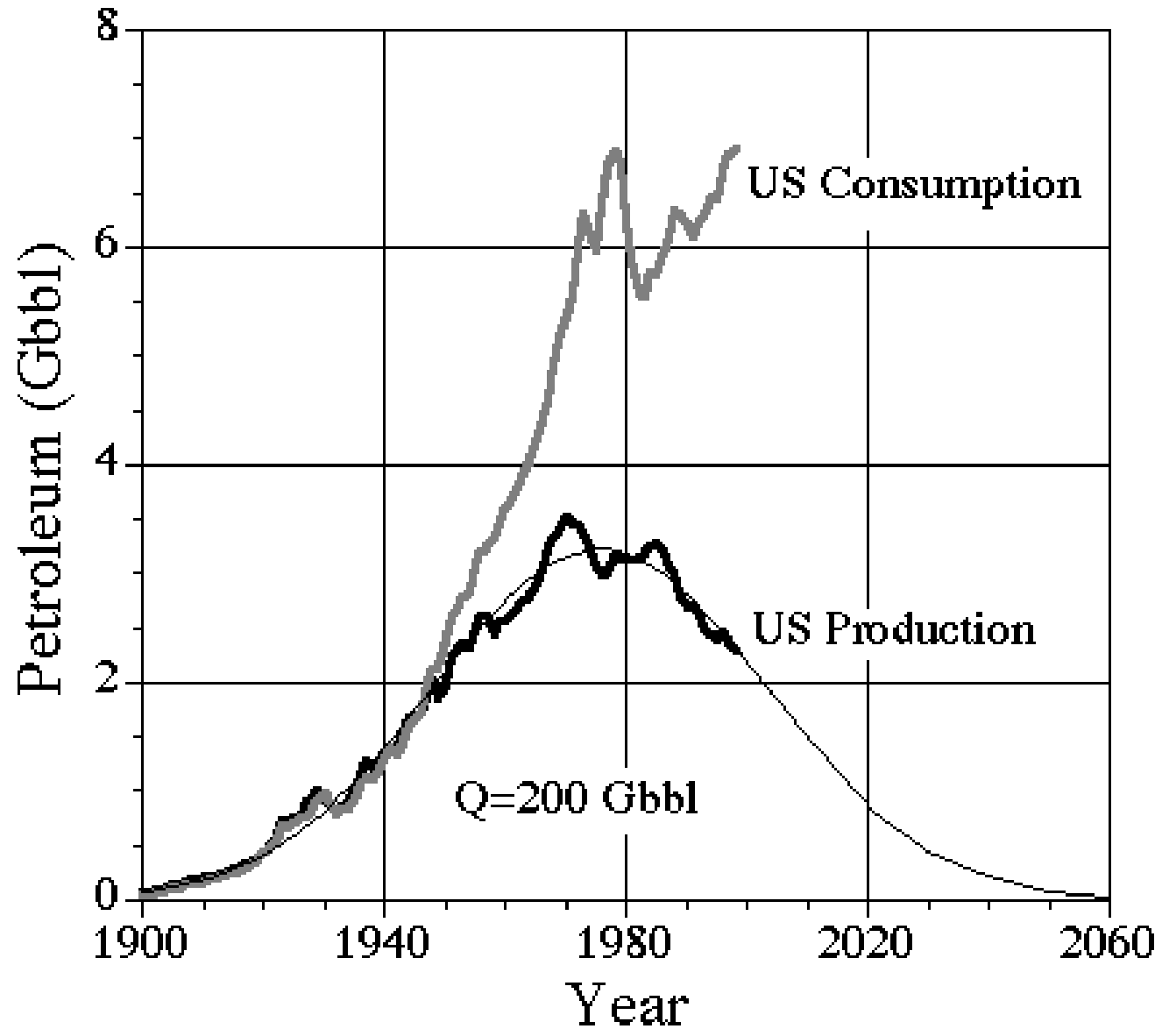


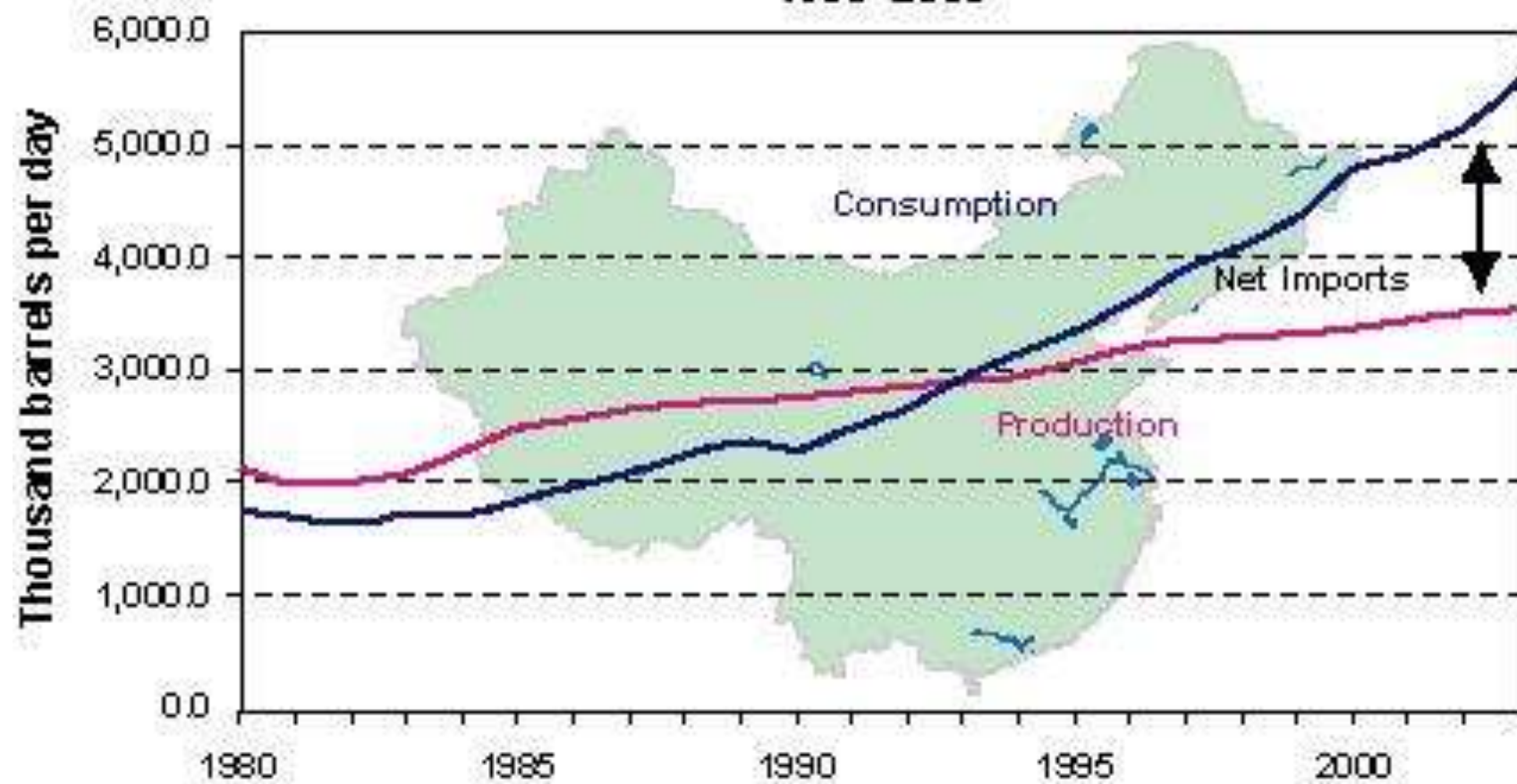
Alternative Energy



US Petroleum

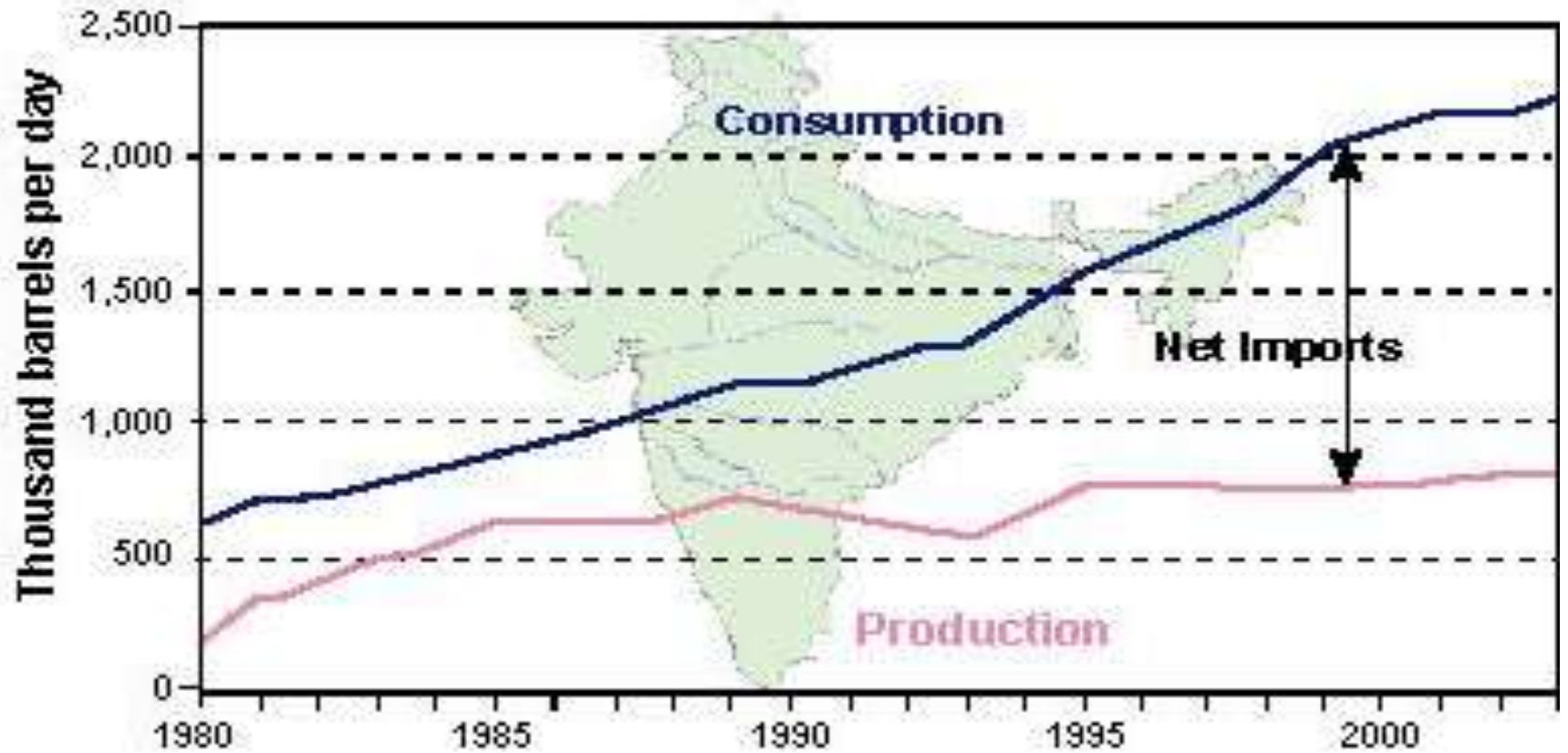


China's Oil Production and Consumption, 1980-2003

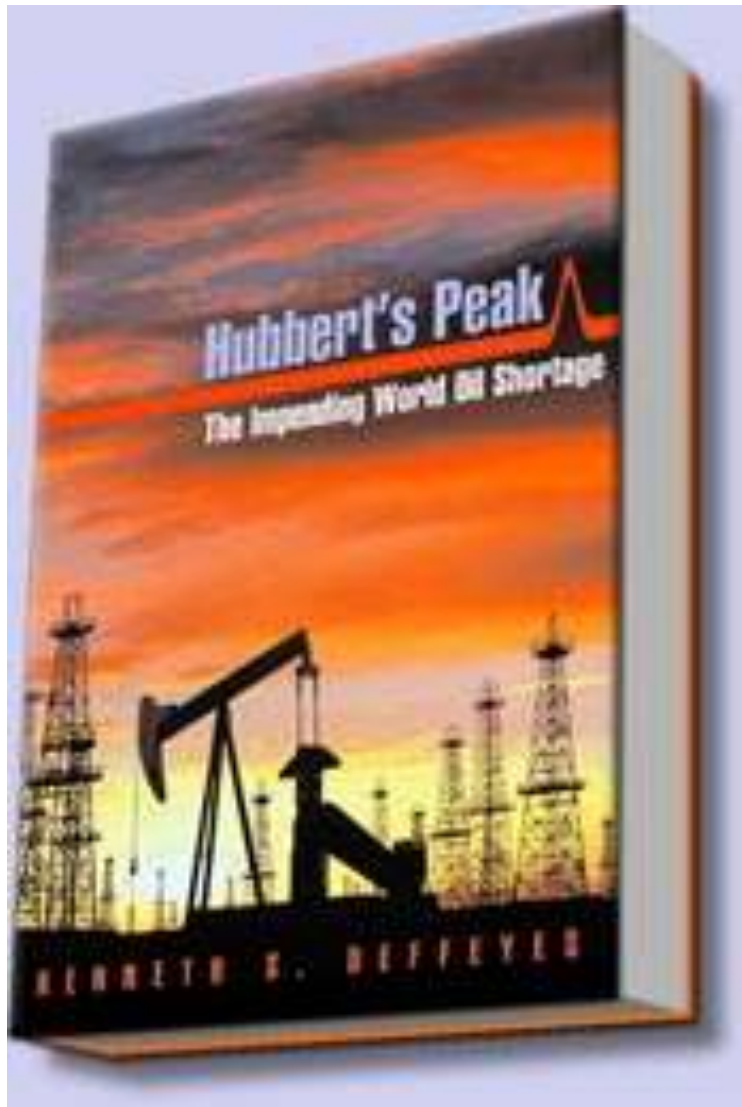


Source: EIA

Indian Oil Production and Consumption, 1980-2003



Source: EIA



