# Renewable –vs- Nonrenewable Resources

# Energy Sources – Renewable and Nonrenewable Resources

- Renewable = can be replenished fairly easily
  - Renewable Energy = Derived from resources like
     the sun and wind, that can easily be replenished
- Non-renewable = can not be replenished (or at least not in our life time)
  - Non-renewable Energy = energy sources like coal and oil, that can not be replaced over a useful period of time.

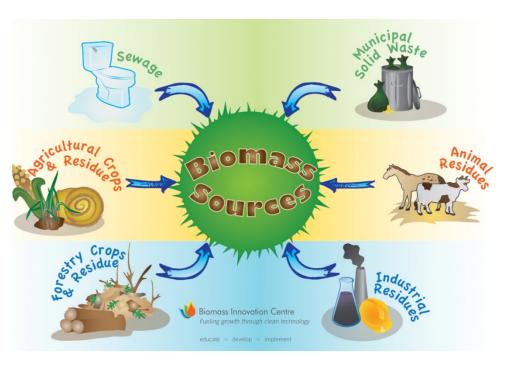
## Renewable Energy/Resources

# **Biomass** - organic material made from plants and animals (microorganisms).

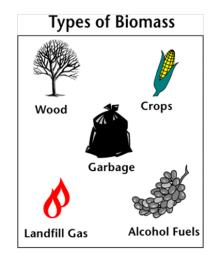


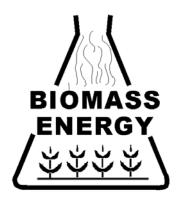
#### **Pros:**

- Cleaner burning than oil
- Abundant
- renewable



- Causes food prices to rise because we use grains to make ethanol
- Greenhouse gas producer
- Not efficient to transport the raw material





**Geothermal** - Temperatures hotter than the sun's surface are continuously produced inside the Earth by the slow decay of radioactive particles, a process that happens in all rocks.

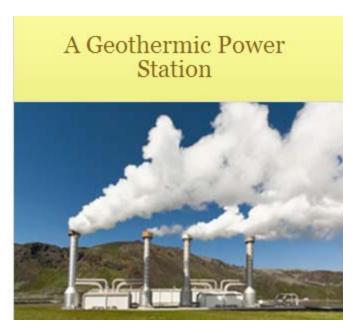
#### **Pros:**

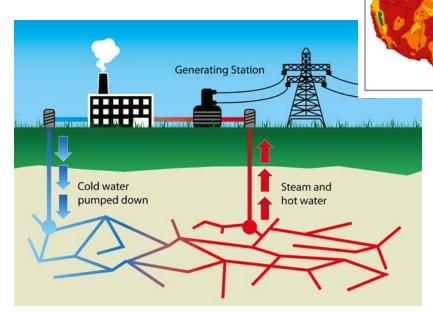
- Low greenhouse gas producer
- Renewable in some places
- Energy and cost efficient

#### Cons:

 Few geothermal fields that are not on protected land

> U.S. Geothermal Resource Map





## Hydropower - energy from moving water

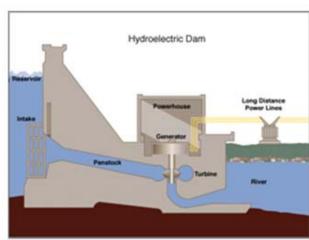
#### **Pros:**

- No greenhouse gases
- Can generate lots of electricity
- Renewable

Fish Ladder at the Bonneville Dam on the Columbia River Separating Washington and Oregon



- Can damage environment where
   dam is built (can change the natural water
   temperatures, chemistry, flow characteristics, and
   silt loads, all of which can lead to significant
   changes in the ecology (living organisms and the
   environment) and rocks and land forms of the
   river upstream and downstream.
- Expensive to build



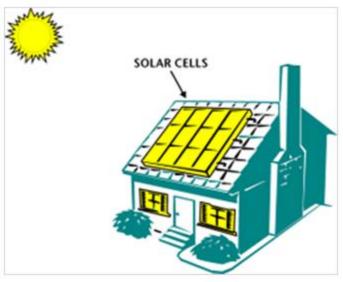


**Solar Power** - the sun's rays (solar radiation) that reach the Earth. This energy can be converted into other forms of energy, such as heat and electricity.

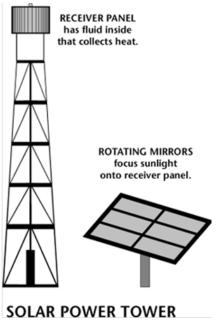
#### **Pros:**

- No greenhouse gases released
- When located on buildings have limited impact on environment
- Renewable





- Expensive investment to install
- Not effective in areas with limited light

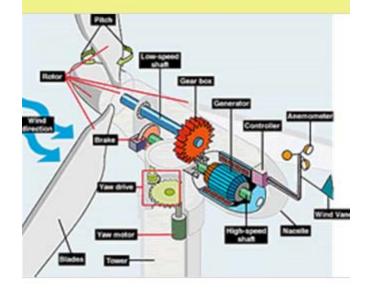


**Wind Power** - wind turbines use blades, the wind flows over the blades creating lift, like the effect on airplane wings, which causes them to turn. The blades are connected to a drive shaft that turns an electric generator to produce electricity.

