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1. Discuss the advantages and disadvantages of solar PV cell.

Answer :-

Advantages:-

- Electricity produced by solar cells is clean and silent. Because they do not use fuel other than sunshine, PV systems do not release any harmful air or water pollution into the environment, deplete natural resources, or endanger animal or human health.
- Photo-voltaic systems are quiet and visually unobtrusive.
- Small-scale solar plants can take advantage of unused space on rooftops of existing buildings.
- PV cells were originally developed for use in space, where repair is extremely expensive, if not impossible. PV still powers nearly every satellite circling the earth because it operates reliably for long periods of time with virtually no maintenance.
- Solar energy is a locally available renewable resource. It does not need to be imported from other regions of the country or across the world. This reduces environmental impacts associated with transportation and also reduces our dependence on imported oil. And, unlike fuels that are mined and harvested, when we use solar energy to produce electricity we do not deplete or alter the resource.
- A PV system can be constructed to any size based on energy requirements. Furthermore, the owner of a PV system can enlarge or move it if his or her energy needs change. For instance, homeowners can add modules every few years as their energy usage and financial resources grow. Ranchers can use mobile trailer-mounted pumping systems to water cattle as the cattle are rotated to different fields.

Disadvantages:-

- Some toxic chemicals, like cadmium and arsenic, are used in the PV production process. These environmental impacts are minor and can be easily controlled through recycling and proper disposal.
- Solar energy is somewhat more expensive to produce than conventional sources of energy due in part to the cost of manufacturing PV devices and in part to the conversion efficiencies of the equipment. As the conversion efficiencies continue to increase and the manufacturing costs continue to come down, PV will become increasingly cost competitive with conventional fuels.
- Solar power is a variable energy source, with energy production dependent on the sun. Solar facilities may produce no power at all some of the time, which could lead to an energy shortage if too much of a region's power comes from solar power.

2. State the advantages and limitations of fuel cells.

Answer :-

Advantages of Fuel Cells:-

i) **High efficiency** – Most fuel cells are 60%-80% energy efficient. However, this efficiency can increase to 85%, when these fuel cells are used in a co-generation system.

ii) **Clean** – Fuel cells work with little to no emissions, the only byproducts being electricity, heat and water. They are thus, much cleaner than traditional power generation, producing 97% less nitrogen oxide emissions than the thermal power plants.

iii) **Scalable** – can be stacked onto one another

iv) **No Noise** – More silent in operation when compared to the conventional sources of power generators. There are no moving parts in a fuel cell stack, making them quieter.

v) **Low Maintenance** – Though the initial cost is higher, fuel cell technology does not involve much maintenance. Fuel cells do not degrade over time, unlike batteries, and can, therefore, provide electricity continuously.

Limitations of Fuel Cells:-

The fuel cell technology has failed to gain much popularity and some have reasons to believe that they might not become economically competitive with other clean technologies. One of the major criticism of this technology is the challenge in production, transportation, flammability and storage of hydrogen gas, which is the main constituent in the fuel cells.

Though the technology has been around three decades now, still much work/ research is yet to be done. As such, the technology is still costly to use. Moreover, critics argue that fossil fuel is still needed to separate hydrogen and oxygen atoms. The fuel cell technology would not be viable if there was no fossil fuel. However, one may still argue that the amount of fossil fuel used will be way lesser than what is used in the conventional vehicles. Lack of proper infrastructure in the form of recharging stations also stunts the growth of fuel cell vehicles. The absence of proper hydrogen infrastructure to supply hydrogen fuel is a major disadvantage too.

3. Write the advantages and disadvantages of tidal power generation.

Answer :-

Advantages of Tidal Energy:-

1 Renewable

Tidal Energy is a renewable energy source. This energy source is a result of the gravitational fields from both the sun and the moon, combined with the earth's rotation around its axis, resulting in high and low tides.

It is this difference in potential energy that is the source of power generation from tidal energy, whether we are talking about stream generators, tidal barrages or more the more recent technology, dynamic tidal power (DTP).

So, why is tidal energy renewable? Compared to fossil fuels or nuclear reserves, the gravitational fields from the sun and the moon, as well as the earth's rotation around its axis won't cease to exist any time soon.

