

# Alternative Energy

1. Solar
2. Biofuels (biomass)
3. Nuclear
  - a. Fusion
  - b. Fission
4. Fuel Cells
5. Wind
6. Hydroelectric
7. Geothermal
8. Tidal (wave power)

# Solar Energy

- Solar energy uses energy from the **sun**.
- **Benefits** –Solar power is clean and quiet!
- **Disadvantages** – It's expensive! (The main expense is **collecting, storing and converting the sun's rays into useful forms of energy.**)
- **Environmental Impacts** - are negligible.

# 4.2 Alternate Energy Sources

## Solar Energy

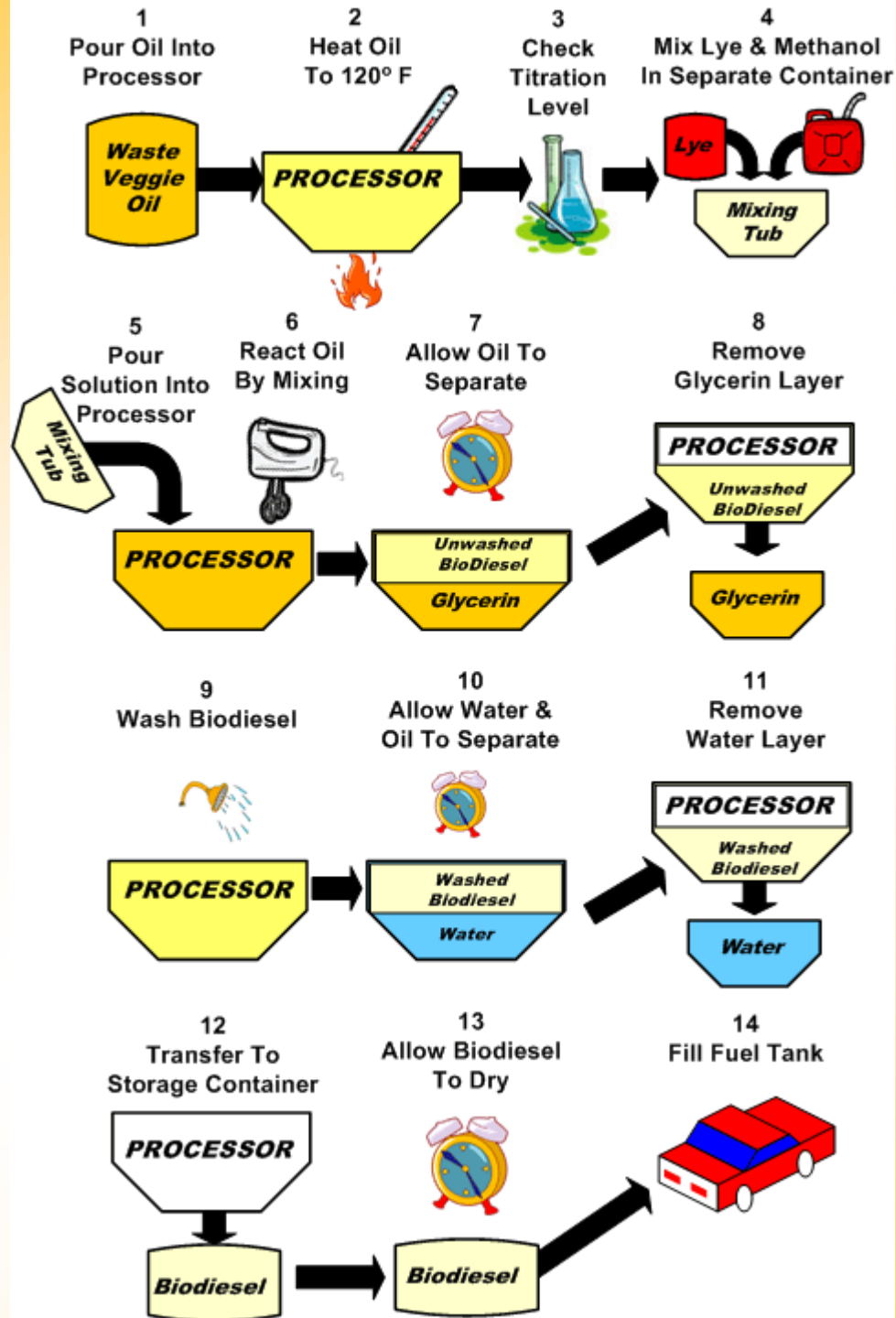
- ◆ Solar energy has two advantages:
  1. Solar energy's "fuel" is free.
  2. Solar energy is non-polluting.