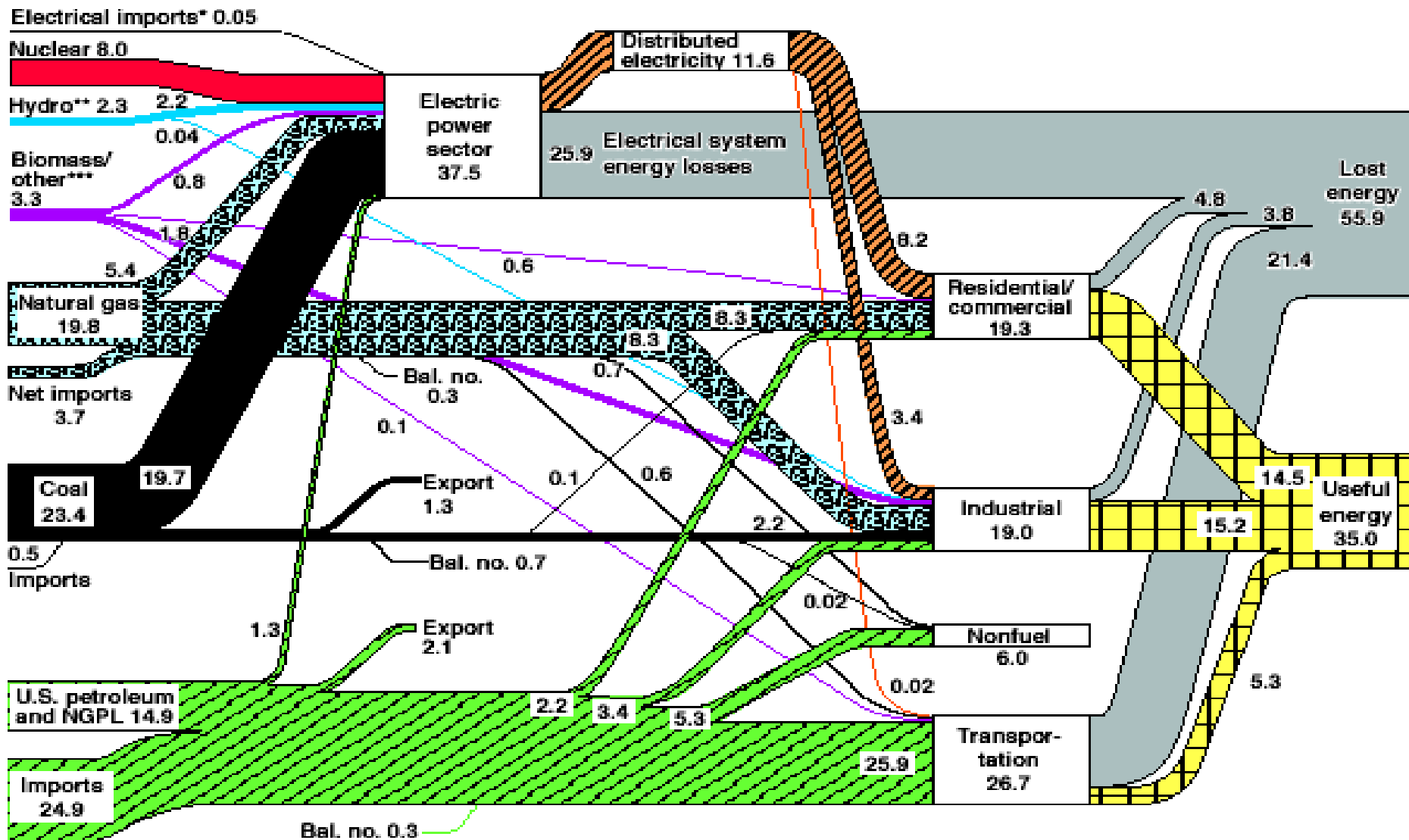
THE OIL AGE IS OVER



WHAT TO EXPECT AS THE WORLD
RUNS OUT OF CHEAP OIL, 2005-2050

BY MATTHEW DAVID SAVINAR, ESQ.

The U.S. Energy Situation



Source: Production and end-use data from Energy Information Administration, *Annual Energy Review 2001*

*Net fossil-fuel electrical imports

