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AP Environmental Science
Wiki Review Module

# Renewable Energy

What is renewable energy?

- Renewable energy is energy extracted from a source that is not depleted as it's used. This is contrasting from non-renewable energy sources such as coal and oil that are a limited resource and will eventually be deemed unusable due to a lack of availability. Renewable energy sources generally have less of a negative impact on the environment.
- Globally only about 15% of our energy needs are met using renewable resources.
- The biggest issue with renewable energy is finding a way to properly store it.
- Power Grids: The power grid is a network for delivering electricity to consumers. The power grid includes generator stations, transmission lines and towers, and individual consumer distribution lines.
    - Step One: Energy is created
    - Step Two: Energy is converted to high voltage for distribution
    - Step Three: Distribution and power use. Power lines deliver power to populated areas while transformers intersect the high voltage power and convert it back to a voltage that a house can use. Delivered to consumers.

The Main Renewable Energy Sources are...

- Solar, Wind, Hydroelectric, Geothermal, Tidal, and Biomass.

Solar

- Solar energy is derived from capturing energy from the sun and converting it into heat, electricity, or hot water.
- Photovoltaic (PV) systems can convert direct sunlight into electricity through the use of solar cells. This is stored in batteries. When sunlight hits the PV cells, electrons are energized and can flow freely, producing an eclectic current. If the building is connected to a grid, the energy produced is fed into the grid. If the building isn't connected to a grid, it can be stored in batteries for use later.
- Passive Solar Collection is the use of building materials, placement, and design to passively collect solar energy (such as through the concrete outside of the Elab). This can be used to keep a building warm or cool.
- Active Solar Collection is the use of devices, such as solar panels, that collect, focus, transport, or store solar energy.
- Active Heat Systems pump a heat-absorbing fluid (such as water) through a small collector. These collectors are usually placed near or on top of the building.
- Benefits: No limit to the collection of sunlight, will not run out,

- Limitations: Significant upfront cost, need ample sunlight, space for the solar panels. Making PV cells does require fossil fuels. Storing the heat for times where there is no sunlight.
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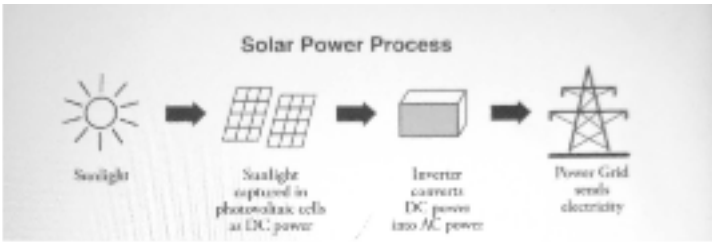


Wind

- Wind farms capture the energy of wind flow by using turbines and converting it into electricity.
- Benefits: Clean (no harmful emissions), renewable, one of the lowest-priced forms of renewable energy
- Limitations: Turbines are loud, can harm birds, obstruct visuals so they need to be placed away from the general public. There is a certain window that turbines work in (not too little wind that it cannot move the blades but not too strong of wind that the turbine is overworked) and there are many regions where this isn't achievable. More costly than fossil fuels.
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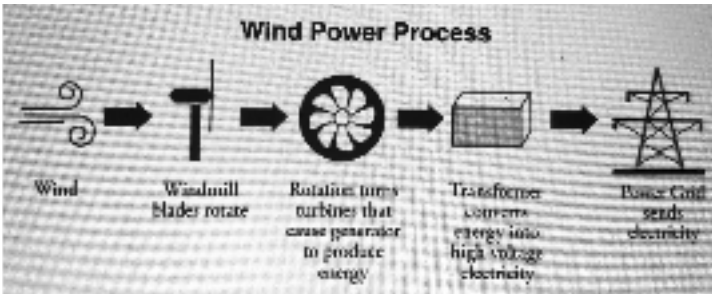
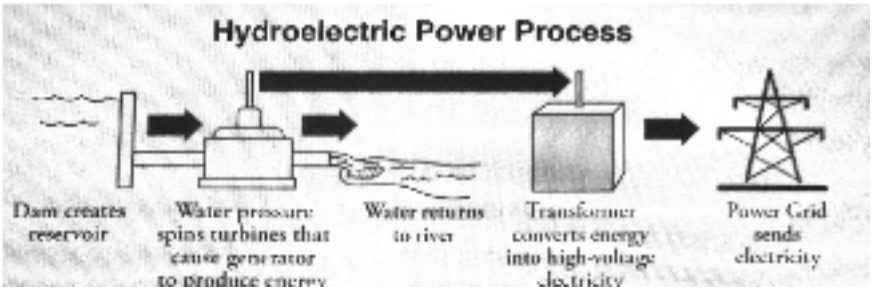
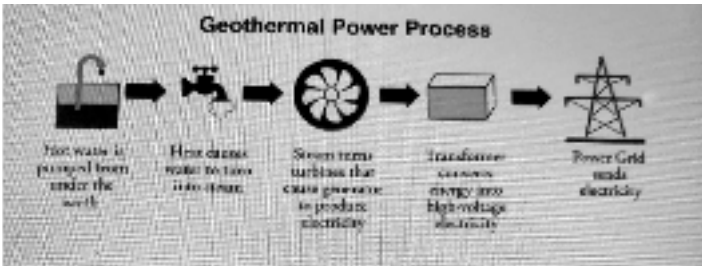



