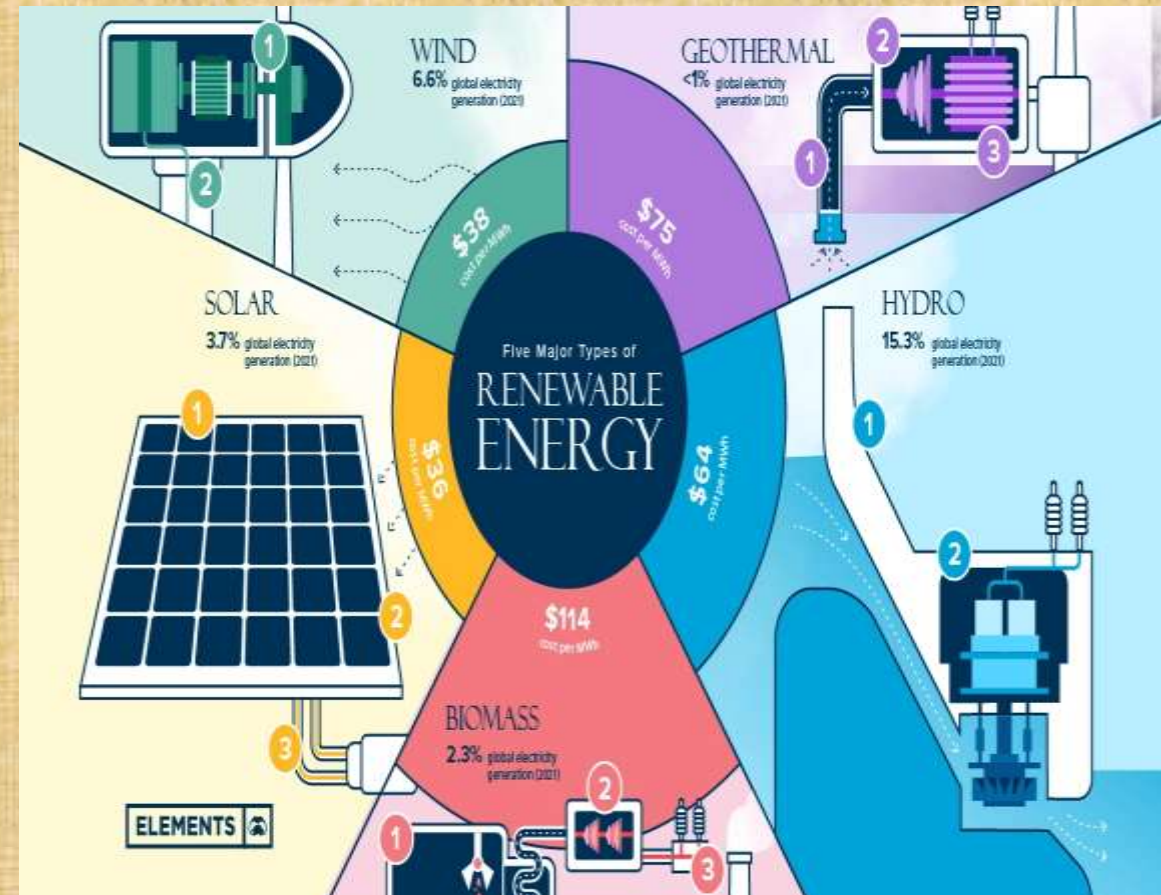


# INTRODUCTION ON RENEWABLE ENERGY

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## OBJECTIVES

1. TO KNOW ABOUT RENEWABLE ENERGY
2. DIFFERENCE BETWEEN RENEWABLE AND NON RENEWABLE ENERGY
3. TYPES OF RENEWABLE ENERGY
4. SOLAR CELLS (PHOTO VOLTAIC CELLS)
5. WORKING PRINCIPLE OF PHOTO VOLTAIC CELLS OR SOLAR CELL
6. SOLAR CELL MATERIALS
7. TYPES OF SOLAR CELLS
8. DIFFERENCE BETWEEN MONOCRYSTALLINE AND POLYCRYSTALLINE SOLAR PANELS
9. DIFFERENCE BETWEEN SOLAR CELL, MODULE & ARRAY
10. REVIEW

