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Basic Perspectives of Solar Energy

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ABSTRACT: Solar energy is radiant light and heat from the Sun that is harnessed using a range of technologies such as solar power to generate electricity, solar thermal energy (including solar water heating), and solar architecture. It is an essential source of renewable energy, and its technologies are broadly characterized as either passive solar or active solar depending on how they capture and distribute solar energy or convert it into solar power. Active solar techniques include the use of photovoltaic systems, concentrated solar power, and solar water heating to harness the energy. Passive solar techniques include orienting a building to the Sun, selecting materials with favorable thermal mass or light-dispersing properties, and designing spaces that naturally circulate air. The large magnitude of solar energy available makes it a highly appealing source of electricity. Solar energy has been the cheapest source of Electricity. In Saudi Arabia a power purchase agreement (ppa) have been signed for a new solar power plant in Al-Faisaliah. The project has recorded the world's lowest cost for Solar PV electricity production of USD 1.04 cents/ kWh. In 2011, the International Energy Agency said that "the development of affordable, inexhaustible and clean solar energy technologies will have huge longer-term benefits. It will increase countries' energy security through reliance on an indigenous, inexhaustible, and mostly import-independent resource, enhance sustainability, reduce pollution, lower the costs of mitigating global warming These advantages are global.

KEYWORDS: solar, energy, heating, techniques, electricity, pollution, resource, sustainability

I. INTRODUCTION

The amount of sunlight that strikes the earth's surface in an hour and a half is enough to handle the entire world's energy consumption for a full year. Solar technologies convert sunlight into electrical energy either through photovoltaic (PV) panels or through mirrors that concentrate solar radiation. This energy can be used to generate electricity or be stored in batteries or thermal storage. Solar radiation is light – [1,2] also known as electromagnetic radiation – that is emitted by the sun. While every location on Earth receives some sunlight over a year, the amount of solar radiation that reaches any one spot on the Earth's surface varies. Solar technologies capture this radiation and turn it into useful forms of energy. There are many types of solar energy technologies—

Photovoltaics Basics

This is utilized in solar panels. When the sun shines onto a solar panel, energy from the sunlight is absorbed by the PV cells in the panel. This energy creates electrical charges that move in response to an internal electrical field in the cell, causing electricity to flow.

Concentrating Solar-Thermal Power Basics

Concentrating solar-thermal power (CSP) systems use mirrors to reflect and concentrate sunlight onto receivers that collect solar energy and convert it to heat, which can then be used to produce electricity or stored for later use. It is used primarily in very large power plants.

Systems Integration Basics

Solar energy technology doesn't end with electricity generation by PV or CSP systems. These solar energy systems must be integrated into homes, businesses, and existing electrical grids with varying mixtures of traditional and other renewable energy sources.



Soft Costs Basics

A number of non-hardware costs, known as soft costs, also impact the cost of solar energy. These costs include permitting, financing, and installing solar, as well as the expenses solar companies incur to acquire new customers, pay suppliers, and cover their bottom line. For rooftop solar energy systems, soft costs represent the largest share of total costs.[3,4]

Going Solar Basics

Solar energy can help to reduce the cost of electricity, contribute to a resilient electrical grid, create jobs and spur economic growth, generate back-up power for nighttime and outages when paired with storage, and operate at similar efficiency on both small and large scales.

Solar Industry Basics

Solar energy systems come in all shapes and sizes. Residential systems are found on rooftops across the United States, and businesses are also opting to install solar panels. Utilities, too, are building large solar power plants to provide energy to all customers connected to the grid.

II. DISCUSSION

Solar energy is a powerful source of energy that can be used to heat, cool, and light homes and businesses.

More energy from the sun falls on the earth in one hour than is used by everyone in the world in one year. A variety of technologies convert sunlight to usable energy for buildings. The most commonly used solar technologies for homes and businesses are solar photovoltaics for electricity, passive solar design for space heating and cooling, and solar water heating.

Businesses and industry use solar technologies to diversify their energy sources, improve efficiency, and save money. Energy developers and utilities use solar photovoltaic and concentrating solar power technologies to produce electricity on a massive scale to power cities and small towns.[5,6]

The following solar technologies:

Solar Photovoltaic Technology

Converts sunlight directly into electricity to power homes and businesses.

Passive Solar Technology

Provides light and harnesses heat from the sun to warm our homes and businesses in winter.

Solar Water Heating

Harnesses heat from the sun to provide hot water for homes and businesses.

Solar Process Heat

Uses solar energy to heat or cool commercial and industrial buildings.

