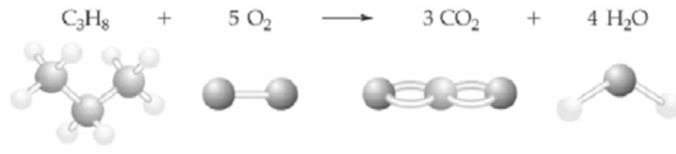
(Grubb & Meyer, 1993)

Years of supply at 1995 production rate

Oil Reserves



Burning 1 Mole Propane



8 C-H, 2 C-C, 5 O-O bonds broken

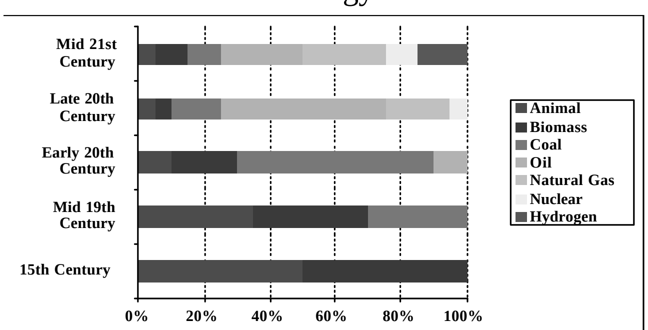
Bond	Bond energy (kcal)	Number of bonds broken	Bond energy/ mole (kcal)
C—H	99	8	8 × 99 = 792
C—C	83	2	2 × 83 = 166
O—O	118	5	5 × 118 = 590
			Energy required to break bonds = 1548

Bond	Bond energy (kcal)	Number of bonds formed	Bond energy/ mole (kcal)
C=O	192	6	6 × 192 = 1152
O—H	111	8	8 × 111 = 888
			Energy released in forming bonds = 2040

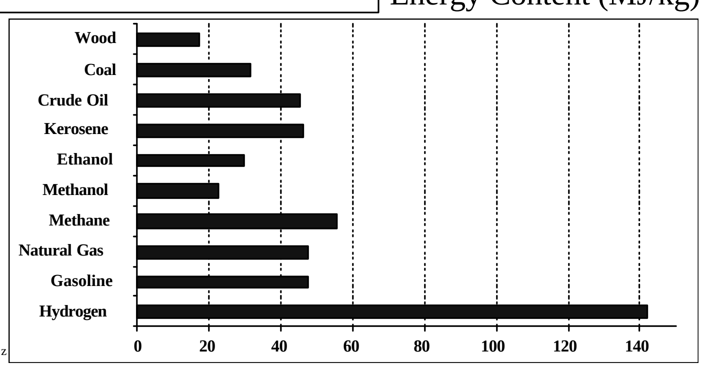
mole = 6.022 x 10^{23} atoms

2040 – 1548 = 492 kcal/mole

Evolution of Energy Sources

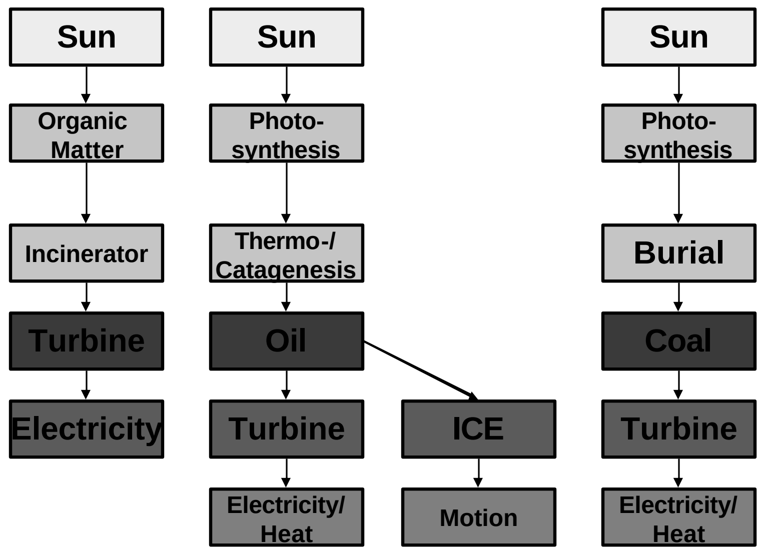


Fuel Chemical Energy Content (MJ/kg)



people.hofstra.edu/faculty/Jean-paul_Rodriguez

Fossil Fuel Energy Paths



Non-FF Energy Paths