**Includes 0.2 quads of imported hydro

***Biomass/other includes wood, waste, alcohol, geothermal, solar, and wind.

August 2003
Lawrence Livermore
National Laboratory
<http://eed.llnl.gov/flow>

Other Ways to View This Data

The U.S. Consumed ~97 Quads of Energy in 2002

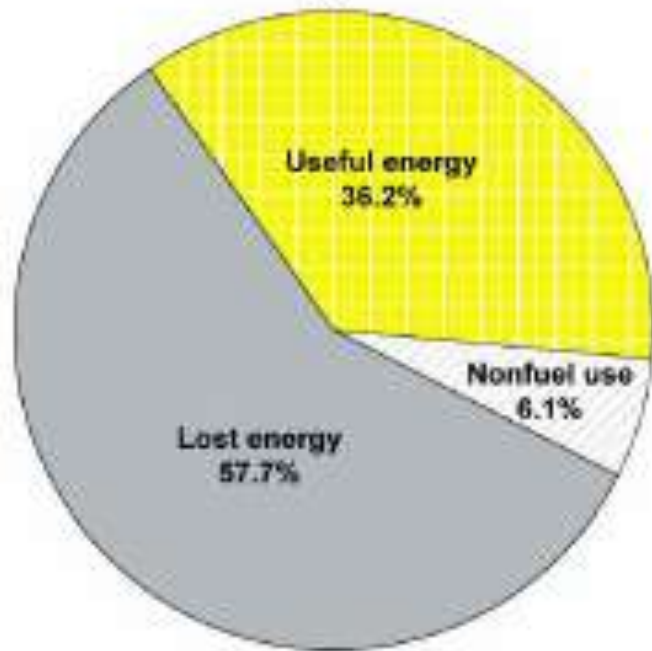
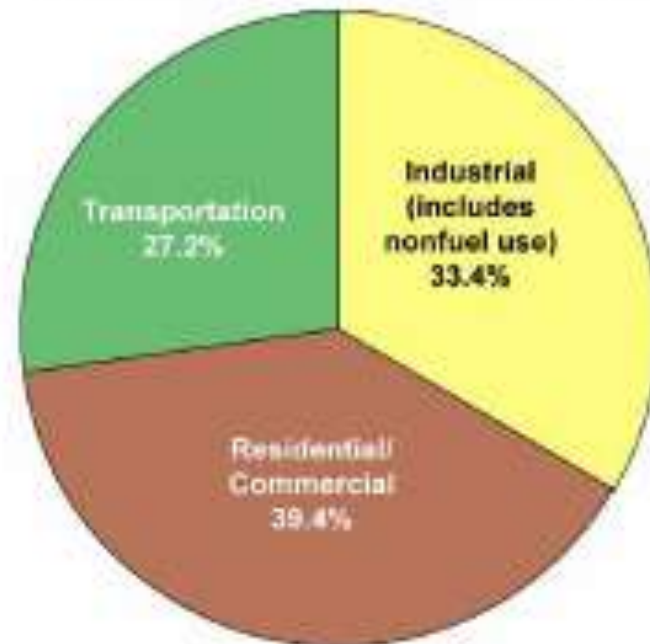


