EES End Sem Set C

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Q-3 Solar Cookers

Solar cookers are used to harness solar energy for cooking purposes. It is a renewable source that makes use of solar energy to cook food.

There are mainly 4 main types of solar cookers –

① Box type solar cookers

② Dish type solar cookers

③ Community Solar cookers

and ④ Advance solar cookers

Explanation about Box Type Solar Cookers →

① This cooker is simpler in construction and operation.

② An insulated box of blackened Aluminium(AL) contains the utentils of food material

③ This solar cooker receives direct radiation and also reflected radiation from a reflected mirror fixed on inner side of the box cover which is hinged to one side of the box

④ The angle of reflector can be adjusted as required A glass cover consisting of two layers of clear window glass is used inside.

Diagram of Box solar cooker

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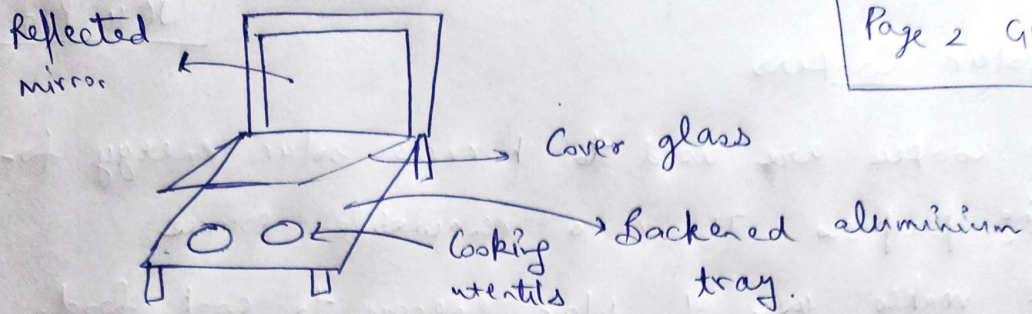

Q-4 Explain about the following terms →

(a) Solar Radiation → Solar radiation is the radiation reflected back to space from both the Earth and the atmosphere. Earth and atmosphere absorbs solar radiation upto an extent. There are types of solar radiation - direct and diffuse.

(b) Solar Air Mass -

It is defined as the ratio of distance that solar radiation travels through the Earth's atmosphere (path length), to the distance it would travel if the Sun is directly overhead.

Air Mass = sec(z), where θ_z is the Solar zenith angle

$$\sec(z) = \frac{1}{\cos(z)}$$

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Q4 (c) Solar window

Solar window represents the effective area through which useful levels of sunlight pass throughout the year in specific location. Solar window is used to determine potential shading when designing a photovoltaic system.

(d) Solar insulation → It is the amount of solar energy that ~~it~~ strikes a square meter of earth's surface in a single day. The average incoming solar radiation is called solar insulation, this value is 342 w/m².

(e) Solar constant → Solar constant is the rate at which the solar energy, at all wavelengths, is received per unit area at top level of Earth's atmosphere. Its value is 1368 w/m², which is four times that of solar insulation value.

~~Q5 Gasification of Biogass →~~

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Q-5 Gasification of Biomass →

Partial combustion of biomass produces Carbon monoxide (CO) and hydrogen (H_2). which are combustible gases and the gas produced in this way is called producer gas.

→ Reaction takes place at temperature of about 1000°C. Partial combustion is facilitated by supplying less air than required.

Gasification Reactions in a gassifier are as follows →

① Drying → Biomass fuels usually contain upto 35% moisture. When biomass is heated to around 1000°C the moisture get converted to steam.

② Pyrolysis → After drying, as the biomass is heated, it undergoes pyrolysis. Pyrolysis is the thermal decomposition of biomass fuels in the absence of oxygen. Biomass gets decomposed into solid charcoal and liquid tars.

③ Oxidation → Air is introduced then in the gasifier in the oxidation phase. This oxidation takes place at about 700-1400°C in which carbon solidified fuel reacts to oxygen in air producing CO_2 and heat

Q.5 $C + O_2 = CO_2 + 406\ KJ/gmol$

(d) Reduction → At higher temperatures and under reducing conditions, several reactions take place which result in formation of CO, H_2 and CH_4

$CO_2 + C \rightarrow 2CO + (176.6)\ KJ/gmol$

$C + H_2O \rightarrow CO + H_2 - 131.4\ KJg/mol$

$CO_2 + H_2 \rightarrow CO + H_2O - 41.2\ KJg/mol$

$C + 2H_2 \rightarrow CH_4 + 75\ KJ/g.mol$

Producer gas

$CO = 19\%$.
$H_2 = 18\%$.
$N_2 = 5\%$.
$CH_4 = 3\%$.
$CO_2 = 10\%$.

Q.6 Application of Wind Energy

The power of wind (flowing air) is harnessed by wind turbines to generate electricity. This is how wind energy is utilized.

Applications

1. Electricity production
2. Wind energy for water application
3. Water pumping
4. ~~Indust~~

Q-6 (5) Industrial Application
→ Telecommunications
→ Weather stations
(6) Wind Mills.
(7) For hydropower applications

Since, wind energy is renewable, it is utilized in industrial, and electricity sectors majorly.

Advantages from Environmental Application

(1) It is safe, clean and renewable source of energy.
(2) No air/water pollution or any waste generated from wind mills. So, they are environmental ~~frei~~ friendly.
(3) They have minimal effect on local ecosystem. This means farming can be done alongside wind mills.
(4) They make us less dependent on non-renewable sources of energy.

Disadvantage

(1) Birds can come in contact with ~~mt~~ wind mills and can die
(2) Noise pollution is caused by wind turbines.
(3) They are a threat to wildlife in case when an entire forest is cut down to plant many wind turbine
(4) A lot of money required for installation and maintenance.

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Q-7 Composition and fuel properties of Wood

① Fuel Wood / Virgin wood is the oldest source of biomass energy and main source of energy used by humanity for many years

② Direct combustion is the simplist way to produce heat energy from fuel wood. Its density is 16-20 MJ/kg.

③ Convential household use stove (Chulhas), which has only 5% efficiency

④ Now, innovation is shifted towards improved stoves and use of pressure cookers for better utilization of fuel.

Charcoal

→ It is a clean and smokeless, dry, solid fuel of black carbon.

→ This has 75-80% per-cent carbon content and has energy density of about 30 MJ/kg.

→ obtained from carbonization process of woody biomass to get better energy mass densities.

→ Chemical grade charcoal has many uses proved in the laboratories and industrial Chemical processes.

→ It is also used in making steel.

→ Charcoal has impurity absorbing capabilities. So, it is also used in facewashes and to purify water.

Q-8 Wave Energy

→ Wave power is the power to capture energy of wind waves to do useful work. The major application are electricity generation, water desalination and pumping water.

→ A machine that harnesses wave power is called wave energy converter. (WEC)

→ Wave power is distinct from tidal power which captures the energy of current caused by the gravitational pull of Moon and Sun.

→ Not widely employed.

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Q-3 Tidal Energy

Tidal energy is harnessed by converting energy from tides into useful forms of power, mainly electricity and water desalination

→ Since, tides are more predictable because of movements of Sun and Moon, there is a bigger impact of this becoming most used renewable energy in future.

→ Axial and cross-flow turbines are used to indicate tidal power, which is then converted to useful forms of energy.

Thanks