2 Green

Tidal power is an environmentally friendly energy source. In addition to being a renewable energy, it does not emit any climate gases and does not take up a lot of space.

However, there are currently very few examples from real tidal power plants and their effects on the enviroment. An important task is therefore to study and assess these things.

3 Predictable

Tidal currents are highly predictable. High and low tide develop with well-known cycles, making it easier to construct the system with right dimensions, since we already know what kind of powers the equipment will be exposed to.

Because of this, even though the turbines that are being used (tidal stream generators that is) are very similar to wind turbines, both the physical size and the installed capacity has entirely other limitations.

4 Effective at Low Speeds

Water has 1000 times higher density than air, which makes it possible to generate electricity at low speeds. Calculations show that power can be generated even at 1m/s (equivalent to a little over 3ft/s).

5 Long Lifespans

We have no reason to believe that tidal power plants are not long lived. This ultimately reduces the cost these power plants can sell their electricity, making tidal energy more cost-competitive. The tidal barrage power plant La Rance was opened already in 1966 and still generates large amounts of electricity.

Disadvantages of Tidal Energy:-

1 Environmental Effects

As previously mentioned, the effects tidal power plants have on the environment are not completely determined yet. We know that these power plants generate green electricity

Tidal barrages relies on manipulation on ocean levels and therefore potentially have the environmental effects on the environment similar

to those of hydroelectric dams. Technological solutions that will resolve some of these issues are currently being developed.

2 Close to Land

Tidal power plants needs to be constructed close to land. This is also an area where technological solutions are being worked on. Hopefully in a few years we can exploit weaker tidal currents, at locations further out in the sea.

3 Expensive

It is important to realize that the methods for generating electricity from tidal energy is a relatively are relatively new technologies. It is projected that tidal power will be commercially profitable within 2020 with better technology and larger scales.

4. Discuss the advantages and disadvantages of biomass energy?

Answer :-

Advantages of biomass energy are:-

1. **Biomass is always and widely available as a renewable source of energy.**

The organic materials used to produce biomass are infinite, since our society consistently produces waste such as garbage, wood and manure.

2. **It is carbon neutral.**

As a natural part of photosynthesis, biomass fuels only release the same amount of carbon into the atmosphere as was absorbed by plants in the course of their life cycle.

3. **It reduces the overreliance of fossil fuels.**

Not only is there is a limited supply of fossil fuels, but fossil fuels come with environmental baggage, including the release of large amounts of

carbon dioxide into the atmosphere and the pollutants that result from removal, transportation and production.

4. Is less expensive than fossil fuels.

While fossil fuel production requires a heavy outlay of capital, such as oil drills, gas pipelines and fuel collection, biomass technology is much cheaper. Manufacturers and producers are able to generate higher profits from a lower output.

5. Biomass production adds a revenue source for manufacturers.

Producers of waste can add value by channeling their garbage to create a more profitable use in the form biomass energy.

6. Less garbage in landfills.

By burning solid waste, the amount of garbage dumped in landfills is reduced by 60 to 90 percent, and reduces the cost of landfill disposal and amount of land required for landfill.

<u>Disadvantages of biomass energy :-</u>

1. Biomass energy is not as efficient as fossil fuels

Some biofuels, like Ethanol, is relatively inefficient as compared to gasoline. In fact, it has to be fortified with fossil fuels to increase its efficiency.

2. **It is not entirely clean**

While biomass is carbon neutral, the use of animal and human waste escalates the amount of methane gases, which are also damaging to the environment. Additionally, the pollution created from burning wood and other natural materials can be considered just as bad as that resulting from burning coal and other types of energy resources.

3. Can lead to deforestation.

Since wood is one of the most used source of biomass energy, vast amounts of wood and other waste products have to be burned to

produce the desired amount of power. While currently there is enough wood waste already, there is a risk of deforestation in the future.

4. **Biomass plants require a lot of space.**

While it's difficult to find a plant that is in a convenient place in an urban area, utilizing onsite hardware like the BioMax® technology, companies can create biomass energy at a fraction of the space of a large facility.

While there are some downsides to biomass energy, more research and innovation is continuing to be devoted to the field as a more widely available, cheaper alternate and valuable substitute for traditional electricity and other energy sources.