Bioenergy

Four Main Parts to be Covered

Bioenergy Resources

Production of Biofuels

Applications of Bioenergy

Bioenergy Economics Concerns

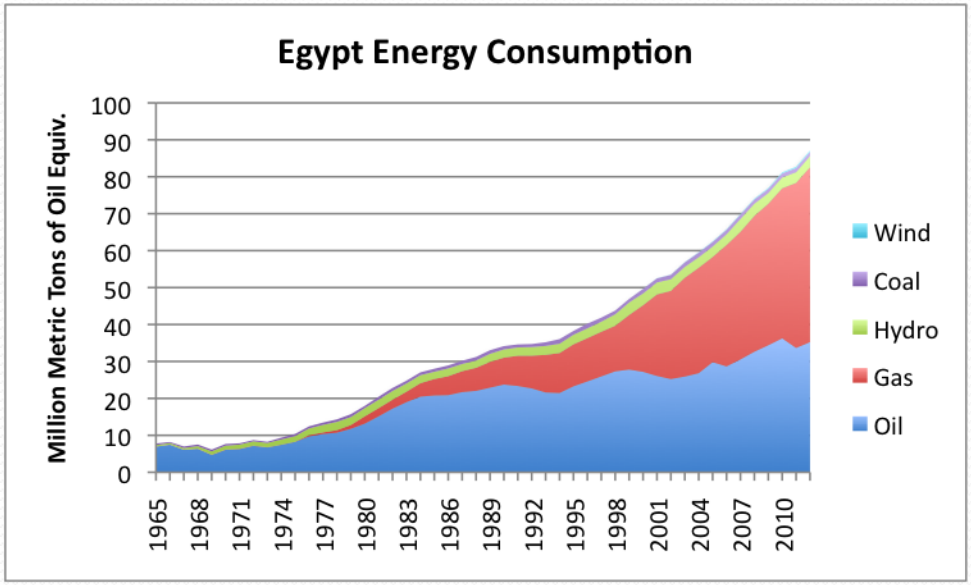
World Energy Picture

Our Needs: electricity, transport, heat

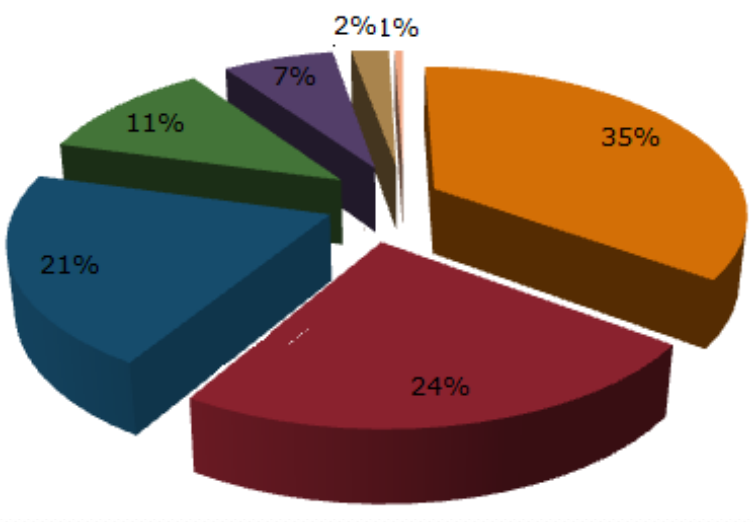
Requirements: coal, oil, gas

Challenges and Concerns:

- Pollution & Climate Change .
- Resource Depletion, Security.
- Rapid increase in population, increase in energy demand.
- Price: people can't afford the energy they want.



Types of Energy Resources



Sources

- **Renewable**
  - Solar energy
  - Hydro power
  - **Biofuel**
  - **Biomass**
  - Tidal energy
  - Wind energy
  - Nuclear energy
- **Non-renewable**
  - Oil
  - Natural gas
  - Coal

What is fuel?, Can you imagine life without it?

- **Fuels** are any materials that store potential energy in forms that can be released and used as heat.
- They are required for a variety of purposes such as:

1) Transportation: it accounts for 25% of energy demand and nearly 62% of oil consumed.