# RENEWABLE ENERGY

- ❖ **Definition of renewable: capable of being renewed.**
- ❖ **Renewable energy sources are energy sources that are always being replenished. They can never be depleted.**
- ❖ **Some examples of Renewable energy sources are solar energy, wind energy, hydropower, geothermal energy, and biomass energy.**
- ❖ **Renewable energy sources, such as biomass, geothermal resources, sunlight, water, and wind, are natural resources that can be converted into these types of clean, usable energy: Bioenergy**



# DIFFERENCE BETWEEN RENEWABLE AND NON RENEWABLE ENERGY

## ► NON RENEWABLE ENERGY

- 1. Conventional energy, such as thermal powers (from coal, petroleum, and natural gas), hydel power (from high velocity of running water) are tapped and used abundantly at present.**
- 2. Their uses are practiced for a long time.**
- 3. The sources of thermal power i.e. other conventional energies are non renewable in nature.**
- 4. The generation of other conventional energy produces air pollution.**
- 5. The other conventional energy is costly.**

## RENEWABLE ENERGY

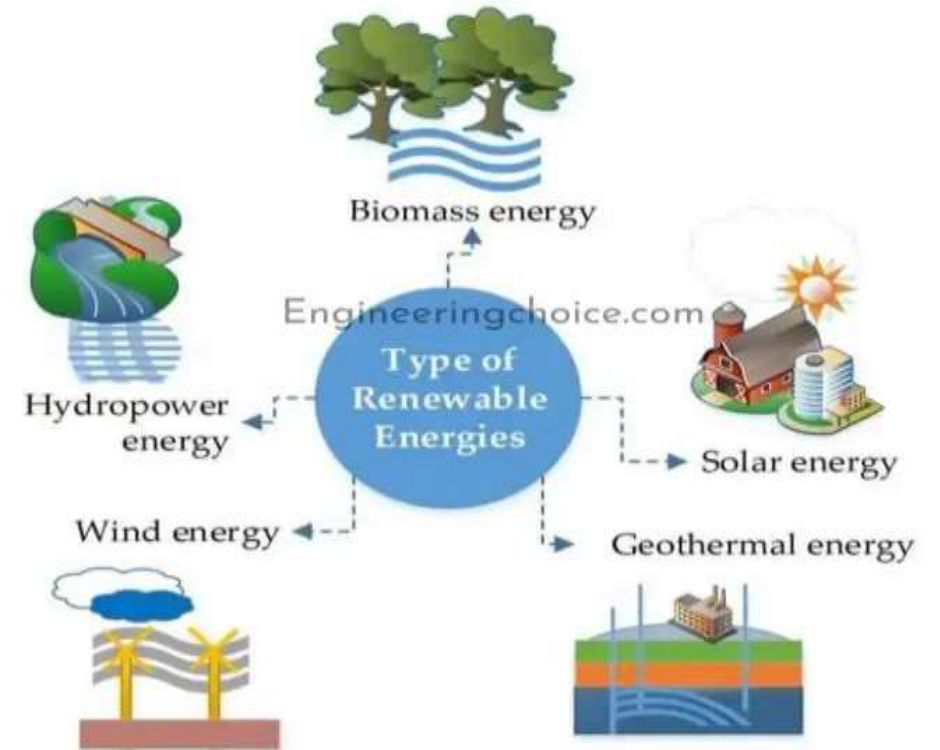
- 1. Non-conventional sources of energy (solar energy tidal energy, geo-thermal energy, wind energy etc) are not used frequently and in large scale (commercially).**
- 2. Their uses are comparatively more recent.**
- 3. But the sources of non-conventional energy are flow-resources. There is no anxiety for their exhaustion.**
- 4. But the generation of non-conventional energy does not produce air pollution.**
- 5. But comparatively, the non-conventional energy is much cheaper.**

# RENEWABLE ENERGY SOURCE STYPES

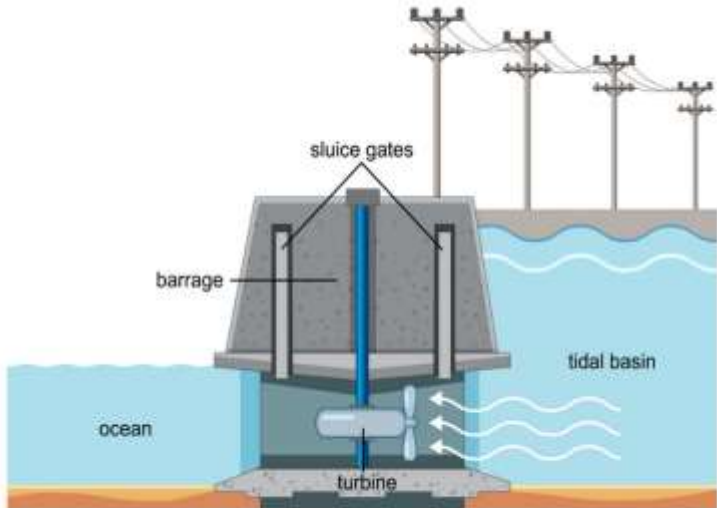
1. TIDAL ENERGY
2. SOLAR ENERGY
3. GEOTHERMAL
4. WIND ENERGY
5. HYDROELECTRICITYMICRO HYDRO