# Biofuels a.k.a Biomass

- Biomass includes municipal wastes, crop residues, manure, lumber and paper by-products.
- Biomass is “combusted” or burned to heat water to produce steam and electricity.

# Biofuels a.k.a Biomass

- Benefits – renewable!
- •Disadvantages –
  - –“Food” is used as fuel!
  - •Environmental Impact –
    - –The use of farm and forest residue disrupts the recycling of nutrients back into the ecosystem.
    - –Generates pollution in the process of converting biomass to energy.



# 4.2 Alternate Energy Sources

## Nuclear Energy

- ◆ In nuclear fission, the nuclei of heavy atoms such as uranium-235 are bombarded with neutrons.
- ◆ The uranium nuclei split into smaller nuclei and emit neutrons and heat energy.

# Diablo Canyon Nuclear Plant





# Nuclear Fission

- Fission reactions are used to supply significant amounts of energy for...
- –Electricity
- –Heating
- –Military use- for nuclear submarines!

# Nuclear Fusion

Benefits - It could become a clean, potentially limitless energy source.

•Disadvantages –

–Scientists have not yet been able to initiate a controlled, long-lasting fusion reaction suitable for producing heat and electricity.

–Fusion reactions produce intense **radiation** that bombards all the materials in the reactor – making them intensely radioactive.

–Fusion reactors are **very expensive** to build.

–<http://science.howstuffworks.com/fusion-reactor.htm>

•Env't. Impacts – none, as yet!

# Nuclear Energy

- **Benefits...**
- –It produces huge amounts of energy from small amounts of nuclear fuel (uranium and plutonium).
- –Earth contains enough nuclear fuel to meet all present and future needs.

# Nuclear Energy

- **Disadvantages...**
- Peoples' fear of exposure to radiation and that nuclear weapons could be developed using this technology
- High cost
- **Environmental Impacts...**
- The threat of a meltdown (nuclear explosion)
- Spent fuel can remain radioactive for thousands of years!

# Fuel Cells- Hydrogen

- **Benefits** - Fuel cell reactions produce no pollution.
- **Disadvantages** -
  - –Currently it is expensive. Large-scale production will reduce its costs
  - –Driving range is limited with current fuel storage options
  - –Current small distribution channels - California is making some progress
  - –It is extremely flammable – Remember the Hindenburg!
- **Env't. Impacts** - Hydrogen must be in the proper form to be used as a fuel. Most hydrogen used in today's fuel cells comes from methane

# 4.2 Alternate Energy Sources

## Wind Energy

- ◆ In the next 50 to 60 years, wind power could meet between 5 to 10 percent of the country's demand for electricity.

# Wind Power

- Wind mills generate electricity when the wind spins the giant turbines.
- **Benefits** – Wind is free and clean!
- **Disadvantages** – The wind doesn't always blow!
- **Environmental Impacts** - wind farms can be noisy, unsightly, and can kill migrating birds.
- [rochsolarartech.itcstore](http://rochsolarartech.itcstore).

# Wind Turbines





# 4.2 Alternate Energy Sources

## Hydroelectric Power

- ◆ **Hydroelectric power** is the power generated by falling water.
- ◆ The water held in a reservoir behind a dam is a form of stored energy that can be released through the dam to produce electric power.
- ◆ The strong water flow that results drives turbines and electric generators.

# Glen Canyon Dam



# 4.2 Alternate Energy Sources

## Geothermal Energy

- ◆ **Geothermal energy** is harnessed by tapping natural underground reservoirs of steam and hot water.
- ◆ Hot water is used directly for heating and to turn turbines that generate electric power.

- **Geothermal energy produces electricity when “Earth’s heat” turns water to steam to spin turbines**
- **It can also heat water and homes.**

