
A

INDUSTRIAL TRAINING REPORT
ON STUDY OF SOLAR ENERGY TAKEN AT
COURSERA DIGITAL PLATFORM

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B. TECH

BOARD OF TECHNICAL EDUCATION RAJASTHAN
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Submitted to:

Electrical Engineering Department

Submitted By:

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CERTIFICATE



May 18, 2020

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has successfully completed

Solar Energy Basics

an online non-credit course authorized by The State University of New York and offered through Coursera

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COURSE
CERTIFICATE



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SOLAR ENERGY

- In physics, work is done when a force applied to an object which moves it some distance in the direction of the force.
- Mathematically, $W = Fs$, where W is the work done, F is the force applied, and s is the distance moved.

DIFFERENT ENERGY SOURCES

- 'Traditional' fuels such as fuel wood, crop wastes, and animal dung. (non-commercial)
- Fossil fuels such as coal, oil and natural gas (commercial 'traditional' fuels)
- Non-traditional renewable energy sources as hydro, modern biomass, solar, wind, ocean and geothermal.

ENERGY FORMS

- Solar
- Water
- Wind
- Geothermal



WHAT IS SOLAR ENERGY?

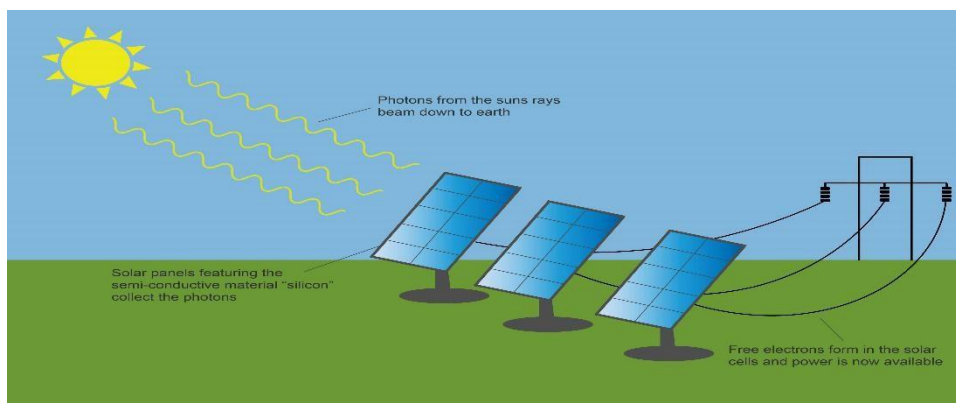
- It is the radiation from the sun that is capable of producing heat, causing chemical reactions, or generating electricity.
- Solar energy is rapidly becoming the ultimate energy source because of its non-polluting character and its inexhaustible supply which are in stark contrast to such fossil fuel sources as coal, oil, and natural gas.

COMPOSITION:

- The Sun emits EM radiation across most of the electromagnetic spectrum.
- The Sun does, however, emit X-rays, ultraviolet, visible light, infrared, and even Radio waves. When ultraviolet radiation is not absorbed by the atmosphere or other protective coating, it can cause damage to the skin known as sunburn or trigger an adaptive change in human skin pigmentation.
- The sunlight that reaches the ground consists of nearly 50% visible light, 45% infrared radiation, and smaller amounts of ultraviolet light and other forms of electromagnetic radiation.
- This radiation can be converted either into: thermal energy or into electrical energy.
- Two main types of devices are used to capture solar energy and convert it into thermal energy:
- Flat-plate collectors and Concentrating collectors.
- The flat plate collectors are used for hot water heating and house heating.

- Concentrating collectors are used when higher temperatures are needed. That is, where they reflect and concentrate sunlight from a wide area.
- Solar energy can be converted to electricity using photovoltaic cells/ solar cells.
- This converted energy is used to provide electricity for watches, calculators and cameras.
- Unfortunately, though solar energy is free, the high cost of its collection, conversion and storage has limited its exploitation.

GENERATION OF SOLAR POWER:



- Solar power is the conversion of sunlight into electricity, either directly using photovoltaics (PV), or indirectly using concentrated solar power (CSP).

- Photovoltaics converts light into electric current using the photoelectric effect.

Energy storage methods:

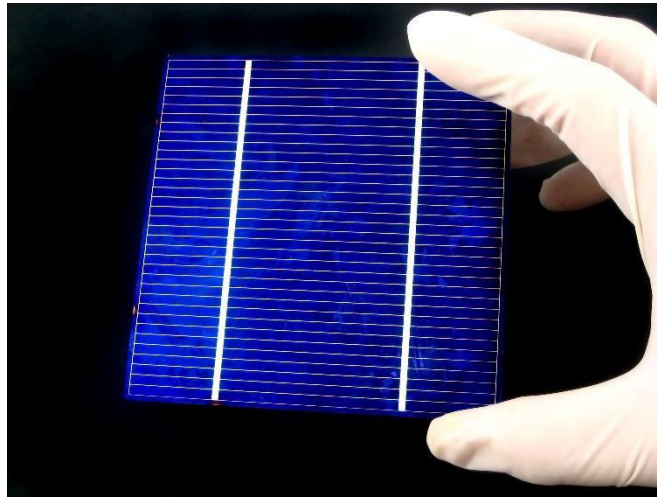
- Solar energy can be stored at high temperatures using molten salts. Salts are an effective storage medium because they are low-cost, have a high specific heat capacity and can deliver heat at temperatures compatible with conventional power systems.