## RENEWABLE ENERGY

- Solar energy from the sun
- Geothermal energy from heat inside the earth
- Wind energy
- Biomass from plants
- Hydropower from flowing water

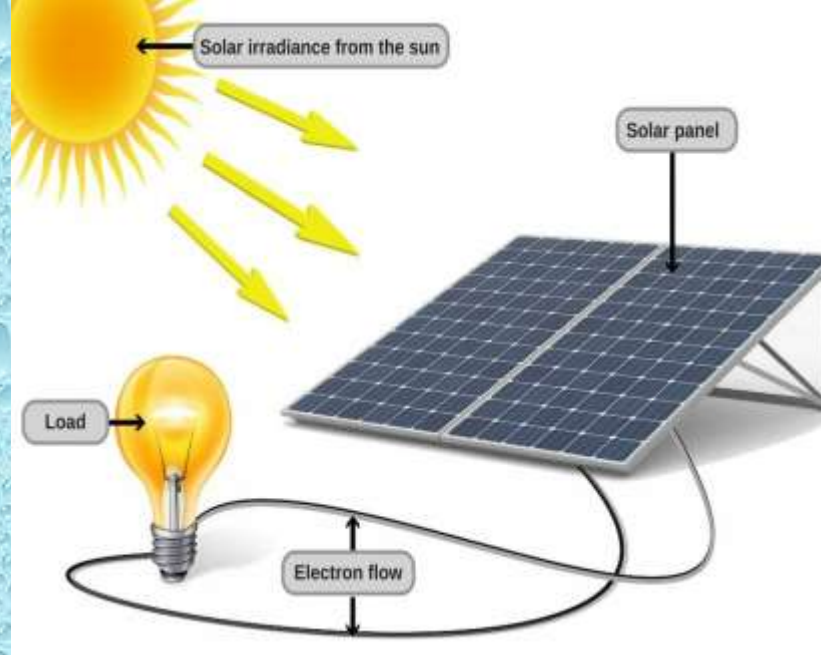


# Tidal Power Station



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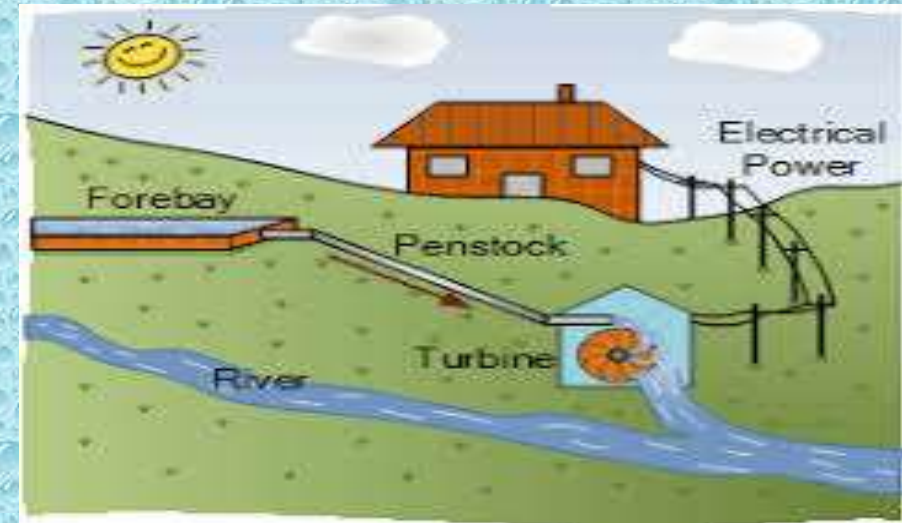
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## TIDAL ENERGY