2) Electricity Generation:

- The generation of electricity is the single largest use of fuel in the world.
- More than 60 % of electricity generated comes from fossil fuels.

Types of Fuel: Fossil fuel & Biofuel.

- **I) Fossil fuels:**
- They are hydrocarbon fuels that take millions years to be formed.
- They are nonrenewable (once used it is no longer available)
- They are very hazardous and cause environmental pollution because their burning releases CO_2 or CO.
- Their prices are always in rising.
- Power stations consume lots of fuel and effort to generate electricity , they will be stopped if there is reduction in fuel. which use coal, need lots of fuel.

Types of Fuel: Fossil fuel & Biofuel.

II) Biofuels:

- Any hydrocarbon fuel that is produced from living organic matter in a short period of time (days, weeks, or months).
- They are alternative of fossil fuels, so they are ways of energy security.
- They burn cleaner than fossil fuels, resulting in fewer emissions of greenhouse gases or substances that cause acid rain such as sulfur.
- They are biodegradable, so when spill, less harm is done compared to when fossil fuels spill.

Bioenergy origin and types

- **Bioenergy** is energy produced from recently living organic matters called biomass. These matters can be burned directly for heat (traditional biomass) or converted to biofuels such as biodiesel or ethanol.

- **Types of bioenergy:**

- **Biofuels**
  - Liquids: Methanol, Ethanol, Butane, Biodiesel
  - Gases: Methane, Hydrogen

- **Bioheat**
  - Wood burning

- **Bioelectricity**
  - Combustion in Boiler to Turbine
  - Microbial Fuel Cells (MFCs)

History of Bioenergy

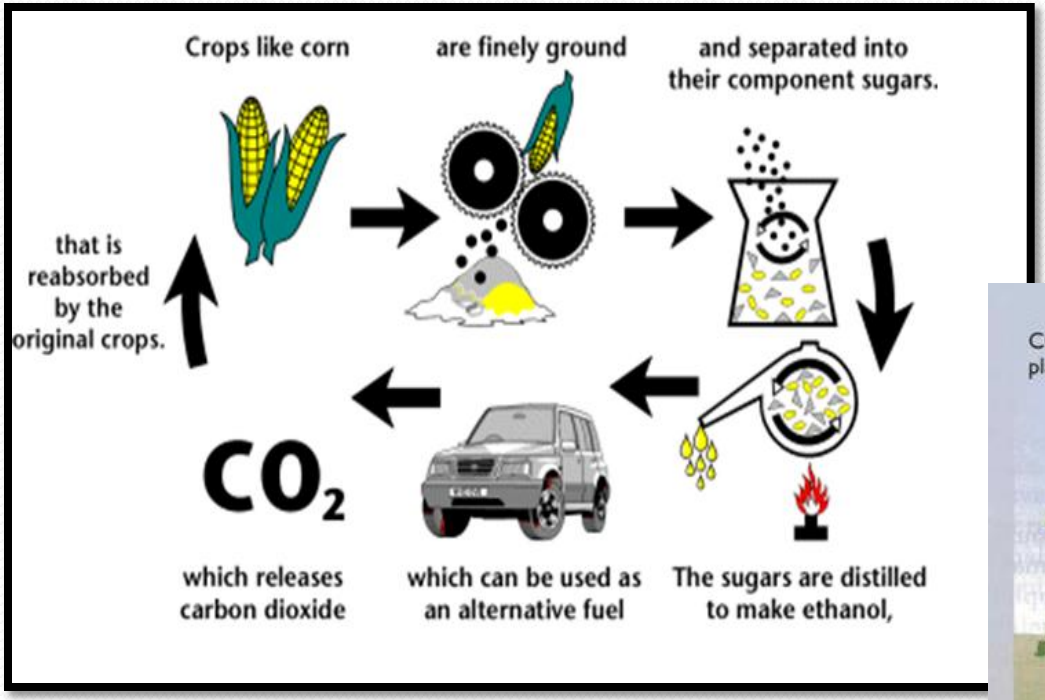
Bioenergy is not new!!!!!

