

Energy is needed for heating, cooling, generating electricity, and transportation

Electric power

Is the rate where electricity works, its unit of measure is **watt**

Electric energy

Is the amount of work that can be done by electricity, measured in **watts/hour**

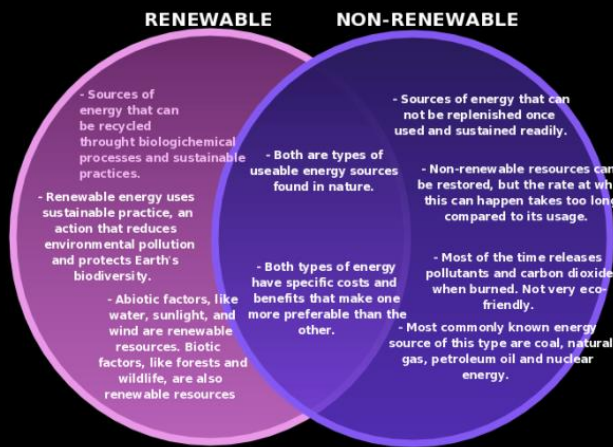
Energy resources include

Non-renewable (coal, natural gas, petroleum, nuclear fission)

Renewable (hydropower, solar, wind, waste, biomass, and oceanic power, nuclear fusion)

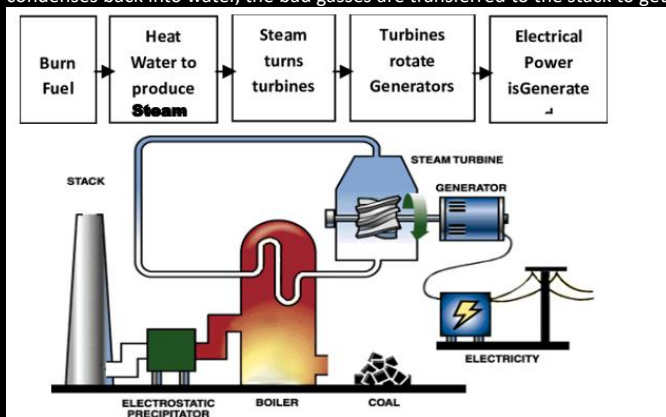
Commented [SD1]: Sources that exist in a fixed amount or have a usage rate faster than their replaced rate

Commented [SD2]: Sources that can be replaced in nature at a rate close to its rate of use, they are better than fossil fuels and non-renewable sources as they are cleaner and sustainable



Fossil fuels (non-renewable)

- are sources generated from fossil organic matter and stored deep in earth for geologically long times, where coal is produced from plants, and gas/petrol are produced from fossilized animals
- the usage process, coal is dumped into the boiler generating steam which is used to move the turbines, then it condenses back into water, the bad gasses are transferred to the stack to get shot off




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- **Petroleum & natural gas**

- It's produces when organic matter goes through slow chemical reactions becoming **hydrocarbons**, which are long chains of carbon and hydrogen
- They consist of many different hydrocarbons such as **paraffins** which have the chemical formula C_nH_{2n+2}
- Petroleum is produced from in the Cenozoic age, with less produced in the Mesozoic and Paleozoic age

- **Coal**

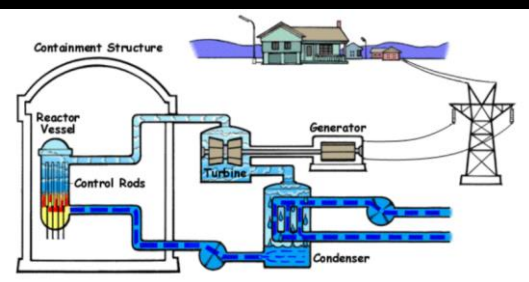
- Is a sedimentary/metamorphic rock produced in swamps when there Is a large accumulation of organic plant matter that condenses and becomes **peat**, then compaction of peat due to burial removes water and methane turning it into the black organic rich coal **lignite**, further compaction and heating results in **bituminous coal**, but if that got metamorphed, it will turn into a high grade called **anthracite (ancient coal)**, with further heating it will become an unusable energy source called **graphite**, as it takes a lot of energy to reach the needed temperature

S. No.	Advantages	Disadvantages
1.	Fossil fuels are used to generate electricity in bulk at a single location.	Emission of carbon dioxide from burning fossil fuels causes global warming and degrades our environment.
2.	Fossil fuels are found easily.	Fossil fuels are exhaustible or non renewable resources.
3.	Fossil fuels are cost effective.	Over the years the consumption of fossil fuel has negatively impacted our environment
4.	Over time fossil fuels have become safer.	Exposure to chemicals and silica is dangerous for the health of fossil fuel harvesters. Ex: Coal miners.
5.	Fossil fuel power stations can be built anywhere	Burning Fossil fuels creates carbon dioxide.
6.	Transportation of fossil fuels has become easier.	Harvesting fossil fuels is difficult and poses health risks.

