

PROFESSIONAL TRAINING REPORT
at
Sathyabama Institute of Science and Technology
(Deemed to be University)

Submitted in partial fulfilment of the requirements for the award of
Bachelor of Engineering Degree in
Electrical and Electronics Engineering

By
ANUSHAA.A (39140003)



DEPARTMENT OF ELECTRICAL AND ELECTRONICS
SCHOOL OF ELECTRICAL AND ELECTRONICS
SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY
JEPPIAAR NAGAR, RAJIV GANDHI SALAI,
CHENNAI – 600119. TAMILNADU.

JULY 2020

VATIO ENERGY INDIA PRIVATE LIMITED

VATIO Energy is an efficiency-driven entrepreneurship inspired by a vision of creating a greener tomorrow by harnessing the power of solar energy. In doing so, we seek to improve our customers' daily lives by significantly reducing your electricity bills.

VATIO has provided solar panels and inverters to large corporations and government agencies, and has also helped thousands of individual homeowners with tailor-made solar and energy systems.



1.SOLAR ENERGY

1.a. What is energy?

The simplest definition for energy is "**the ability to do work**". Energy is how things change and move. Energy can take a number of different forms. It takes energy to cook food, to drive to school, and to jump in the air.



1.b. Energy Resources:

There are two types of energy resources

- *Renewable resources

- *Nonrenewable resources

Renewable Energy:

It is referred to as clean energy, comes from natural sources or processes that are constantly replenished.

Non-Renewable Energy:

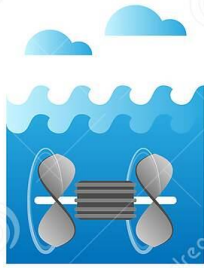
It comes from sources that will run out or will not be replenished for thousands or even millions of years.

ENERGY SOURCES

RENEWABLE ENERGY



Wind



Hydropower



Solar



Geothermal



Biomass

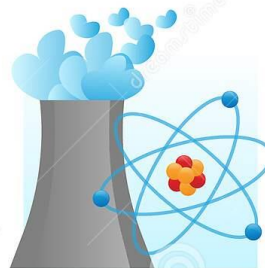
NON-RENEWABLE ENERGY



Oil



Coal



Nuclear



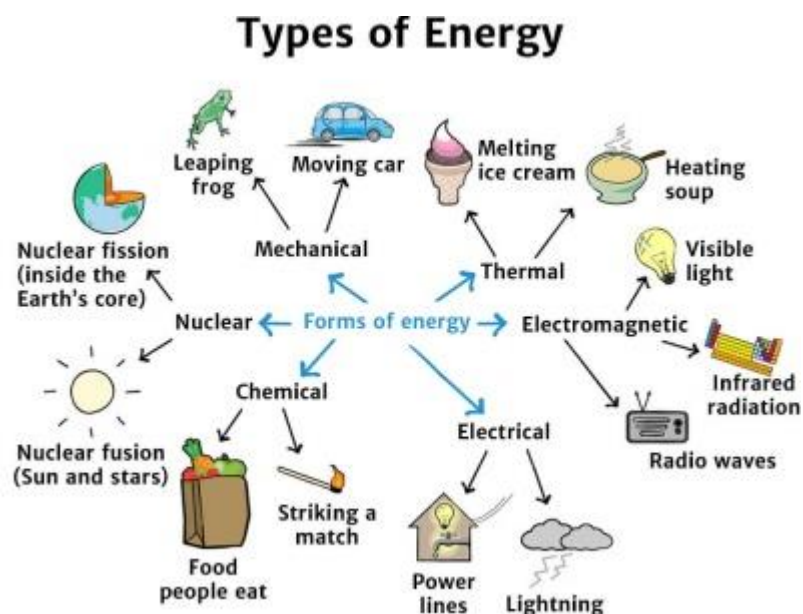
Natural Gas

1.c.Forms of energy:

- *Heat
- *Light
- *Electrical
- *Chemical
- *Gravitational

But the major forms of energy for doing work are

- *Potential or stored energy
- *Kinetic or working energy



1.d.What is solar energy?

Solar energy is radiant light and heat from the Sun that is harnessed using a range of ever-evolving technologies such as solar heating, photovoltaics, solar thermal energy, solar architecture, molten salt power plants and artificial photosynthesis.



1.e. Why solar energy is more effective?