Figure 3. In 2002 the United States consumed about 97 quads of energy. As shown in the U.S. energy flow chart (Figure 1), 36.2% of that energy total was "useful," while 57.7% of energy content was lost in the conversion process.

2002 Energy Consumption by End-Use Sector (Includes electrical system energy losses)



Source: AEP/2002

Figure 4. U.S. energy consumption by end-use sector. Distributed electricity and related electrical system energy losses are included in each sector.

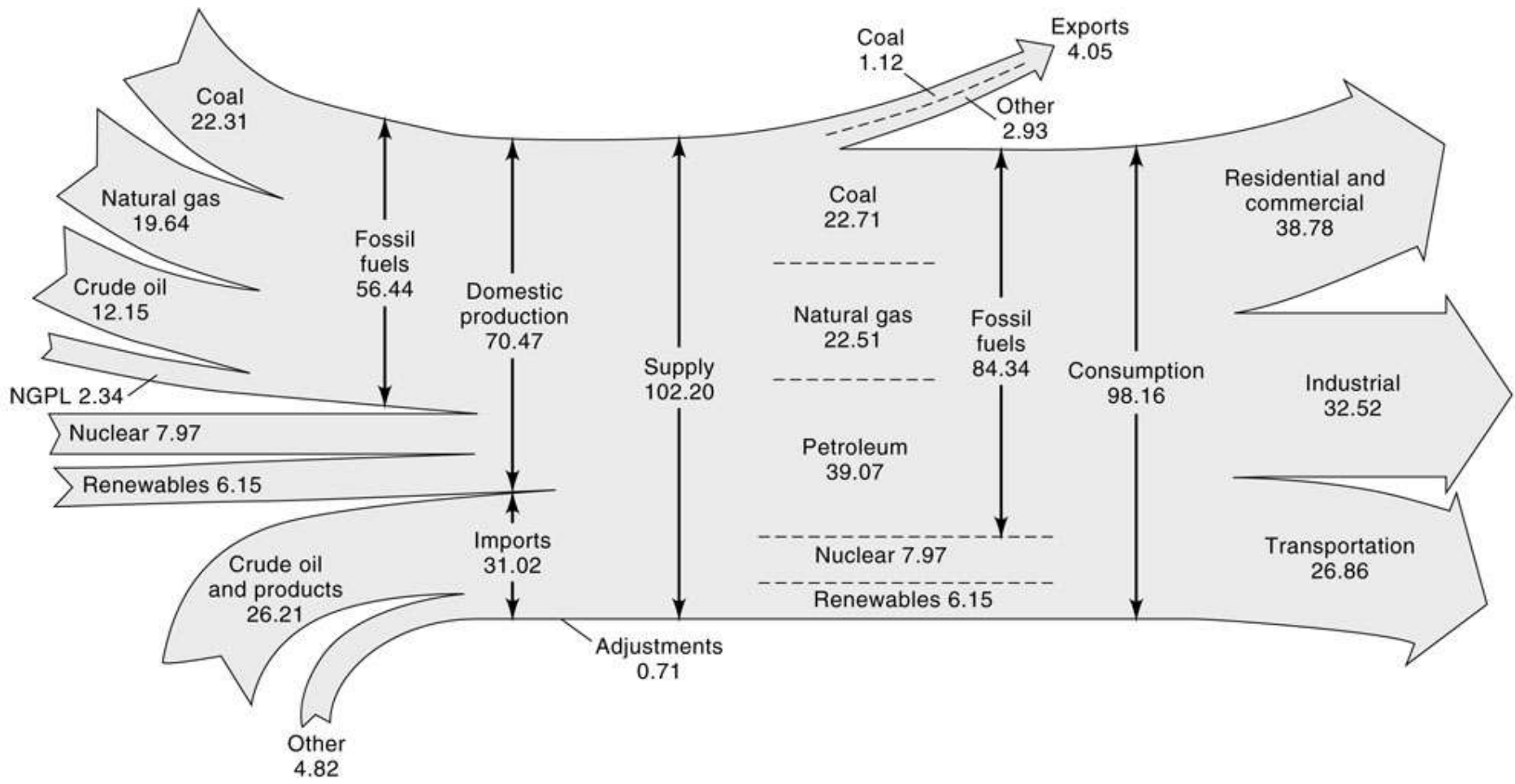


Fig. 1-9, p. 13

Job possibilities

- Building Retrofitting
- Mass Transit/Freight Rail
- Smart Grid
- Wind Power
- Solar Power
- Biofuels

