Renewable Energy Resources

1. Produces most electricity from renewable solar energy
2. Rapidly growing, strong potential (wind and solar are growing at 30% per year)
3. Used today; important energy source
4. Potentially a very important fuel to transition from fossil fuels
US Renewable energy use

**Figure 14-4** Renewable-energy use in the United States. A mix of sources of renewable energy provided 6% of the nation’s energy use in 2002. (Source: Data from Department of Energy, Energy Information Agency, *Renewable Energy Annual* 2002, November 2003.)
Solar Energy

- Passive vs Active systems
- Water Heating
- Electricity
Passive Solar systems

- Architectural designs
- Heat absorbing tiles
- Protection from weather, can build into hillside
Figure 14–10 Landscaping in solar heating and cooling. (a) In summer, the house may be shaded with deciduous trees or vines. (b) In winter, leaves drop, and the bare trees allow the house to benefit from sunlight. Evergreen trees on the opposite side protect against, and provide insulation from, cold winds.
Active Solar

- Water Heater
- Heating of house
Solar

Figure 14–3  Solar thermal power in southern California. A solar-trough power plant. Sunlight striking the parabolic-shaped mirrors is reflected onto the central pipe, where it heats a fluid that is used, in turn, to boil water and drive turbogenerators.
Solar Panels

Figure 14–15  Power tower Solar Two. Sun-tracking mirrors are used to focus a broad area of sunlight onto a molten-salt receiver mounted on the tower in the center. The hot salt is stored or pumped through a steam generator that drives a conventional turbogenerator.

Figure 14–14  PV power plant. The world’s first photovoltaic (solar cell) power plant, located near Bakersfield, California. The array of 220 thirty-four-foot (eleven-meter) panels produces 6.6 MW at peak, enough energy for 6,000 homes.
Photovoltaics

- Sunlight into electricity
- 10% efficiency
- Cost of central power plants
Geothermal

- Use of Earth’s internal heat
- Generate electricity in Iceland, US, New Zealand, Japan
- Use of hydrothermal convection
- Water circulates to bring heat up
Wind

Topography and wind

Windmill
Wind power
Biogas

- Ethanol
- Methane
- Wood, sugarcane, corn, manure
- Bagasse

Figure 14-20 Biogas power. Animal wastes are introduced to this unit in rural India and mixed with water. The wastes then decompose under anaerobic conditions, producing biogas.
Hydroelectric

- Dams
- Tidal power
Economics of Renewable resources

- Hydrogen fuel technology
- Energy efficient systems
- Tree farms
- Co-generation plants
- Encourage funding for renewable resources