



PROFESSIONAL TRAINING REPORT

Sathyabama Institute of Science and Technology (Deemed to be University)

DEPARTMENT OF ELECTRICAL AND
ELECTRONICSENGINEERING

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VATIO®



Certificate

OF INDUSTRY INTERNSHIP

This is to certify that

SARAN.P

Studying **3rd Year, B.E, EEE** in **SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY**

has successfully completed the Industry Internship Programme at VATIO Energy India Pvt Ltd, Chennai
through Online from 21st July to 05th August 2021 in the area of
"Solar Photovoltaic system & its Design Practices"

Best wishes from VATIO Energy for future endeavors !

G.Rajaganesan, Director - Technical
VATIO Energy India Pvt Ltd.



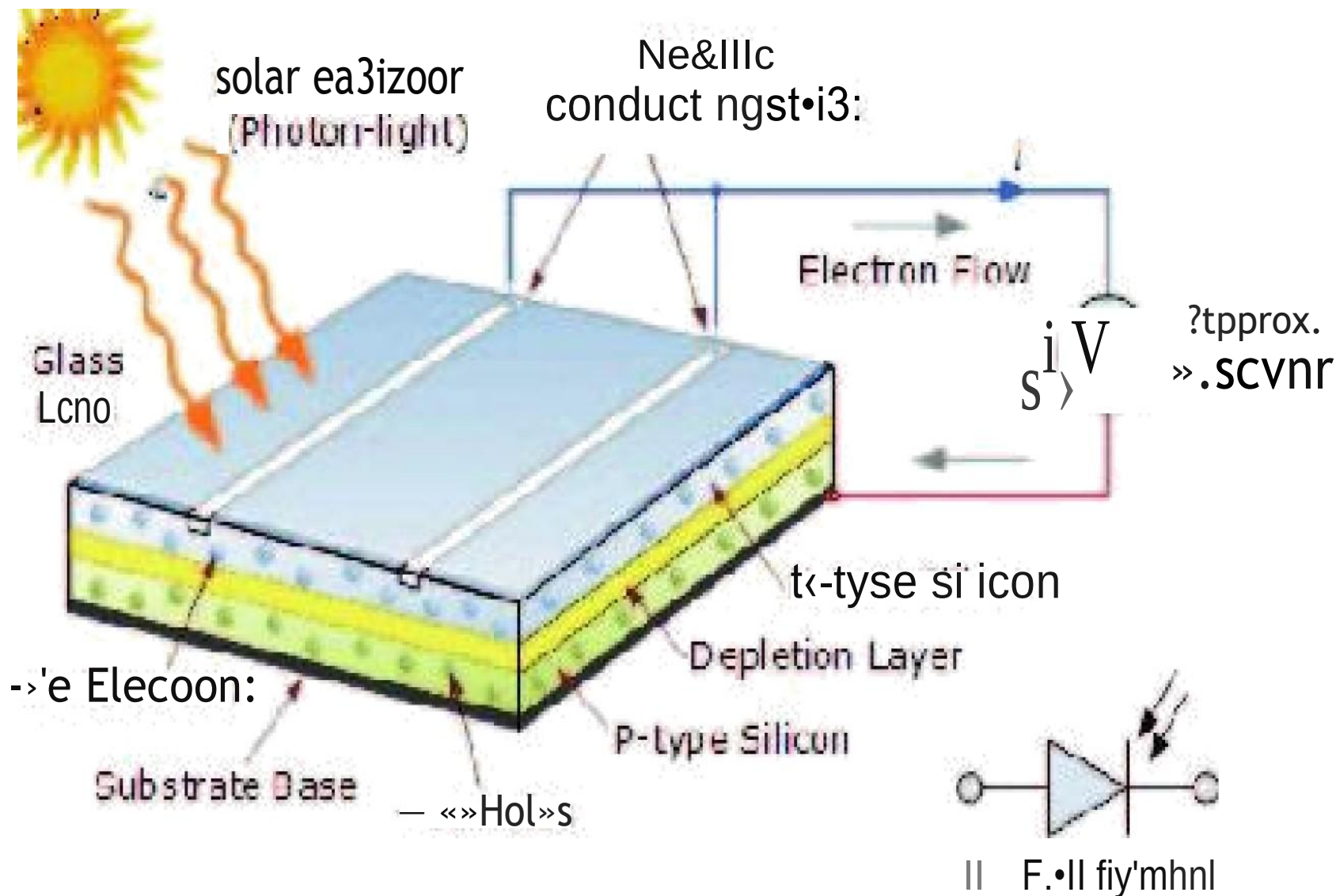