Solar cell:

- A solar cell (also called photovoltaic cell or photoelectric cell) is a solid-state device that converts the energy of sunlight directly into electricity by the photovoltaic effect. Assemblies of cells are used to make solar modules, also known as solar panels. The energy generated from these solar modules, referred to as solar power, is an example of solar energy.
- Cells are described as photovoltaic cells when the light source is not necessarily sunlight. These are used

for detecting light or other electromagnetic radiation near the visible range, for example infrared detectors, or measurement of light intensity.

Solar cell:



- Solar modules/panels A basic structure of a typical solar cell
- Solar technologies are broadly characterized as either passive solar or active solar depending on the way they capture, convert and distribute solar energy.
- Active solar techniques include the use of photovoltaic panels and solar thermal collectors to harness the energy.
- Passive solar techniques include orienting a building to the Sun, selecting materials with favourable thermal mass or light dispersing properties, and designing spaces that naturally circulate air.

- Active solar technologies increase the supply of energy and are considered supply side technologies, while passive solar technologies reduce the need for alternate resources and are generally considered demand side technologies.

Applications of solar energy:

- A partial list of solar applications includes space heating and cooling through solar architecture, potable water via distillation and disinfection, daylighting, solar hot water, solar cooking, and high temperature process heat for industrial purposes.
- To harvest the solar energy, the most common way is to use solar panels.

Agriculture and horticulture:

- Agriculture and horticulture seek to optimize the capture of solar energy in order to optimize the productivity of plants.
- Applications of solar energy in agriculture aside from growing crops include pumping water, drying crops, brooding chicks and drying chicken manure

- More recently the technology has been embraced by vinters, who use the energy generated by solar panels to power grape presses.
- Greenhouses convert solar light to heat, enabling year-round production and the growth (in enclosed environments) of specialty crops and other plants not naturally suited to the local climate.

Solar lighting:



- Daylighting systems collect and distribute sunlight to provide interior illumination.
- Hybrid solar lighting is an active solar method of providing interior illumination.

- Solar thermal technologies can be used for water heating, space heating, space cooling and process heat generation
- Solar hot water systems use sunlight to heat water.

Water treatment:

- Solar distillation can be used to make saline or brackish water potable
- Solar water disinfection (SODIS) involves exposing water-filled plastic polyethylene terephthalate (PET) bottles to sunlight for several hours
- It is recommended by the World Health Organization as a viable method for household water treatment and safe storage
- Solar energy may be used in a water stabilisation pond to treat waste water without chemicals or electricity. Solar water heater.

Cooking:

- Solar cookers use sunlight for cooking, drying and pasteurization. They can be grouped into three broad categories: box cookers, panel cookers and reflector cookers
- A basic box cooker consists of an insulated container with a transparent lid.
- Panel cookers use a reflective panel to direct sunlight onto an insulated container and reach temperatures comparable to box cookers.
- Reflector cookers use various concentrating geometries (dish, trough, Fresnel mirrors) to focus light on a cooking container.

Process heat:

- Solar concentrating technologies such as parabolic dish, trough and Scheffler reflectors can provide process heat for commercial and industrial applications.
- Evaporation ponds are shallow pools that concentrate dissolved solids through evaporation.

- Clothes lines, clotheshorses, and clothes racks dry clothes through evaporation by wind and sunlight without consuming electricity or gas. STEP parabolic dishes used for steam production and electrical generation.

Electrical generation (solar power):

