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CSS2022: Differentiate between renewable and non-renewable energy sources. Briefly explain wind energy, solar energy and biofuels.

Answer 8

1. Difference between renewable and non-renewable energy sources:

Aspect	Renewable Energy Source	Non-renewable Energy source
1) Source Availability	These are derived from naturally replenishing resources such as Sunlight, wind, water	These are derived from finite resources
2) Environmental Impact	Generally, renewable resources have lower environmental impact, they emit fewer greenhouse gases and pollutants during energy production.	They tend to have higher environmental impact, contributing to air and water pollution
3) Sustainability	They are considered sustainable; essentially inexhaustible on a human timescale.	They are limited in supply and can be exhausted over time, leading to depletion
1) Energy Security	Offers greater security by reducing dependence on imported fuels and reducing vulnerability to supply disruptions	They are prone to energy insecurity due to reliance on limited imported resources, subject to geopolitical tensions
5) Cost	Generally enjoys lower upfront costs but lower operating costs	Often involves lower upfront costs but higher ongoing fuel expenses.

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2- **Wind energy:**

Wind energy is generated by harnessing the kinetic energy of wind using wind turbines. Wind turbines convert rotational energy of the wind into electricity. The initial costs of installing turbine and other infrastructure is generally high, but ongoing operating costs are relatively low. However, the cost of wind energy can vary depending on factors such as wind speed, turbine efficiency, and project scale

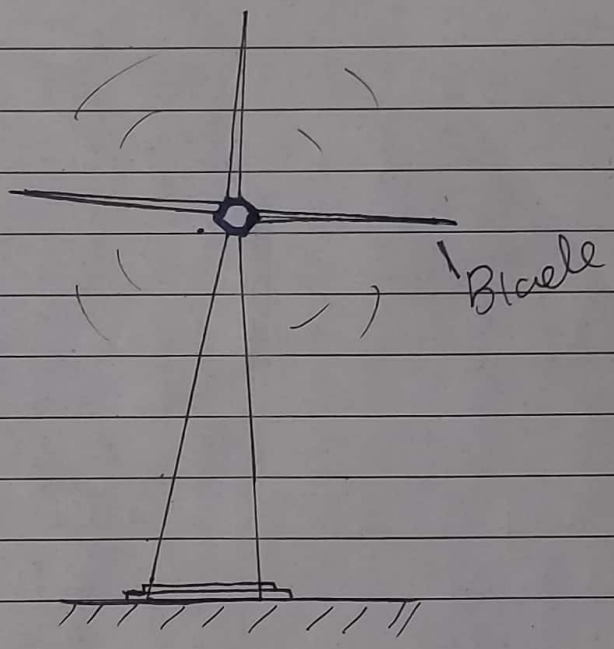

Figure: Wind Turbine.

3- **Solar energy**

Solar energy is derived from sunlight and can be harnessed using photovoltaic (PV) panels or solar thermal systems. PV panels convert sunlight directly into electricity, while solar thermal systems use

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sunlight to heat water or other fluids to generate electricity. Initial installation costs can vary depending on factors such as location, system size, and local incentives, but solar energy is generally considered cost-effective over the long term, with low operating costs once installed.

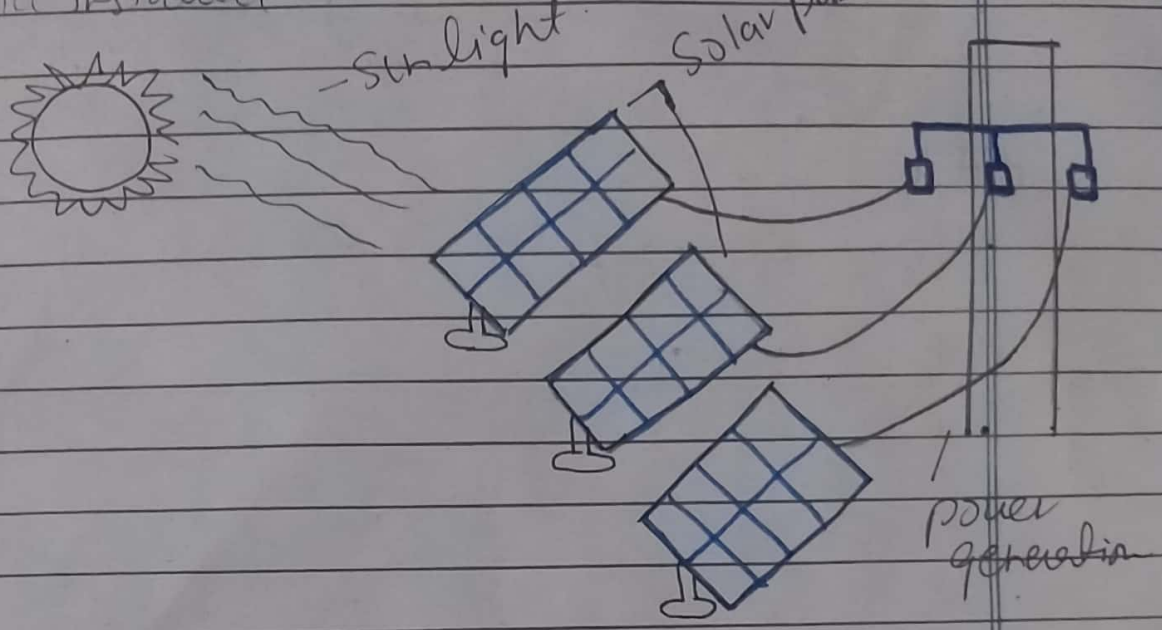

Figure : Solar panels

4- Biofuels

Bioenergy is energy derived from biofuels. Biofuels are derived from directly or indirectly from organic material - biomass - including plant materials and animal waste. They can be used to produce liquid fuels such as ethanol or biodiesel, which can be used as alternatives to conventional fossil fuels in transportation and heating. Biofuels are typically more expensive than fossil fuels, but ongoing research and development aim to improve

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efficiency and reduce costs.