05th August 2021

Date

SOLAR PV

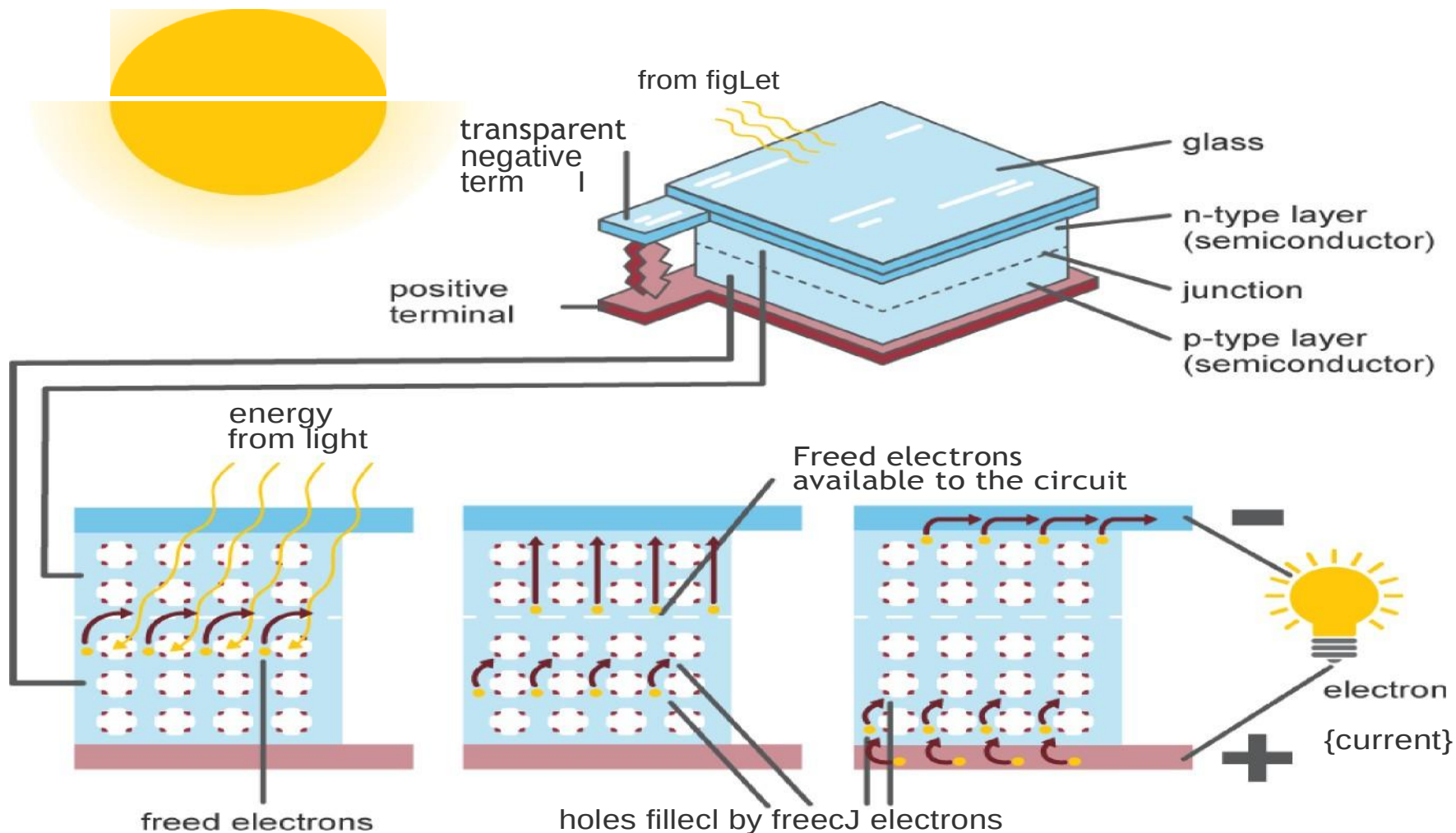
- Solar cell is basic unit of solar energy conversion system, where electrical energy is extracted directly from light energy without any intermediate process.
- Working is depend on photovoltaic effect hence it is called as PV cell.
- A solar cell is semi conductive device, it produce electricity when light strike on it and voltage is established across the terminal of cell is fixed to 0.5 V and it is nearly independent of intensity of incident light whereas current capacity of cell is nearly proportional intensity of incident light as well area that exposed to the light.
- a solar cell has negative front contact and positive back contact and a semiconductor pn junction is in the middle.