Solar energy is most effective in terms of environmental impact, whereas coal and natural gas are more effective by reliable applications. solar panels typically have an efficiency between 15%and 20%,coal has an efficiency of up to 40% and natural gas efficiency levels reach up to 60%

1.f.Advantages:

- *Solar power is pollution-free and causes no greenhouse gases to be emitted after installation.
- *Reduced dependence on foreign oil and fossil fuels.
- *Renewable clean power that is available every day of the year, even cloudy days produce some power.
- *Return on investment unlike paying for utility bills.

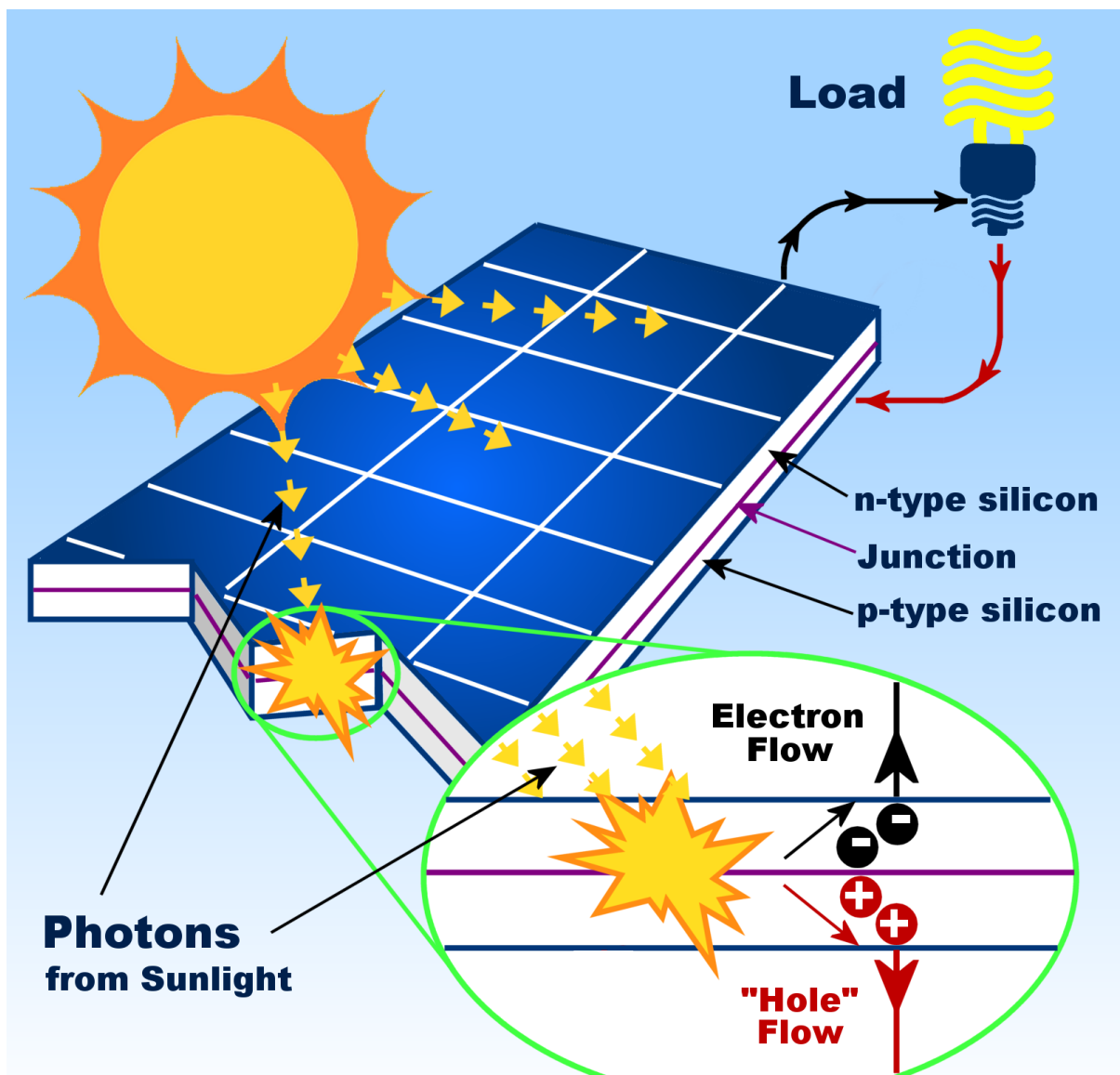
1.g. Disadvantages:

- *High upfront cost. ...
- *The size of system is dependent on your available space. ...
- *Requires sunny weather to work best. ...
- *Manufacturing of solar panels can harm the environment. ...
- *Low energy conversion rate. ...
- *Cannot be used at night. ...
- *Solar panels are fixed at their installed location

2. SOLAR PV

2.a. what is Solar PV?