- 1850s: Ethanol used for lighting
- 1896: 1st ethanol-fueled automobile, the Ford Quadricycle
- 1908: 1st Ford Model T working with ethanol
- 1919-1933: Prohibition banned ethanol unless mixed with petroleum.
- WWI and WWII: Ethanol used due to high oil costs.

- 1990s: The most recent biofuel popularity in response to high emissions standards and increasing demands for enhanced fuel economy.

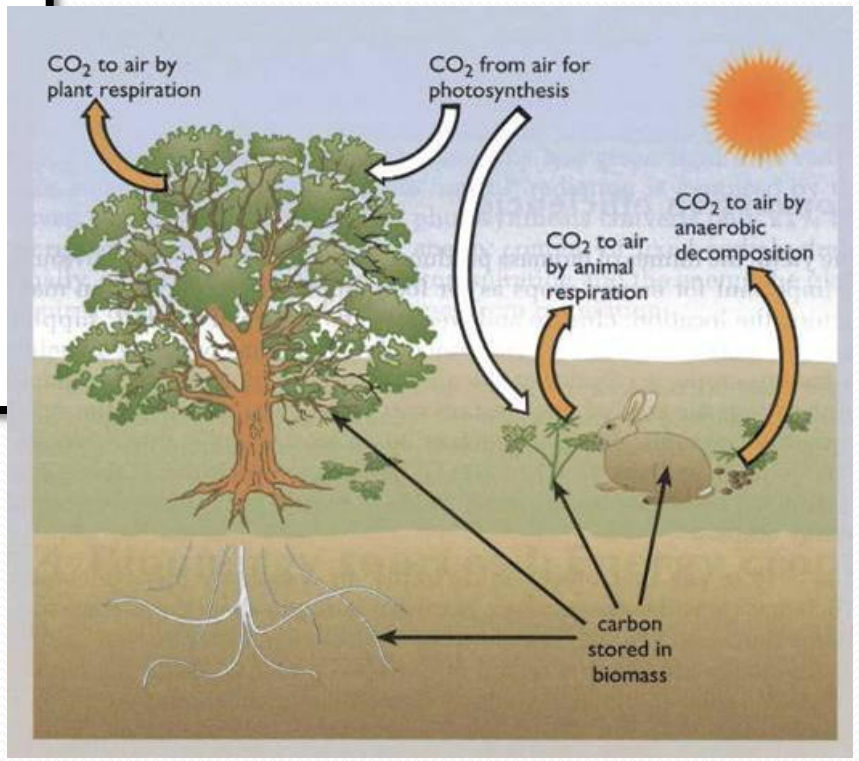
Lessons from Nature

Some important cycles



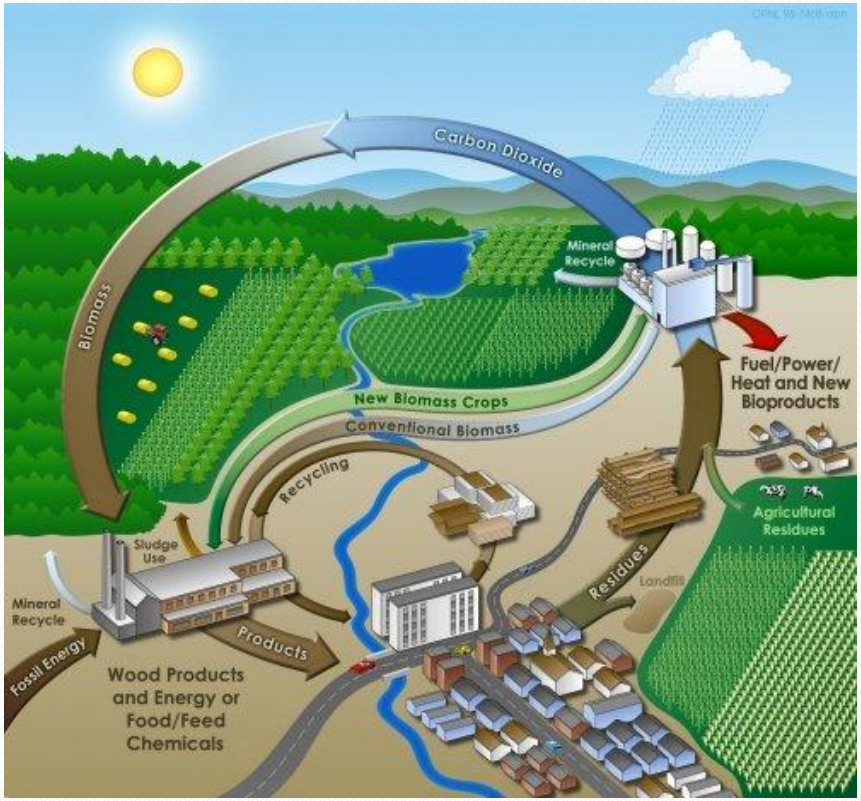