#### **Pros:**

- No greenhouse gases produced
- Renewable in some places

#### Diagram of Windmill Workings



#### Cons:

- Limited to areas of reliable high winds
- High initial cost (but not as much as solar)
- Extensive land use

Harms bats and migrating birds

Top Wind Power Producing States, 2011





## Non-Renewable Energy/Resources

## Oil (Petroleum) - Crude oil is a smelly, yellow-to-black liquid and is usually found in underground areas called reservoirs.

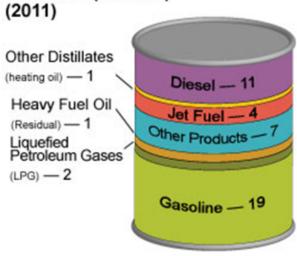
#### **Pros:**

- Easy to produce and transport
- High energy output

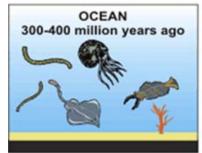
#### Cons:

- Non-renewable
- Region specific (causes lots of wars)
- Running out
- Environmental damage from spills
- High greenhouse gas (CO2) producer

#### Products Made from a Barrel of Crude Oil (Gallons) (2011)



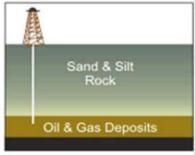
#### PETROLEUM & NATURAL GAS FORMATION



Tiny sea plants and animals died and were buried on the ocean floor. Over time, they were covered by layers of silt and sand.



Over millions of years, the remains were buried deeper and deeper. The enormous heat and pressure turned them into oil and gas.



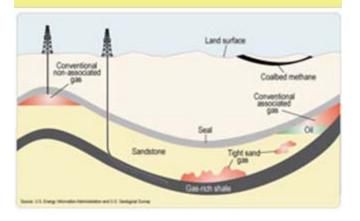
Today, we drill down through layers of sand, silt, and rock to reach the rock formations that contain oil and gas deposits.

# **Natural Gas -** main ingredient in natural gas is methane, a gas (or compound) composed of one carbon atom and four hydrogen atoms.

#### **Pros:**

- Abundant
- Fewer greenhouse gases than coal or oil

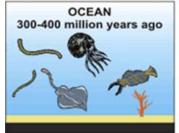
#### Schematic Geology of Natural Gas Resources



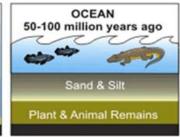
#### Cons:

- Expensive to transport
- Greenhouse gas producer
- Non-renewable
- Many of the areas that are now being explored and developed for natural gas production are wilderness areas, and development of these areas have large impacts on the area's environment, wildlife populations.

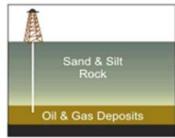
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Today, we drill down through layers of sand, silt, and rock to reach the rock formations that contain oil and gas deposits. **COal** – a combustible black or brownish-black sedimentary rock composed mostly of carbon and hydrocarbons. Most abundant fossil fuel produced in the U.S. The energy in coal comes from the energy stored by plants that lived hundreds of millions of years ago, when the Earth was partly covered with swampy forests.

#### **Pros:**

- Abundant
- High energy output

#### Top Coal Producing States, 2011

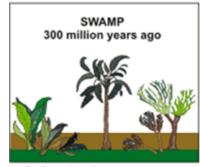


Source: U.S. Energy Information Administration, Quarterly Coal Report (June 2012).

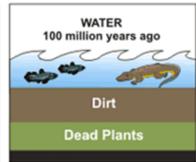
#### Cons:

- Non-renewable (it takes millions of years to create)
- Extraction is destructive to environment
- High greenhouse gas producer

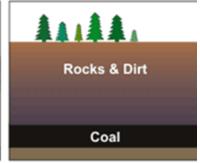
#### HOW COAL WAS FORMED



Before the dinosaurs, many giant plants died in swamps.



Over millions of years, the plants were buried under water and dirt.



Heat and pressure turned the dead plants into coal.

## Nuclear Power/Uranium - nuclear fission, atoms are

split apart to form smaller atoms, releasing energy. Nuclear power plants use this energy to produce electricity.

#### **Pros:**

- No greenhouse gases
- Very efficient energy producer
- abundant

# How Fission Splits the Uranium Atom FISSION The Atom Splits Neutron HEnergy Neutron Viranium 235 Neutron Lighter Element

- Expensive to build and maintain reactors
- Produces radioactive waste
- Difficult to dispose of waste
- Heated waste water is harmful to aquatic life
- Terrorism threat with spent fuel (nuclear weapons)