Hydroelectric

- This works through the systematic placement of river dams that spin turbines to produce electricity.
- Benefits: Its production releases no pollutants, New habitats are created (wetlands), renewable
- Limitations: Hydroelectric power does produce thermal pollution, requires rivers to be dammed which changes the rates at which the river flows and also leads to the destruction of habitats, a limited number of rivers with sufficient flow and drop.
- Silting is often associated with hydroelectric power. As water sits behind the dam, the sediment that is usually carried by the river sinks to the bottom. This puts pressure on the structure, so dams have to be built strong enough to hold back the tons of sediment. Sediment is used to fertilize the flood plains of the river below but is now trapped behind the dam.

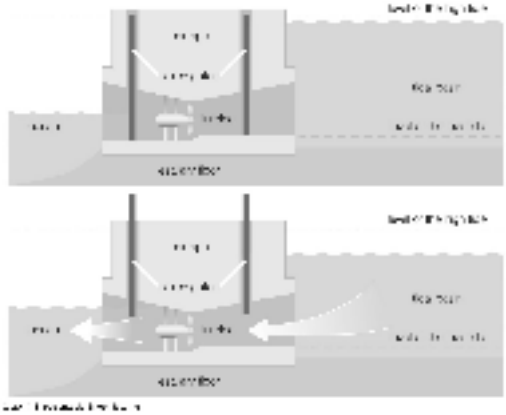
- 


Geothermal

- The energy produced by harnessing Earth's internal heat. Indirectly gains its energy from nuclear power.
- Naturally heated water and steam from Earth's interior turn turbines and this creates electricity.
- Geothermal can be used indirectly, such as pumping the heated water directly through buildings to heat them (this is used in homes in Iceland).
- Technically renewable but similarly to biomass, the groundwater must be used at a rate that allowed for it to be replaced.
- Benefits: Renewable, stable, good for heating and cooling, naturally replenished, underground so not taking up room. Considered environmentally friendly.
- Limitations: Expensive to install, can potentially release toxic gases during the drilling process. Limited locations that have geothermal sources to tap. Salts that are dissolved in the water corrode the machinery parts. Gases trapped in the water may be released as the water is utilized.
- 

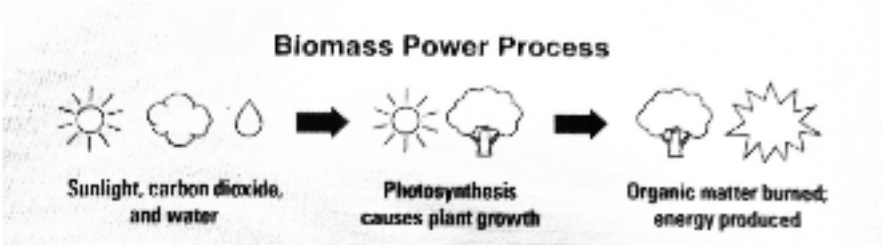

Tidal

- The tidal movement of ocean water can be tapped and used as a source of energy. To harvest this energy, dams are plated across outlets of the tidal basins. Incoming tides flow through the dam, and the outgoing tides pass through the dam and turn turbines to generate electricity.
- Benefits: Clean, predictable cycle, effective at low speeds, long life span
- Limitations: Expensive, can only be used by coastal regions, has to be constructed close to the land.



Biomass

- One of the most consistently used sources. This includes wood, charcoal, and animal waste products.
- Only renewable if it is used a pace that allows time to replace the biomass used.
- Benefits: Low cost, readily available, and better for the environment than fossil fuels. It helps reduce the amount of waste in landfills since it relies on the burning of organic materials.
- Limitations: The initial cost, the large landmass is also required for the installation of a biomass boiler.




Good luck guys! Hope this helps your studying :)