Nuclear fission (non renewable)

is the process of splitting the atomic nucleus into two smaller nuclei which returns a large amount of energy

- Radioactive uranium is concentrated and made into fuel rods, they generate a lot of heat because of radioactive decay in the reactor vessel, water is dumbled into the rods to cool them resulting in generating steam
- This steam then travels to tubrines to generate the mechanical energy which then the generators converts into electricity
- The steam cools down and goes to the condenser where its dumbled back into the fuel rods



- **Advantages**

- Does not emit CO_2 pollutants
- Continuously generates electricity.

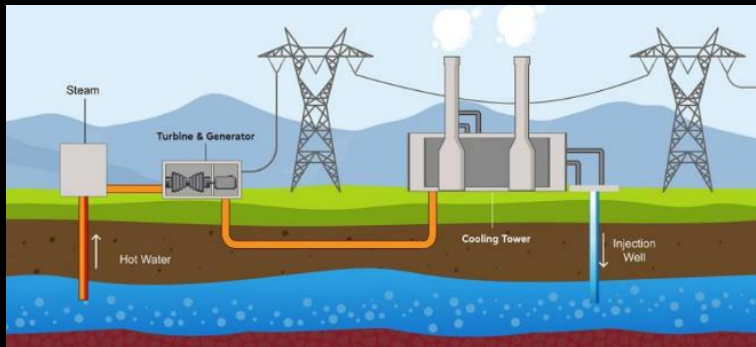
- **Disadvantages:**

- Expensive to start and maintain power plants.
- Safety concerns.
- Waste that remains toxic for many years.
- Non-renewable

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Nuclear fusion is the process of fusing nuclei into heavier nuclei resulting in MUCH more energy than fission

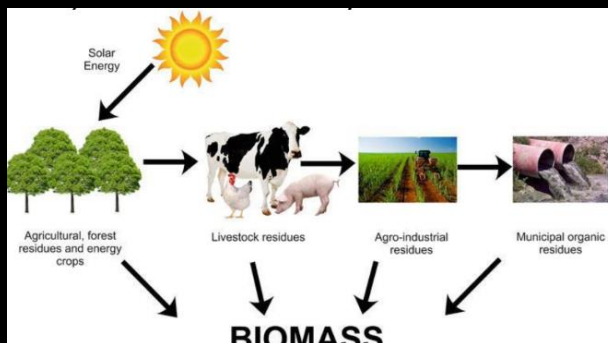
Geothermal energy is energy coming from the hot stuff in earth's core, it is non-renewable, but it will never run out, it is used to heat water which then will produce steam



Advantages	Disadvantages
Geothermal energy sourcing is good for the environment.	The extraction of geothermal energy causes greenhouse emissions.
Geothermal energy is a reliable source of renewable energy.	There is a possibility of depletion in geothermal sources.
Geothermal systems have high efficiency.	There is a high-cost investment needed for geothermal systems.
There is no too little geothermal system maintenance needed.	It is hard to implement geothermal systems in big cities.
There is an unlimited supply of geothermal energy.	Geothermal reservoirs cannot easily be found.

Biomass (renewable)

Is generated or produced by living or once living organisms, the most common materials used are plants such as corn or soy