## SOLAR ENERGY

## GEO THERMAL

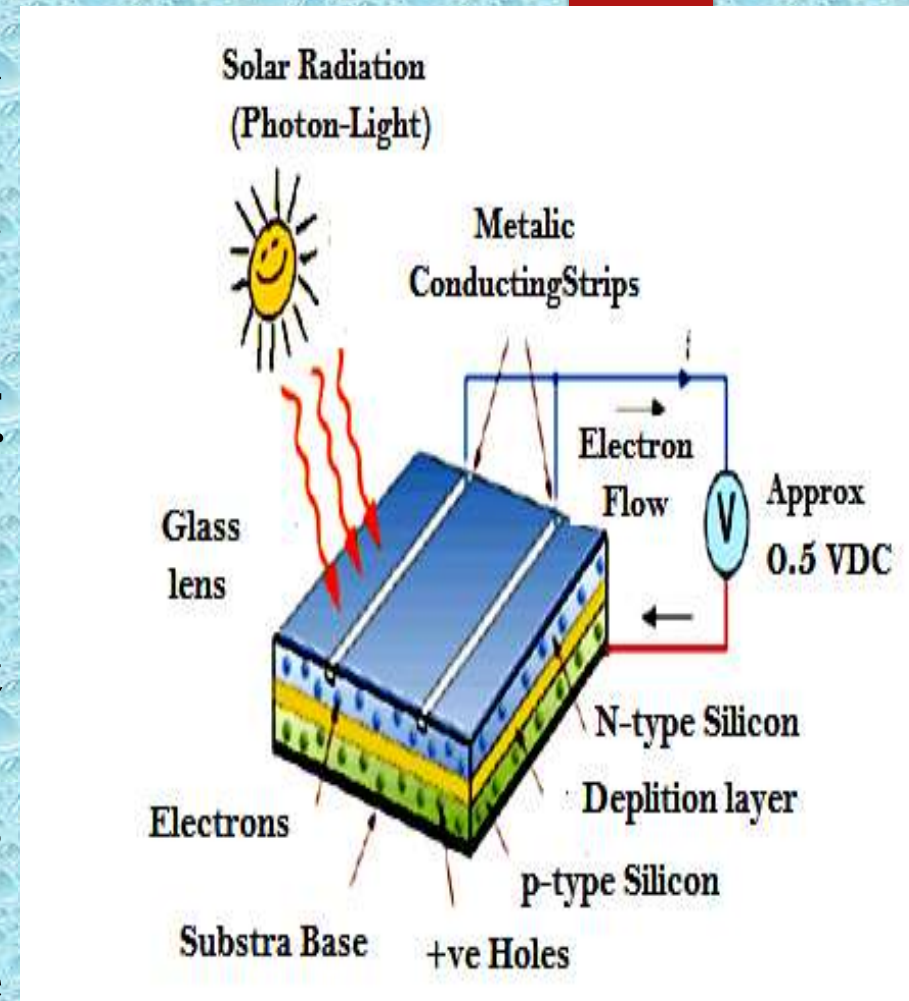


## WIND ENERGY

## HYDROELECTRICITYMICRO HYDRO

# SOLAR CELLS (PHOTO VOLTAIC CELLS)

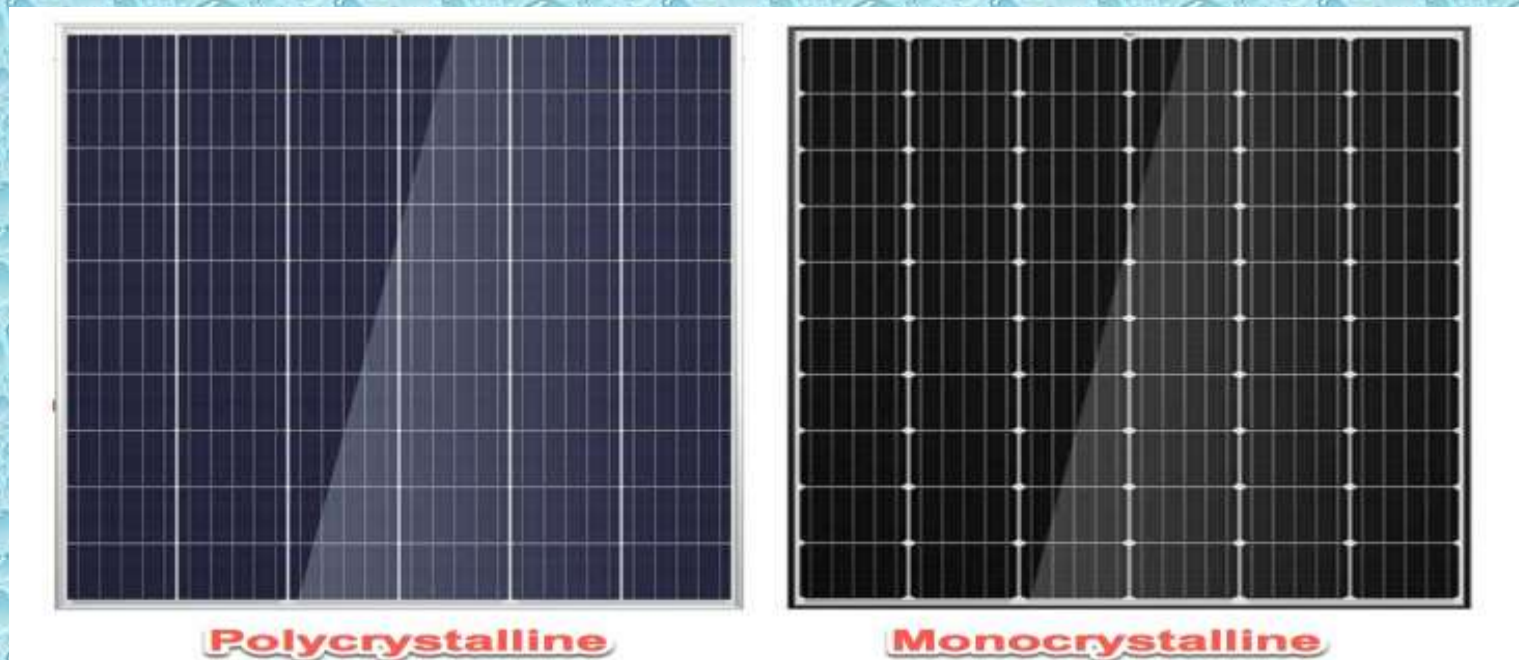
- ❖ Photovoltaic (PV) materials and devices convert sunlight into electrical energy, and PV cells are commonly known as solar cells.
- ❖ Crystalline silicon PV cells are the most common photovoltaic cells in use today.
- ❖ Working principle of photovoltaic cell or solar cell :- Photovoltaic cell consists of high-purity silicon or GaAs(Galium Arsenide) PN Junction Diode.
- ❖ It is covered by glass sheet .
- ❖ The upper layer is of P Type and it is very thin so that sun light photons can easily reach the p-n junction.
- ❖ Photons falling on the PN junction cause the rise of pairs of opposite electrical charge carriers (electron-hole)
- ❖ Electrons go to the semiconductor N and holes go to the semiconductor P. The voltage will arise on the junction.



CONSTRUCTION OF SOLAR CELL

## SOLAR CELL MATERIALS

- ❖ The first generation of solar photovoltaic modules was made from silicon with a crystalline structure, and silicon is still one of the widely used materials in solar photovoltaic technology.
- ❖ Mainly focused on improving its efficiency and sustainability. Monocrystalline and multi-crystalline silicon are the two most basic types of crystalline silicon used in solar photovoltaics.