Solar Panels are commonly called Photovoltaic Panels (PV Panels). Photo means light and voltaic means electricity. Photovoltaic panels are made from Silicon which is the same material that makes up sand. Silicon is heated to extremely high temperatures at a factory, and then formed into very thin layers. When the sunlight hits the PV panel, it moves around tiny particles of silicon called electrons. The silicon electrons travel through the wires that are built into the PV panel to create energy.



2.b. Classification of solar pv modules:

- *Monocrystalline.

- *Polycrystalline.

- *Thin Film.

Monocrystalline :

- *Monocrystalline solar cells, also called "single crystalline" cells are easily recognizable by their coloring. But what makes them most unique is that they are considered to be made from a very pure type of silicon. In fact, monocrystalline solar cells are the most efficient of all; efficiencies have been documented at upwards of 20%.

- *Efficiency - 15 to 22%.

- *Requires less space.

Polycrystalline:

- *Polycrystalline solar cells, also known as polysilicon and multi silicon cells, were the first solar cells ever introduced to the industry, in 1981. Polycrystalline cells do not go through the cutting process used for monocrystalline cells. Instead, the silicon is melted and poured into a square mold, hence the square shape of polycrystalline.

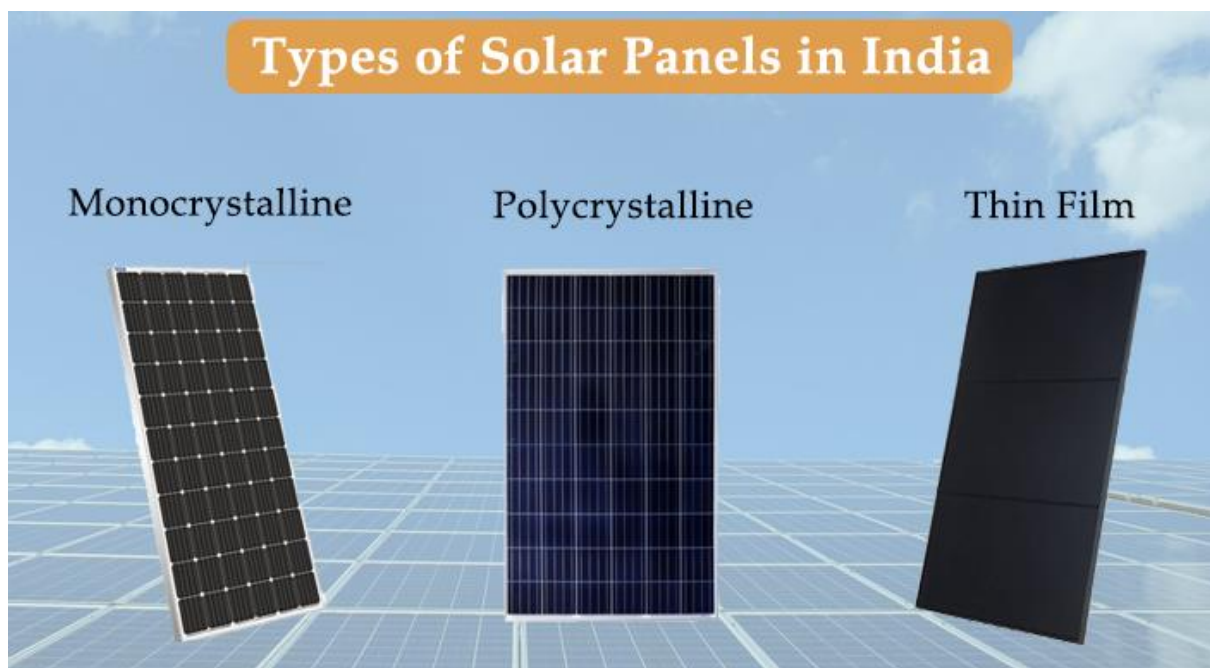
- *polycrystalline solar PV system operated at a 13-16% efficiency.

- *Cheap in cost.

Thin Film:

*Another up and coming type of solar cell is the thin film solar cell with growth rates of around 60% between 2002 to 2007. By 2011, the thin film solar cell industry represented approximately 5% of all cells on the market.

*They typically achieve efficiencies of 7-13%.