# The Geysers Is the World's Largest Electrical Geothermal Facility

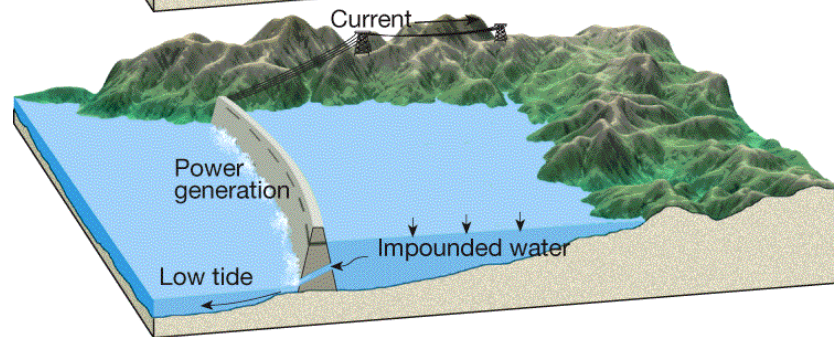
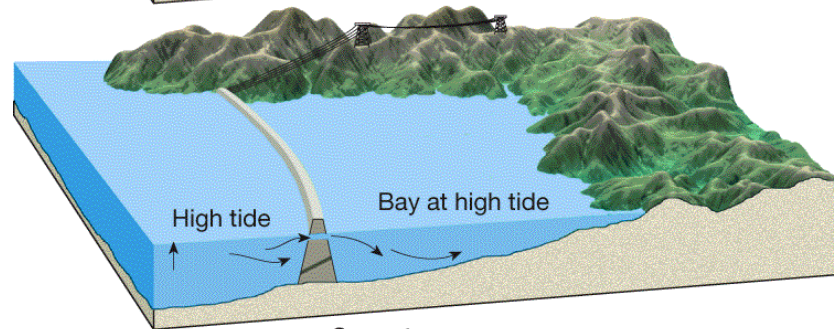
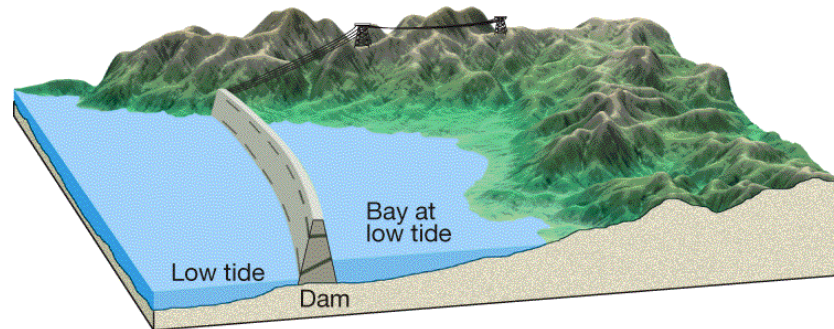


## 4.2 Alternate Energy Sources

### Tidal Power

- ◆ Tidal power is harnessed by constructing a dam across the mouth of a bay or an estuary in coastal areas.
- ◆ The strong in-and-out flow of tidal water drives turbines and electric generators.

# Tidal Dams



# 4.3 Water, Air, and Land Resources

## The Water Planet

- ◆ Each day, people use fresh water for drinking, cooking, bathing, and growing food.



# 4.3 Water, Air, and Land Resources

## The Water Planet

### ◆ Freshwater Pollution

- **Point source pollution** comes from a known and specific location, such as factory pipes.
- **Nonpoint source pollution** is pollution that does not have a specific point of origin.
- **Runoff** is the water that flows over the land rather than seeping into the ground, often carrying nonpoint source pollution.

# Major Types of Water Pollution

**Table 2 Major Types of Water Pollution**

Type	Examples	Sources	Effects
Disease organisms	Bacteria, viruses	Wastes from people and animals	Typhoid, cholera, dysentery, infectious hepatitis
Wastes that remove oxygen from water	Animal manure and plant debris that bacteria decompose	Sewage, animal feedlots	Great amounts of bacteria can remove oxygen from water, killing fish
Inorganic chemicals	Acids, toxic metals	Industrial effluent, urban runoff, household cleaners	Poisons fresh water and can sicken those who drink it
Organic chemicals	Oil, gasoline, plastic, pesticides, detergent	Farm and yard runoff, industrial waste, household cleaners	Some cancers, disorders of nervous and reproductive systems
Plant fertilizer	Water soluble compounds with nitrate, phosphorus ions	Sewage, manure, farm and garden runoff	Spurs rapid growth of algae that decay and deplete water's oxygen; fish die
Sediment	Soil	Erosion	Disrupts aquatic food webs, clogs lakes and reservoirs, reduces photosynthesis of aquatic plants
Radioactive substances	Radon, uranium, radioactive iodine	Nuclear power plants, uranium ore mining and processing	Some cancers, birth defects, genetic mutations