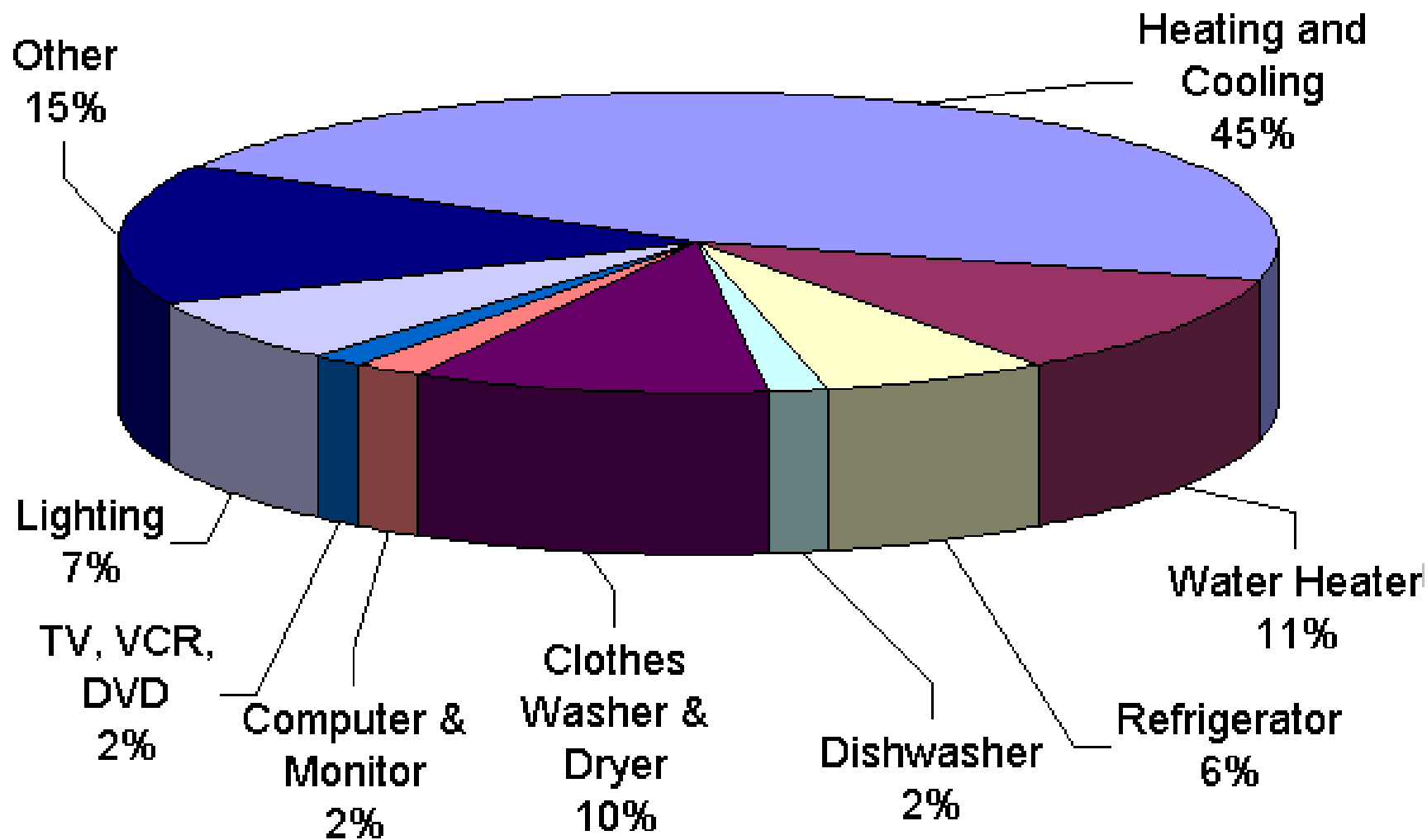
Efficiency Opportunities

- Residential
- Transportation
- Commercial/Institutional

Table 3.1 EFFICIENCIES OF SOME ENERGY CONVERSION DEVICES AND SYSTEMS

Device	Efficiency
Electric generators (mechanical → electrical)	70–99%
Electric motor (electrical → mechanical)	50–90%
Gas furnace (chemical → thermal)	70–95%
Wind turbine (mechanical → electrical)	35–50%
Fossil fuel power plant (chemical → thermal → mechanical → electrical)	30–40%
Nuclear power plant (nuclear → thermal → mechanical → electrical)	30–35%
Automobile engine (chemical → thermal → mechanical)	20–30%
Fluorescent lamp (electrical → light)	20%
Incandescent lamp (electrical → light)	5%
Solar cell (light → electrical)	5–28%
Fuel cell (chemical → electrical)	40–60%

Residential





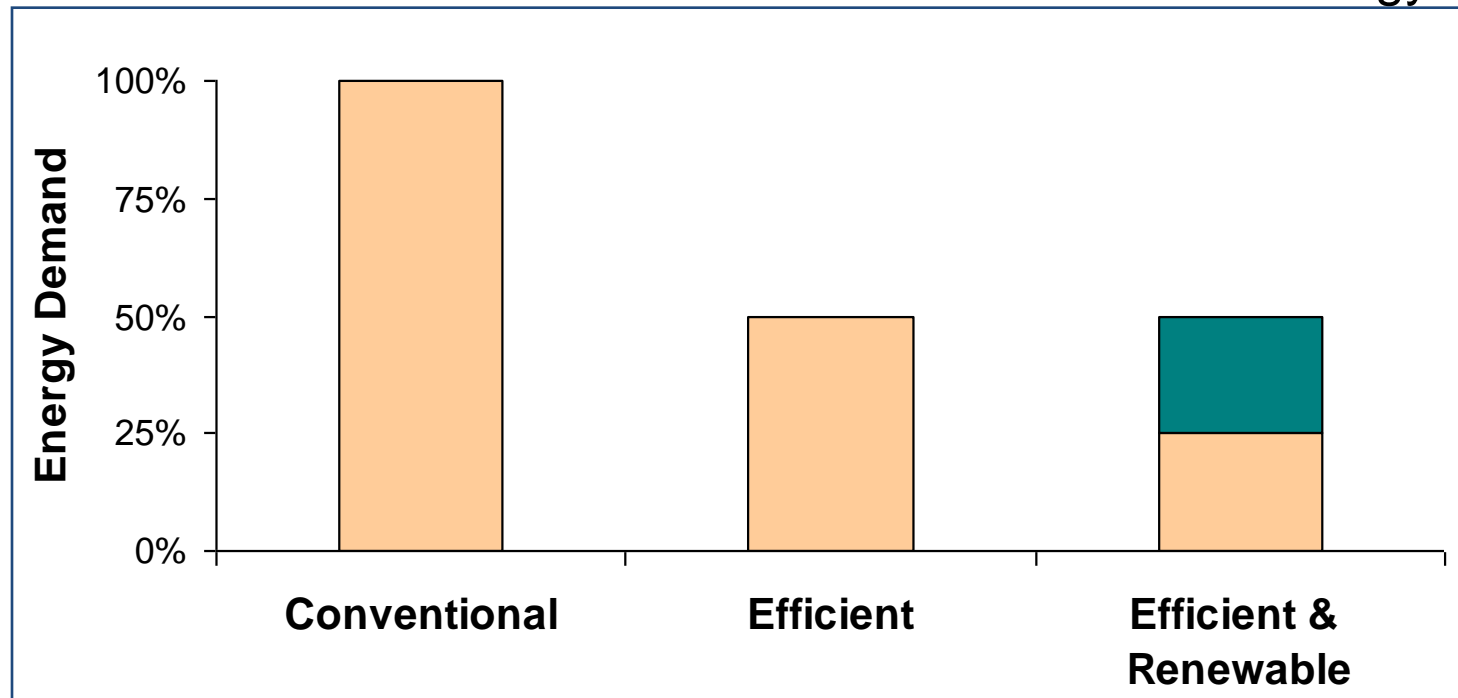
Clean Energy Technologies

Energy Efficiency

- Using less energy resources to meet the same energy needs

Renewable Energy

- Using non-depleting natural resources to meet energy needs



Building Retrofitting

- Electricians
- Heating, ventilation, and air conditioning
- Carpenters and carpenters' helpers
- Construction equipment operators
- Roofers
- Insulators and weatherization specialists
- Construction managers
- Building inspectors