Concentrating Solar Power

Harnesses heat from the sun to provide electricity for large power stations.[7,8]

Solar power is energy from the sun that is converted into thermal or electrical energy. Solar energy is the cleanest and most abundant renewable energy source available, and the U.S. has some of the richest solar resources in the world.



Solar technologies can harness this energy for a variety of uses, including generating electricity, providing light or a comfortable interior environment, and heating water for domestic, commercial, or industrial use.

Solar energy is a very flexible energy technology: it can be built as distributed generation (located at or near the point of use) or as a central-station, utility-scale solar power plant (similar to traditional power plants). Both of these methods can also store the energy they produce for distribution after the sun sets, using cutting edge solar + storage technologies. Solar exists within a complex and interrelated electricity system in the U.S., working alongside other technologies like wind power to transition the U.S. to a clean energy economy. All of these applications depend on supportive policy frameworks at the local, state and federal level to ensure consumers and businesses have fair access to clean energy technologies like solar.[9,10]

The Future of Solar Energy considers only the two widely recognized classes of technologies for converting solar energy into electricity — photovoltaics (PV) and concentrated solar power (CSP), sometimes called solar thermal) — in their current and plausible future forms. Because energy supply facilities typically last several decades, technologies in these classes will dominate solar-powered generation between now and 2050, and we do not attempt to look beyond that date. In contrast to some earlier Future of studies, we also present no forecasts — for two reasons. First, expanding the solar industry dramatically from its relatively tiny current scale may produce changes we do not pretend to be able to foresee today. Second, we recognize that future solar deployment will depend heavily on uncertain future market conditions and public policies — including but not limited to policies aimed at mitigating global climate change.

As in other studies in this series, our primary aim is to inform decision-makers in the developed world, particularly the United States. [11,12] We concentrate on the use of grid-connected solar-powered generators to replace conventional sources of electricity. For the more than one billion people in the developing world who lack access to a reliable electric grid, the cost of small-scale PV generation is often outweighed by the very high value of access to electricity for lighting and charging mobile telephone and radio batteries. In addition, in some developing nations it may be economic to use solar generation to reduce reliance on imported oil, particularly if that oil must be moved by truck to remote generator sites. A companion working paper discusses both these valuable roles for solar energy in the developing world.[13,14]

Advantages of solar energy are:

- Clean: It is considered to be the cleanest form of energy as there is no carbon dioxide emission like in the case of fossil fuels which is one of the causes of global warming.
- Renewable: There is ample energy available on earth as long as the sun exists.
- Reliable: The energy can be stored in the batteries, so there is no unreliability.
- reduction in utility costs.
- Free energy because it can be trapped easily.

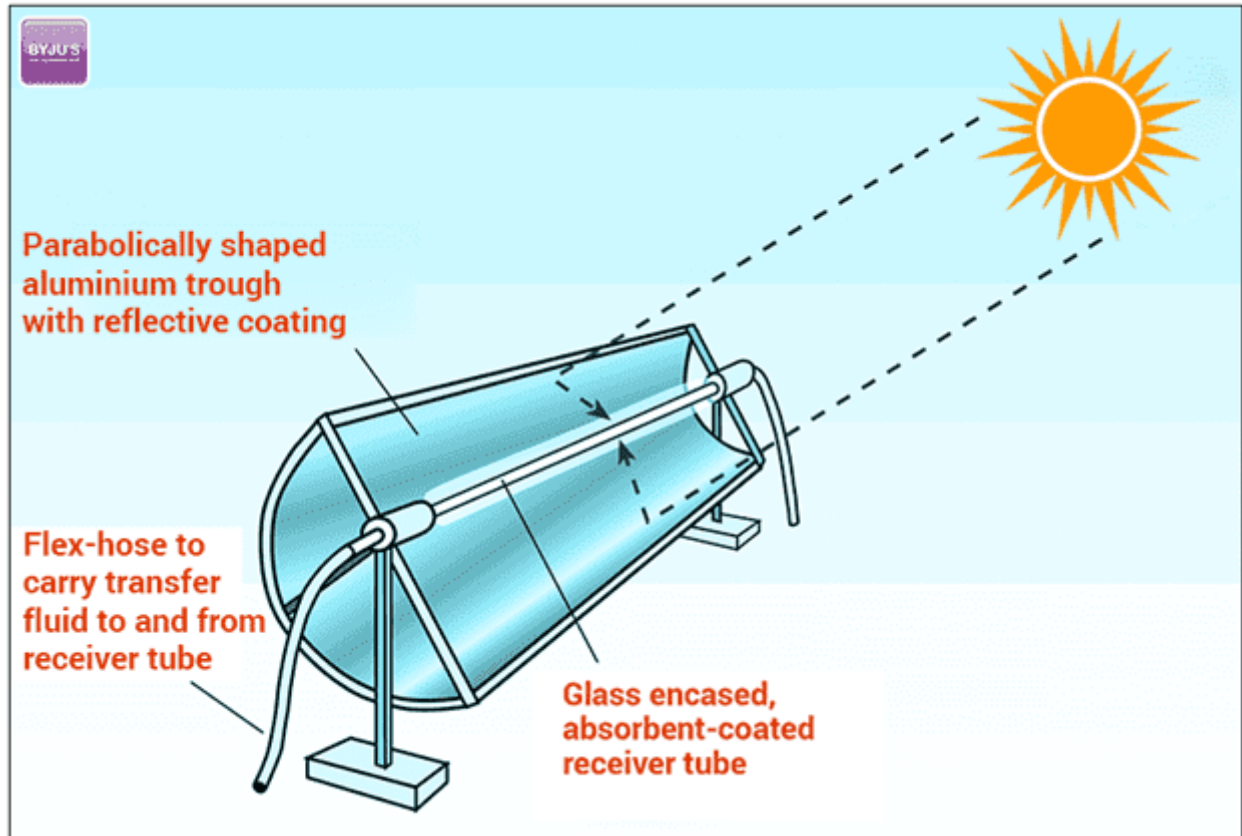
Disadvantages of solar energy:

- The production is low during winters and on cloudy days.
- Installation and the initial cost of the materials are expensive.
- Space consumption is more.

Solar energy – the experiment on the efficiency of the solar heating working model is one of the easiest science experiments that you can prepare for your school fair science project. This working model is quick, simple and very informative.[15,16]

The result may vary if the project is performed outdoors due to the wind and weather conditions, so it is recommended to conduct the experiment indoors.

In this solar heater project, reflectors concentrate the solar energy in one small place to collect and store heat energy. In this experiment, you will see the efficiency of solar energy.



Solar Energy Project

Materials Required

1. A wooden stand
2. Thermometer
3. A concave or converging mirror
4. Tube to flow liquid.
5. Black paper

Procedure

1. Mount the wooden stand
2. Roll pieces of black paper around the tube.
3. Attach the tube in the concave mirror in a way where the sunlight concentrates in one direction.
4. Fill the tube with tap water
5. After 30 minutes, record the temperature of the tube.

Observations

To calculate the efficiency of the concave mirror solar heater, you can divide the temperature increase by the direct sunlight. Eventually, the temperature of the water increases after 30 minutes as the heat is transferred through the concave mirror and concentrated on the tube.



Uses of Solar Energy

- **Water heating:** Solar energy is used to replace electric heaters and gas as efficiency is more with 15-30%.
- **Heating of swimming pools:** Solar blankets are used to keep the pool warm. The other way is by using a solar water heater to keep the water warm.
- **Cooking purposes:** Solar cookers are used for cooking food. Solar energy is used to heat, cook and pasteurize food. A solar cooker consists of an elevated heat sink such that when food is placed in it, it gets cooked well.[17,18]

III. CONCLUSIONS

Solar power is the key to a clean energy future. Every day, the sun gives off far more energy than we need to power everything on earth. That's why we're investing heavily in solar plants and why we are now offering solar kits

Limitless solar energy

The sun provides more than enough energy to meet the whole world's energy needs, and unlike fossil fuels, it won't run out anytime soon. As a renewable energy source, the only limitation of solar power is our ability to turn it into electricity in an efficient and cost-effective way.

Solar energy - a clean source

No greenhouse gas emissions are released into the atmosphere when you use solar panels to create electricity. And because the sun provides more energy than we'll ever need, electricity from solar power is a very important energy source in the move to clean energy production.[19,20]

No fuel to burn

After solar panels have been installed, operational costs are quite low compared to other forms of power generation. Fuel isn't required, and this means that solar power can create large amounts of electricity without the uncertainty and expense of securing a fuel supply.

Solar power and the environment

As a renewable CO₂-free power source, the environmental impact of solar power is significantly smaller than other power generation methods. The impact is mainly related to the production and supply of the special materials and metals that are required to produce solar panels. The location and the water used to clean the solar panels also affect the environment. We are working hard to find alternative ways to clean our solar panels.[21]

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