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Inni4eapFsatavaltaic cell



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While sunlight falling on the cell the some photons of the light are absorbed by [solar cell](#). Some of the absorbed photons will have energy greater than the energy gap between valence band and conduction band in the semiconductor crystal.

one valence electron gets energy from one photon and becomes excited and jumps out from the bond and creates one electron-hole pair. These electrons and holes of e-h pairs are called light-generated electrons andholes.

The light-generated electrons near the [p-n junction](#)are migrated to n-type side of the junction due to electrostatic force of the field across the junction. Similarly the light- generated holes created near the junction are migrated to p-type side of the junction due to same electrostatic force.

[potential difference](#)is established between two sides of the cell and if these two sides are connected by an external circuit current will start flowing from positive to negative terminal of the solar cell

SOLAR PV

SHORT CIRCUIT CURRENT OF SOLAR CELL

The maximum current that a solar cell can deliver without harming its own constriction. It is measured by short circuiting the terminals of the cell at most optimized condition of the cell for producing maximum output.

Maximum current density or short circuit current density rating is nothing but ratio of maximum or short circuit current to exposed surface area of the cell.

$$J_{sc} = \frac{I_{sc}}{A}$$

I_{sc} is short circuit current, J_{sc} maximum current density and A is the area of solar cell

OPEN CIRCUIT VOLTAGE OF SOLAR CELL

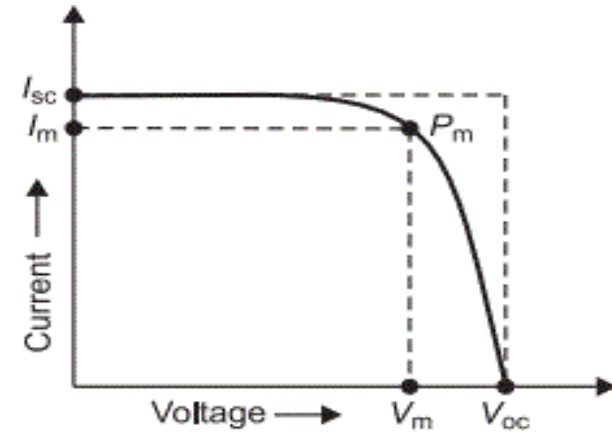
By Measuring [voltage](#) across the terminals of the cell when no load is connected to the cell. This voltage depends upon the techniques of manufacturing and temperature but not fairly on the intensity of light and area of exposed surface.

Normally open circuit voltage of solar cell nearly equal to 0.5 to 0.6 volt. It is normally denoted by V_{oc} .

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MAXIMUM POWER POINT OF SOLAR CELL

The maximum electrical power one solar cell can deliver at its standard test condition. If we draw the v-i characteristics of a solar cell maximum power will occur at the bend point of the characteristic curve. It is shown in the v-i characteristics of solar cell by P_m .



CURRENT AT MAXIMUM POWER POINT

The current at which maximum power occurs. Current at Maximum Power Point is shown in the v-i characteristics of solar cell by I_m

VOLTAGE AT MAXIMUM POWER POINT

The voltage at which maximum power occurs. Voltage at Maximum Power Point is shown in the v-i characteristics of solar cell by V_m .

FILL FACTOR OF SOLAR CELL

The ratio between product of current and voltage at maximum power point to the product of short circuit current and open-circuit voltage of the solar cell.

$$\text{Fill Factor} = \frac{P_m}{I_{sc} \times V_{oc}}$$

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EFFICIENCY OF SOLAR CELL

It is defined as the ratio of maximum electrical power output to the radiation power input to the cell and it is expressed in percentage. It is considered that the radiation power on the earth is about 1000 watt/square metre hence if the exposed surface area of the cell is A then total radiation power on the cell will be $1000 A$ watts. Hence the efficiency of a solar cell may be expressed as