Wind



Wind Power

Environmental engineers

Iron and steel workers

Millwrights

Heat metal workers

Machinists

Electrical equipment assemblers

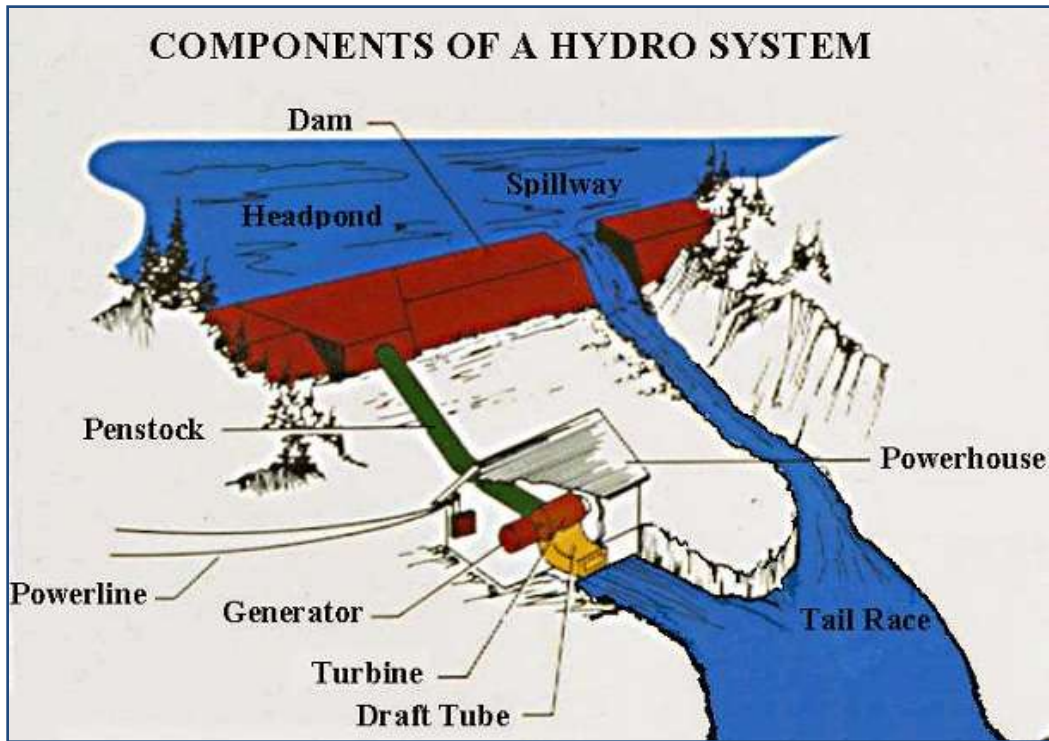
Construction equipment operators

Installation helpers

Laborers

Construction managers

Hydropower



Solar PV



- SOLAR – THERMAL



Solar Thermal



Solar Power

- Electrical engineers
- Electricians
- Industrial machinery mechanics
- Welders
- Metal fabricators
- Electrical equipment assemblers
- Construction equipment operators
- Installation helpers
- Laborers
- Construction managers
- Salespeople
- Architects
- Builders

Biomass/Biofuels



• BIOFUELS



Biofuels

- Chemical engineers
- Chemists
- Chemical equipment operators
- Chemical technicians
- Mixing and blending machine operators
- Agricultural workers
- Industrial truck drivers
- Farm product purchasers
- Agricultural and forestry supervisors
- Agricultural inspectors

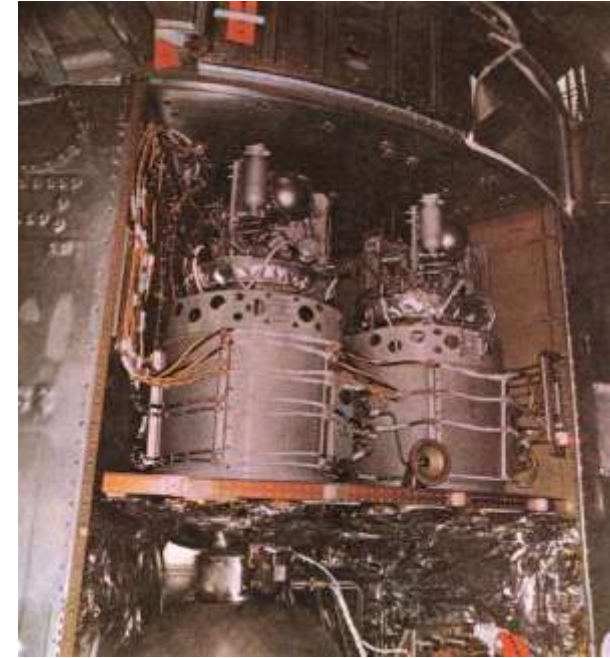
• HYBRID SYSTEMS



Mass Transit/Freight/Rail/ Alternative Transportation Options

- Civil engineers
- Engine assemblers
- Bus drivers
- Mechanics
- Dispatchers
- Locomotive engineers
- Railroad contractors
- Welders
- Metal fabricators
- Rail track layers
- Electricians

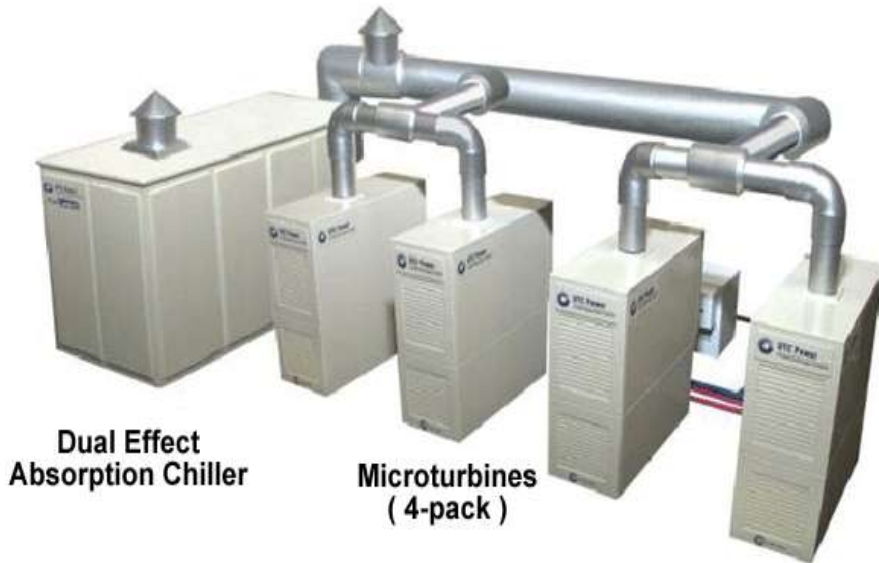
FUEL CELLS & HYDROGEN



Micro-turbines & Micro-CHP (Combined Heat & Power)