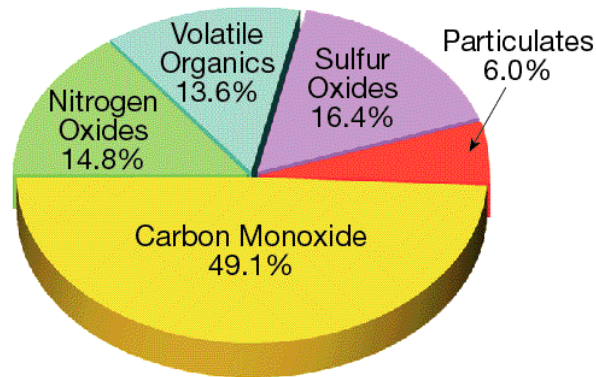
# 4.3 Water, Air, and Land Resources

## Earth's Blanket of Air

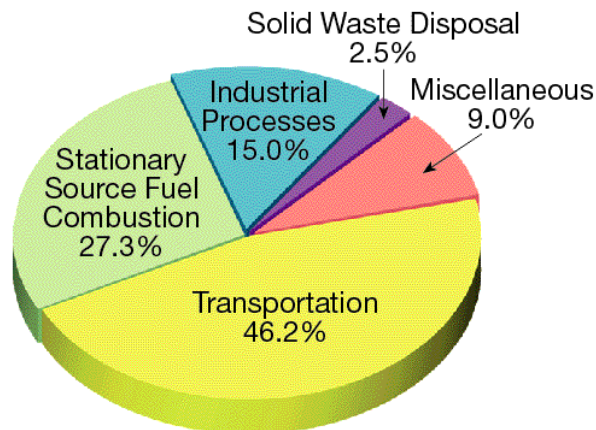
- ◆ The chemical composition of the atmosphere helps maintain life on Earth.
- ◆ Pollution in the Air
  - The increase of carbon dioxide in the atmosphere has altered the carbon cycle and contributed to **global warming**—the unnatural warming of the lower atmosphere.
  - Through a series of chemical reactions, these pollutants in the air are converted into acids that are a major cause of acid precipitation.

# Major Primary Pollutants and Their Sources

## Primary Pollutants



What They Are



Where They Come From

# 4.3 Water, Air, and Land Resources

## Land Resources

- ◆ Earth's land provides soil and forests, as well as mineral and energy resources
- ◆ Damage to Land Resources
  - Mines produce many mineral resources, but mines are destroying, soil, vegetation, and Earth's contours.
  - Mines also cause soil erosion and pollution that contaminates soil and water and destroys ecosystems.

# Surface Mining Destroys Earth's Surface



# 4.4 Protecting Resources

## Keeping Water Clean and Safe

- ◆ **Conservation** is the careful use of resources.
- ◆ Pollution prevention means stopping pollution from entering the environment.

# 4.4 Protecting Resources

## Keeping Water Clean and Safe

- ◆ Starting in the 1970's, the federal government passed several laws to prevent or decrease pollution and protect resources.
  - In 1972, the Clean Water Act (CWA) required industries to reduce or eliminate point source pollution into surface waters.
  - The Safe Drinking Water Act of 1974 helped protect drinking resources.



# Preventing Water Pollution

**Table 3 How You Can Prevent Water Pollution**

- Never pour household chemicals (paints, thinners, cleaners, pesticides, waste oil) down the drain or into the toilet.
- Never dump toxic chemicals in the gutter or onto the ground.
- Don't put items that contain hazardous substances, such as batteries or old computer monitors, into the trash.
- Find out about hazardous waste collection sites and times from your local sanitation or public works department.
- Avoid using hazardous substances in the first place.

# 4.4 Protecting Resources

## Protecting the Air

- ◆ In the 1970's, Congress passed the Clean Air Act, the nation's most important air pollution law.
  - National Ambient Air Quality Standards (NAAQS) established for six "criteria" pollutants known to cause health problems – carbon monoxide, ozone, lead, sulfur dioxide, nitrogen oxides and particulates (fine particles).

# Saving Energy

**Table 4 How You Can Save Energy**

- Recycle when possible.
- Let the sun in on bright winter days using solar energy to warm rooms.
- Use energy-saving fluorescent bulbs instead of incandescent bulbs where you can.
- Turn off lights when you leave a room. Turn off the radio, TV, or computer when you're not using them.
- Walk or ride a bike when you can.
- When buying electric products, look for the Energy Star sticker which denotes energy-saving products.

# 4.4 Protecting Resources

## Caring for Land Resources

- ◆ Protecting land resources involves preventing pollution and managing land resources wisely.
  - **Compost** is partly decomposed organic material that can be used as fertilizer.
  - **Recycling** is the collecting and processing of used items so that they can be made into new products.