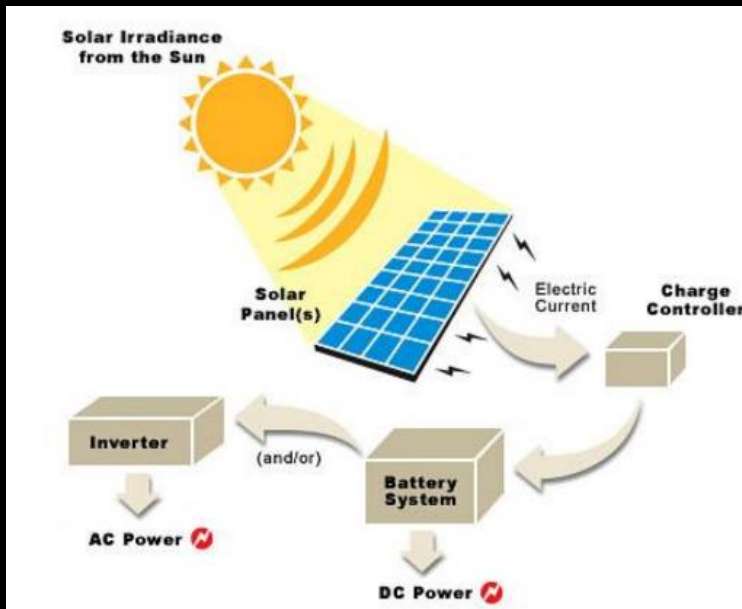


Solar energy

Solar energy is created by nuclear fusion that takes place in the sun. Fusion occurs when protons of hydrogen atoms violently collide in the sun's core and fuse to create a helium atom. This process, known as a PP (proton-proton) chain reaction, emits an enormous amount of energy.

Photovoltaic energy is energy associated with converting solar radiation into electricity, it was discovered by placing silver-chloride in an acidic solution and then exposing it to sunlight, the platinum electrodes attached to it generated an electric current

solar panels are a bunch of solar cells

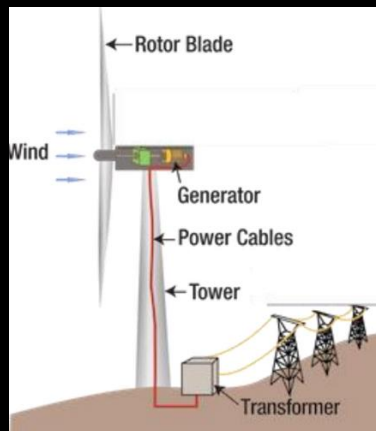


Advantage	Disadvantage
Renewable & Pollution Free	Needs Lots of Space
Reduce Electricity Bill	High Initial Cost
Less to No Maintenance for Years	No Solar Power at Night & Cloudy Days
More Solar Energy in Summer	Less Solar Energy in Winter
Diverse Application	DC Equipment are Expensive
Can be Stored in Battery	Expensive Battery

Wind power (renewable)

The wind blows the blades of turbines attached to a router that spins a generator to create electricity, there are two types of wind turbines

- **Horizontal axis (HAWTs)** are the most common type, they have two or three long thin blades that look like airplane propellers, they are made so that they face the wind directly
- **Vertical axis (VAWTs)** have shorter wider curved blades that resemble the beaters in electric mixers



Advantage	Disadvantage
The wind power industry creates employment opportunities.	Wind turbines can only be successfully installed in specific areas.
Wind energy has relatively low operating expenses.	Wind turbines are really quite difficult and expensive to install.
It is an everlasting and renewable energy source.	Wind blades include a safety concern to individuals working near them in windy conditions.
We are gradually reducing our reliance on fossil fuels by embracing wind energy to create electricity.	To be efficient and effective, a wind turbine necessitates a continuous supply of wind energy and is wholly unpredictable.

Steam turbines are turbines that convert the kinetic energy of fluids into mechanical energy

- Burning fossil fuels in a boiler produces steam that turns turbine blades that generates energy
- Nuclear powered steam turbines use the energy produced from fission/fusion to heat water to steam which then turns the blades producing energy

Hydroelectric power is electrical power derived from the flow of water

Some examples such as

- **Falling water systems** rely on water falling to produce mechanical energy then converted to electricity
- **River current systems** rely on water flowing in a river to produce mechanical energy then converted to electricity



Hydroelectric power is compared in production rates to fossil fuels, plus, its renewable and there is little air pollution



Advantages	Disadvantages
Reduces consumption of fossil fuels for electricity production	Dirt can build up at dams, decreasing their effectiveness
Reduces production of greenhouse gases, such as CO_2	Large-scale wildlife habitat destruction due to river valley flooding
Reduces production of pollution, such as particulate matter	Interferes with natural wildlife migration patterns, such as salmon
Can prevent uncontrolled flooding	Dam construction forces people to leave their homes if they live in or near the flooded river valley
Provides water for irrigation	Very expensive to build
Creates areas for certain types of recreation, such as boating and fishing	Reduces areas for certain types of recreation, such as fishing, camping, hunting, hiking
Is a renewable energy source!	Interferes with natural flow of water through environment
	If natural fisheries are affected, harms the livelihoods of people who rely on those fisheries to make a living
	Requires maintenance
	Can fail catastrophically!