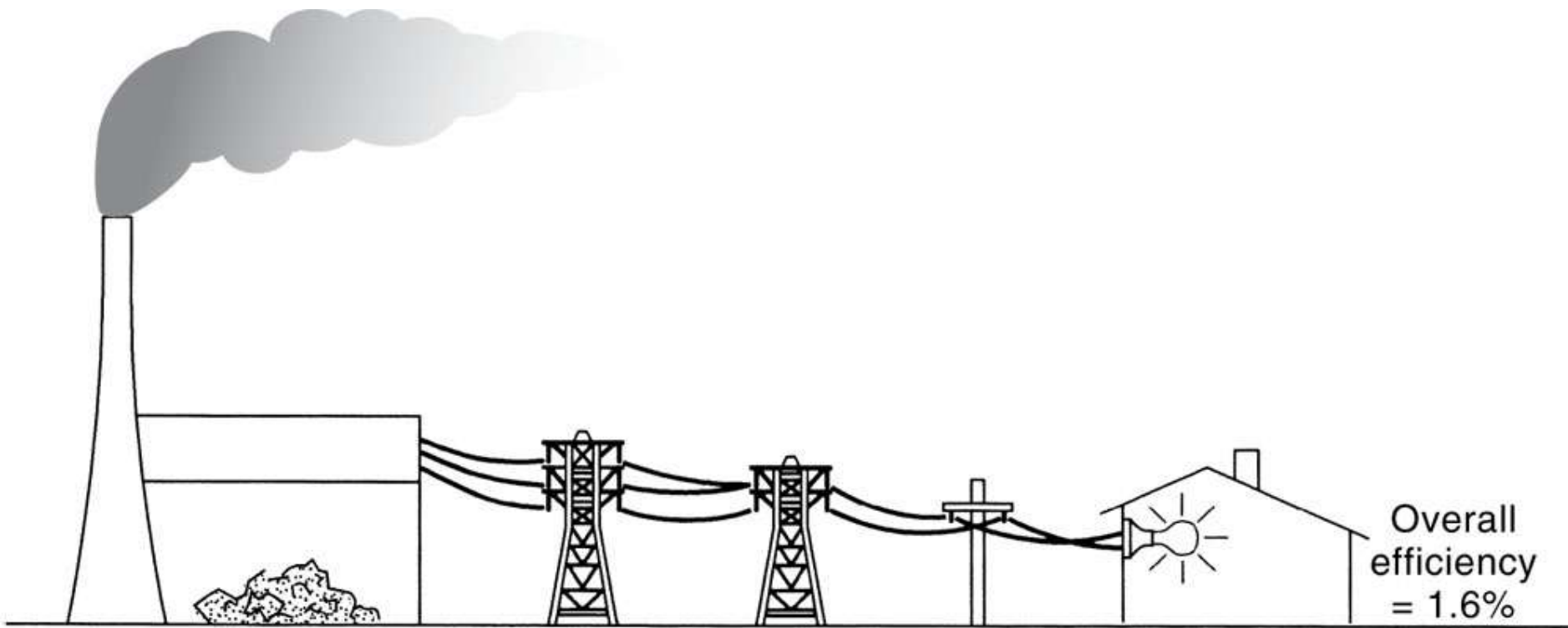
Capstone 28kW Microturbine



Dual Effect
Absorption Chiller

Microturbines
(4-pack)





Power plant
 $E_1 = 0.35$

Transmission lines
 $E_2 = 0.90$

Light
 $E_3 = 0.05$

Overall efficiency
 $= 1.6\%$

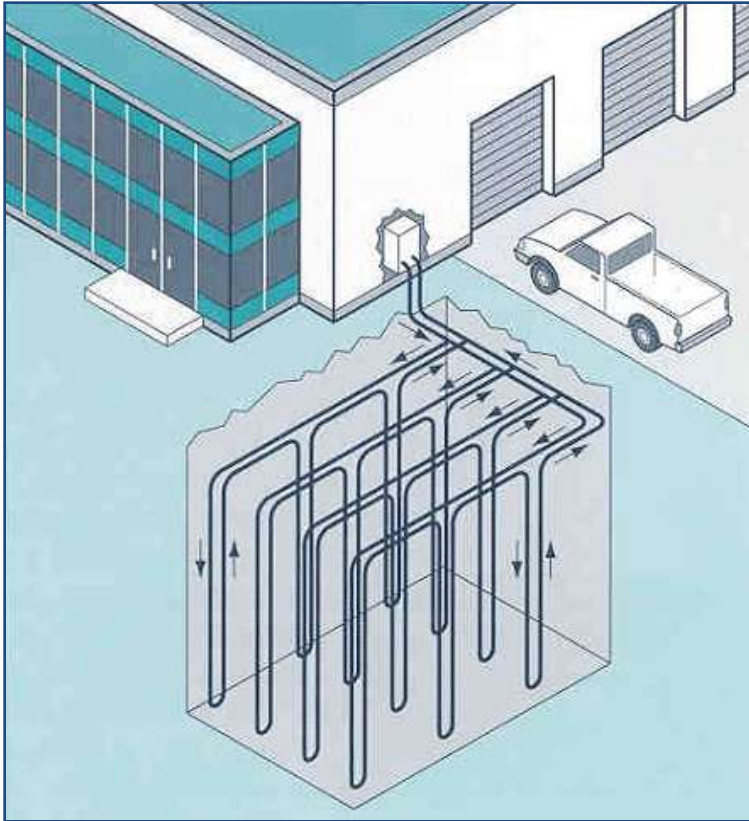
Overall efficiency
 for
 chemical energy
 to light energy conversion