Commercial Carbon Cycle

Carbon Cycle on the local scale



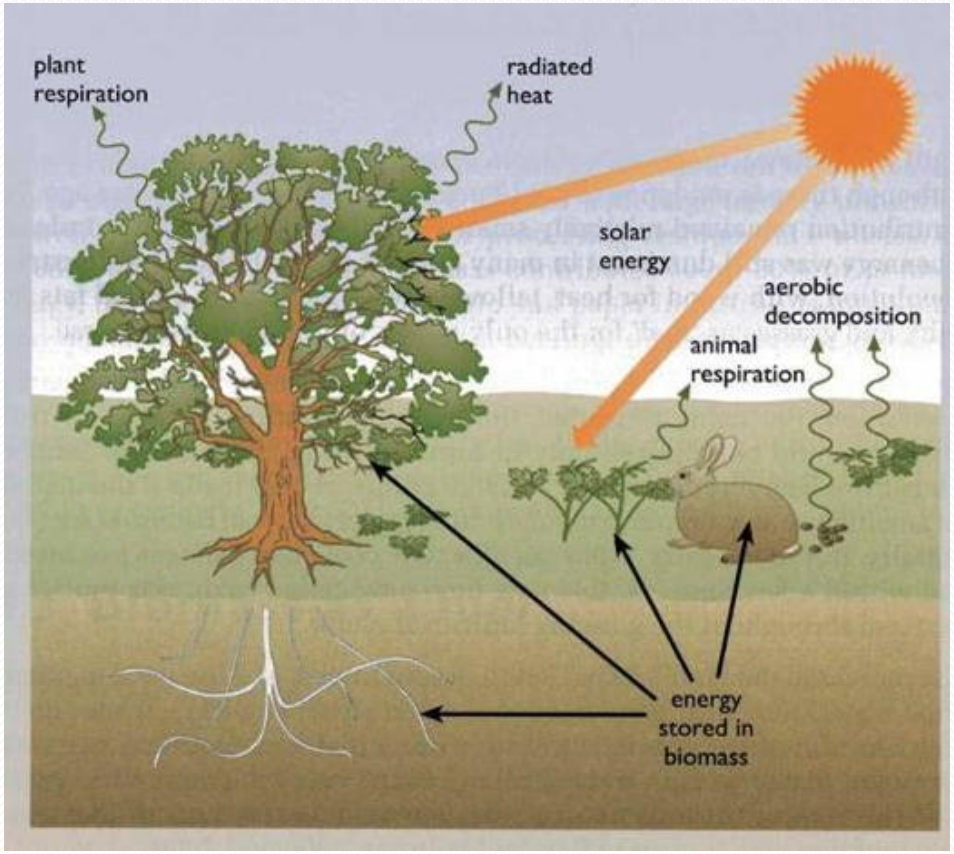
Lessons from Nature

Some important cycles

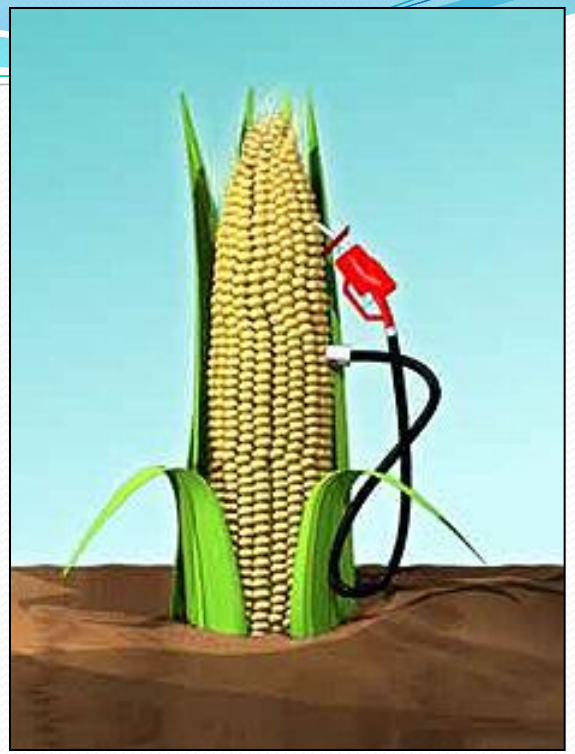


Bioenergy Cycle

Bioenergy Cycle on the local scale



Uses of Biomass



Many important non-energy uses

- Food for humans
- Animal feed (a major and growing use(
- Lumber & other construction materials
- Clothing (cotton, wool, linen, leather(
- Paper, packaging, etc.

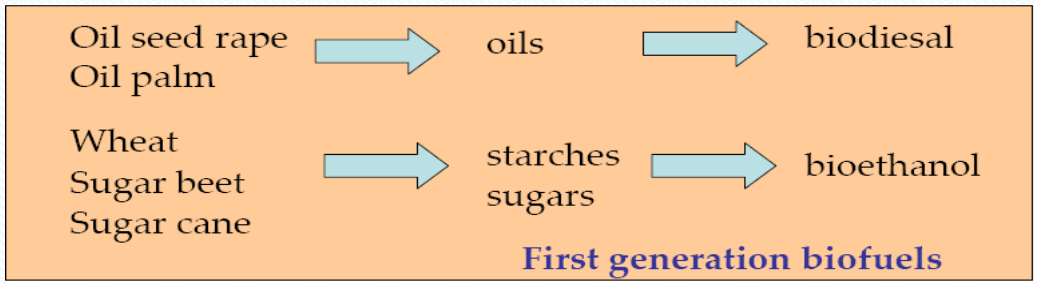
Energy uses:

- To produce heat or electricity