$$Efficiency(\eta) = \frac{P_m}{P_{in}} \approx \frac{P_m}{1000A}$$

SOLAR PV

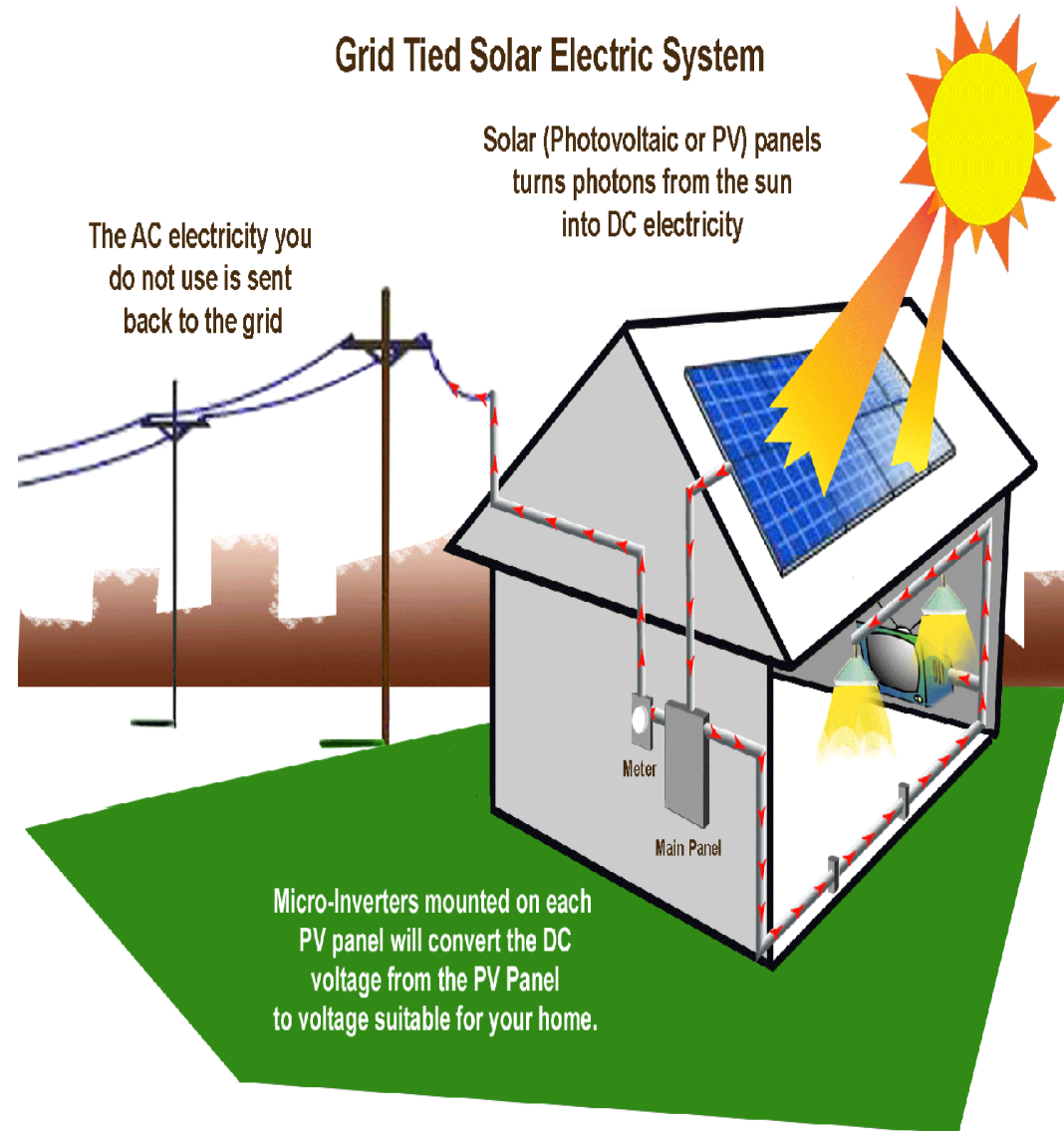
SOLAR CONNECTED GRID

This system create a micro power station and are directly connected to grid.

During day it deliver excess energy to the grid and during night it import energy from the grid.

Here grid act as medium from which power is taken when needed.

This system receive the payment for each KW supplied, this reduce the dependence of electricity and there by reduce the power bill.



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SOLAR CONNECTED GRID

Component used are PV array or cell, metering system and inverter.

Disadvantage of the system is when there is power cut in main, supply from solar panel also switched off, since is tie model

If system doesn't off current will flow back into grid could leads to serious faults

GRID FALLBACK SOLAR ELECTRIC SYSTEM

It combines the grid connected system with batteries, in solar array it generate electricity in turn connected to battery charge it, battery in turn run the inverter which drive the load. When power is not enough to run load , grid supply load and batteries are connected back to grid for charging.

FurtherReadingReferences:

[ISEEnergyCharts](#)

[Study:LevelizedCostofElectricity-RenewableEnergyTechnologies](#)

[RecentfactsaboutphotovoltaicsinGermany](#)

[PowerGenerationfromRenewableEnergyinGermany](#)

[WhatwilltheEnergyTransformationCost?PathwaysforTransformingtheGermanEnergySystemby2](#)

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Sustainable PV Manufacturing in Europe – An Initiative for a 10 GW Green Fab

Meta Study: Future Cross Sectoral Decarbonization Target Systems in Comparison to Current Status of Technologies

Study: Current Status of Concentrator Photovoltaic (CPV) Technology