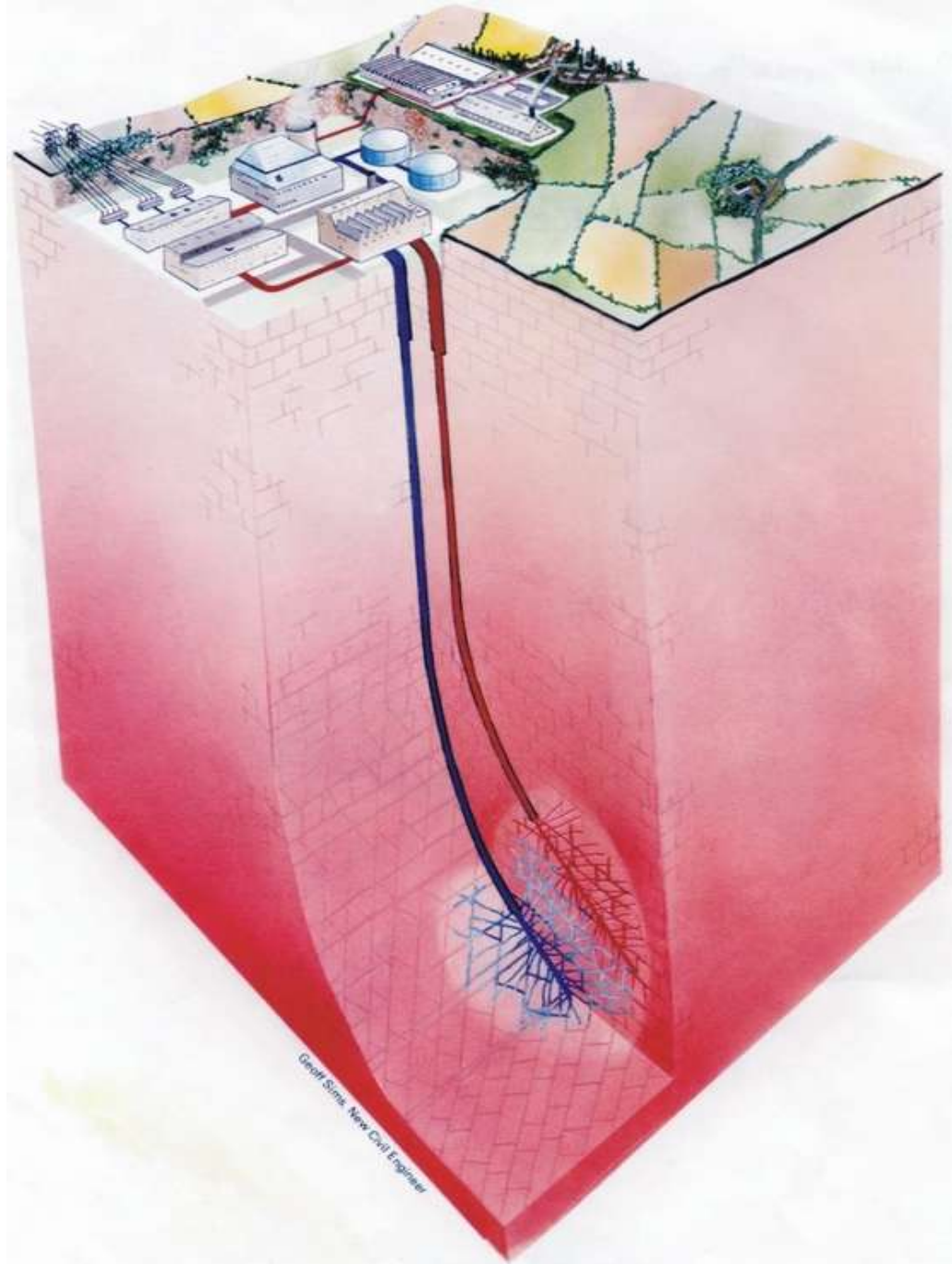
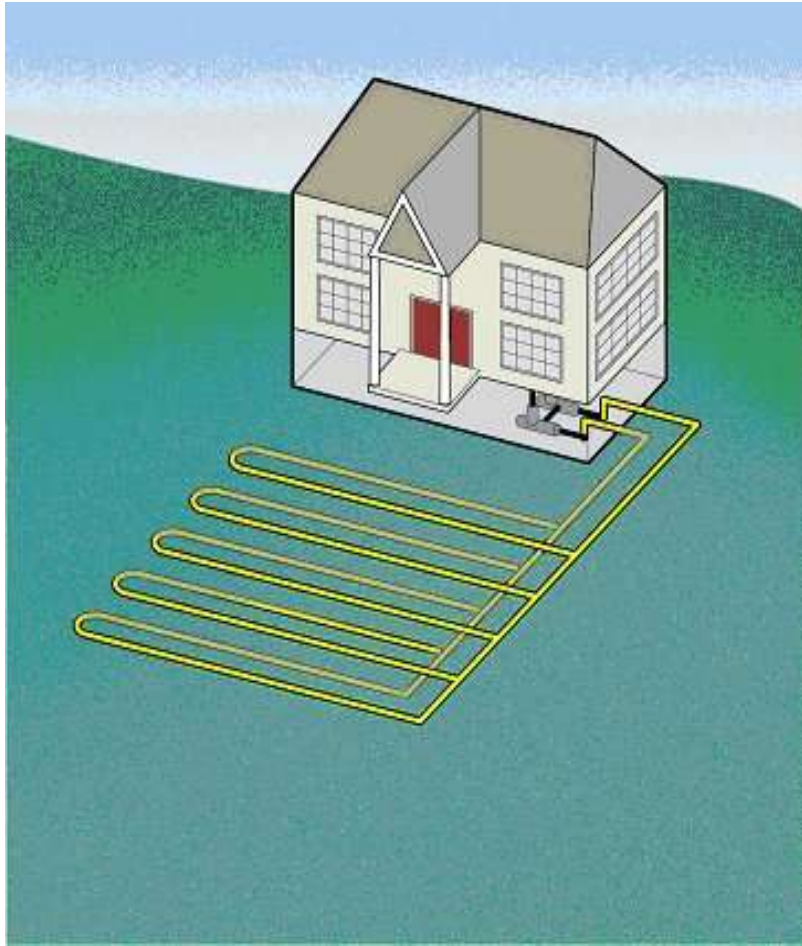
$$= E_1 \times E_2 \times E_3 = 0.35 \times 0.90 \times 0.05 = 0.016$$

Smart Grid

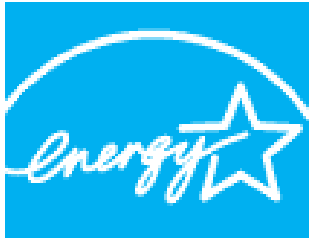
- Computer software engineers
- Electrical engineers
- Electrical equipment assembler
- Electrical equipment technicians
- Machinists
- Team assemblers
- Construction laborers
- Operating engineers
- Electrical power line installers and repairers

Geothermal





Demonstration Projects



<http://www.warmtraining.org/medc/>

Certificates of Achievement

- Solar Energy Technician
- Energy Efficiency Technician
- Geothermal Technician
- Wind Turbine Technician

Associates Degrees

- Alternative Energy Technology
- Customer Energy Specialist
(also currently a certif. program)

**the amount of new technical
information is doubling every 2 years.**

That means for a student starting a four-year technical or college degree . . .

Half of what they learn in their first year of study will be outdated by their third year of study.

Looking for opportunities...

- In your home?
- In your classroom?
- On your way to & from?
- At work?
- At play?
- In service?