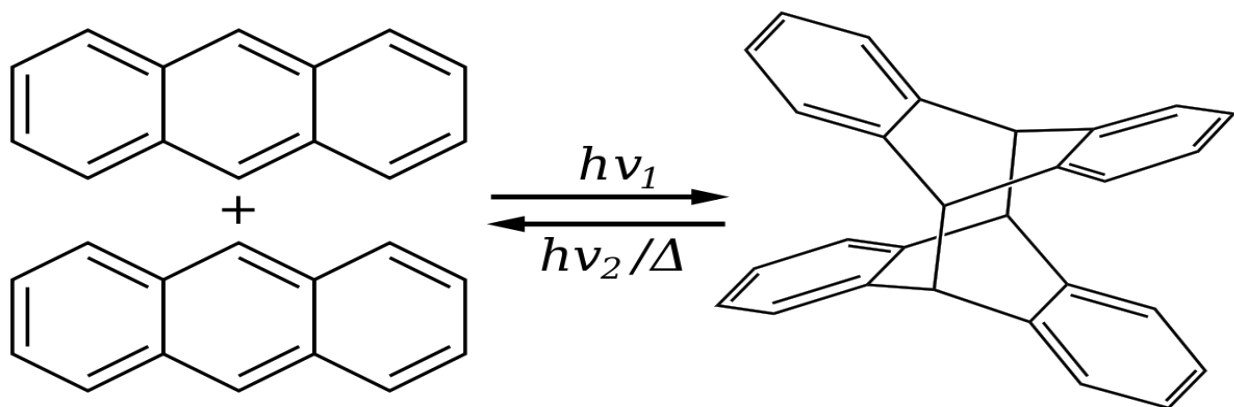
- Solar power is the conversion of sunlight into electricity, either directly using photovoltaics (PV), or indirectly using concentrated solar power (CSP). CSP systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam. PV converts light into electric current using the photoelectric effect.

Experimental solar power:

- A solar pond is a pool of salt water (usually 1–2 m deep) that collects and stores solar energy.

- The pond consisted of layers of water that successively increased from a weak salt solution at the top to a high salt solution at the bottom.
- This solar pond was capable of producing temperatures of 90 °C in its bottom layer and had an estimated solar-to-electric efficiency of two percent.
- Thermoelectric, or thermolytic devices convert a temperature difference between dissimilar materials into an electric current.

Solar chemical:



- Solar chemical processes use solar energy to drive chemical reactions. These processes offset energy that would otherwise come from an alternate source and can convert solar energy into storable and transportable fuels. Solar induced chemical reactions can be divided into thermochemical or photochemical

- Hydrogen production technologies been a significant area of solar chemical research since the 1970s.
- Another approach uses the heat from solar concentrators to drive the steam reformation of natural gas thereby increasing the overall hydrogen yield compared to conventional reforming methods
- Thermochemical cycles characterized by the decomposition and regeneration of reactants present another avenue for hydrogen production.

Solar vehicles:



- Some vehicles use solar panels for auxiliary power, such as for air conditioning, to keep the interior cool, thus reducing fuel consumption
- A solar balloon is a black balloon that is filled with ordinary air.

- Solar sails are a proposed form of spacecraft propulsion using large membrane mirrors to exploit radiation pressure from the Sun.

SOLAR ENERGY PROS:

- Solar panels give off no pollution
- Solar energy produces electricity very quietly.
- It has the ability to harness electricity in remote locations that are not linked to a national grid.
- Very efficient in large areas of the globe.
- Solar panels can be installed on top of many rooftops

- It is affordable in the long run.
- The use of solar energy to produce electricity allows the user to become less dependent on the world's fossil fuel supplies.

SOLAR ENERGY CONS:

- The major con of solar energy is the initial cost of solar cells.
- Solar energy is only able to generate electricity during daylight hours. This means for around half of each day, solar panels are not producing energy for your home.
- The weather can affect the efficiency of solar cells.
- Pollution can be a con of solar energy, as pollution levels can affect a solar cells efficiency, this would be a

major con for businesses or industry wishing to install solar panels in heavily polluted areas, such as cities.

Environmental Effects of Solar Energy:

- Carbon Emissions
- Renewable Energy
- Abundant Components
- Cadmium
- Space Considerations

MEDICAL USES OF SOLAR ENERGY:

- These include, disinfection and sterilization without the use of chemicals. Ultraviolet light is also used to destroy bacteria and viruses.
- It stimulates the immune system and has shown good results in killing blood borne pathogens.
- Some microorganisms destroyed by ultraviolet light are bacillus anthracis, salmonella or food poisoning, shigella dysenteries or dysentery, bacteriophage or E. coli, hepatitis and influenza.
- Ultraviolet light can be combined with other therapies.
- Some kinds of skin conditions can improve with the exposure of ultraviolet light.

Solar Energy Health Effects on Humans are:

- Electromagnetic Radiation from Solar Panels

- Silicon Dust from Solar Panels
- Exposure to Electrical and Chemical Components of Solar Heat Systems
- The Future of Solar Energy
- The body produces vitamin D from sunlight (specifically from the UVB band of ultraviolet light), and excessive seclusion from the sun can lead to deficiency unless adequate amounts are obtained through diet.
- On the other hand, excessive sunlight exposure has been linked to all types of skin cancer caused by the ultraviolet part of radiation from sunlight or sunlamps
- A lack of sunlight, on the other hand, is considered one of the primary causes of seasonal affective disorder (SAD), a serious form of the winter blues. SAD occurrence is more prevalent in locations further from the tropics, and most of the treatments

(other than prescription drugs) involve light therapy
- A recent study indicates that more exposure to sunshine early in a person's life relates to less risk from multiple sclerosis (MS) later in life.