2.c.Comparing solar pannel types:

Comparing Solar Panel Types			
SOLAR PANEL TYPE	 Monocrystalline	 Polycrystalline	 Amorphous
GLASS COLOR	Black	Blue	Brown, Gray, Black
COMPOSITION	Single-crystal silicon	Multi-crystal silicon	Thin silicon layer
SIZE	Small (most space efficient)	Larger (less space efficient)	Largest (least space efficient)
PRICE	Premium	Value	Economy
EFFICIENCY	15 - 20%	13 - 16%	6 - 9%

3.INVERTERS

3.a. What is solar inverter ?

A solar inverter is basically a low level computer installed alongside the other component of our solar Energy system. That's invert our Solar energy from direct current (DC) to alternating current (AC).



3.b. Function of inverter in solar pv:

- *Convert DC to AC .
- *Synchronises voltage to the grid.
- *Finding Maximum power point (MPPT).
- *Monitoring Centre for Solar PV roof system.

3.c.Types of solar Inverters:

- *Straight string Inverter.
- *Optimized String Inverter
- *Micro Inverter.
- *Hybrid Inverter.



3.d. Failures in solar inverters:

- *Capacitor wear : The electro-mechanical wear on condensor is the cause.
 - *overuse : using inverter parts beyond thirnoperating limit.
 - *over and under voltage : if either current or voltage rises to point not rated for inverters.
- Ultrasonic vibrations:because of inductive component cores causing friction.

4.CONTROLLERS

4.a. What is charge controller?

A solar charge controller is a solar-powered voltage and current regulator. They are used in off-grid and hybrid off-grid applications to regulate power input from PV arrays to deliver optimal power output to run electrical loads and charge batteries.



4.b.Types of charge controller

There are three different types of solar charge controllers, they are:

- * Simple 1 or 2 stage controls.
- *PWM (pulse width modulated) .
- *Maximum power point tracking (MPPT).

Simple 1 or 2 stage controls.:

Simple 1 or 2 stage controls which rely on relays or shunt transistors to control the voltage in one or two steps. These essentially just short or disconnect the solar panel when a certain voltage is reached.



PWM (pulse width modulated) :

A PWM solar charge controller stands for "Pulse Width Modulation". These operate by making a connection directly from the solar array to the battery bank. During bulk charging, when there is a continuous connection from the array to the battery bank, the array output voltage is 'pulled down' to the battery voltage.



Maximum power point tracking (MPPT):

*An MPPT, or maximum power point tracker is an electronic DC to DC converter that optimizes the match between the solar array (PV panels), and the battery bank or utility grid.



4.c.Comparison with and without MPPT:

WITHOUT MPPT

Solar panel : 130 watts

Battery : 12 volts

Feed to battery : 88.8 watts

WITH MPPT

Solar panel : 130 watts

Battery : 12 volts

feed to battery :129.6 watts

5.BATTERY

5.a. Definition:

Container consisting of one or more cells, in which chemical energy is converted into electricity and used as a source of power.



5.b. Purpose in solar PV:

A battery stores electrical energy in the form of chemical energy. For a PV-battery system to function effectively, the electrochemical processes must work in both directions—in other words, the system must be rechargeable.

5.c. Types of battery:

<u>Distinction between Primary, Secondary & Fuel cells</u>		
Primary	Secondary	Fuel cells
1) It only acts as galvanic or voltaic cell. i.e., produces electricity	1) It acts as galvanic or voltaic cell while discharging (produces electricity) and acts as electrolytic cell (consumes electricity)	1) It is a simple galvanic or voltaic cell. i.e., produces electricity
2) Cell reaction is not reversible.	2) Cell reaction is reversible.	2) Cell reaction is reversible.
3) Can't be recharged.	3) Can be recharged	3) Energy can be withdrawn continuously
4) Can be used as long as the active materials are present	4) Can be used again and again by recharging.	4) Reactants should be replenished continuously. it does not store energy.
eg: Leclanche cell or Dry cell, Lithium cell.	eg: Lead storage battery, Ni-Cd battery, Lithium ion cell	eg: H_2 & O_2 Fuel cell CH_3OH & O_2 Fuel cell
<u>Uses:</u> In Pace makers watches, Transistors, radios ect.	<u>Uses:</u> In electronic equipments, automobile equipments, digital cameras, laptops, flash light.	<u>Uses:</u> Great use in space vehicles due to its light weight (product of is source of fresh water for astronauts)

5.d. Factors affecting capacity of battery:

Other factors that govern the effective capacity are discharge rate and cell temperature. The warmer the cell temperature, the higher the effective capacity, and vice versa. The slower the rate of battery discharge, the higher the effective capacity, and vice versa.