- Convert to Gas (CH_4 or CO/H_2)
- Convert to Liquid Fuels to be used in transportation.

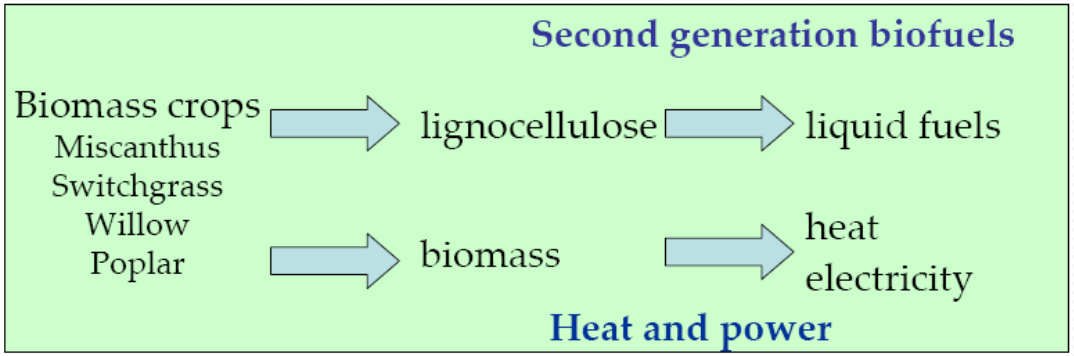
Converting Biomass to biofuels

According to the production method, there are three Generations of biofuels:

1- First generation: called Conventional Biofuels, made from sugar, starch, and vegetable oil.



2- Second generation Biofuel: called advanced biofuels, made from non edible plants.



3- Third generation Biofuel: made from algae and microbes.

Biomass-to-Bioenergy Routes