- ❖ **Monocrystalline cells:-** Monocrystalline silicon materials are used for their higher efficiency compared to multi-crystalline silicon materials.
- ❖ The advantage of multi-crystalline silicon materials is that they are less expensive, hence used by manufacturers for low-cost solar energy systems.





## TYPES OF SOLAR CELLS

There are four types solar cells :-

1. **Monocrystalline silicon solar cell** :- Monocrystalline solar cells are made out of silicon ingots, which are cylindrical in shape. The entire volume of the cell is a single crystal of silicon.
2. **Polycrystalline (or multi-crystalline) solar cell** :- These are also made from pure silicon. Instead of using a single crystal of silicon, however, multicrystalline manufacturers melt many fragments of silicon together to form the solar panel wafers.
3. **Amorphous/thin film solar cell**:- Amorphous silicon solar cells are the most well-developed thin-film solar cell. The structure usually has the p-i-n (or n-i-p) type of duality, where p-layer and n-layer are mainly used for establishing an internal electric field (i-layer) comprising amorphous silicon.
4. **Hybrid silicon solar cell**:- Hybrid solar cells combine advantages of both organic and inorganic semiconductors.

# DIFFERENCE BETWEEN MONOCRYSTALLINE AND POLYCRYSTALLINE SOLAR PANELS

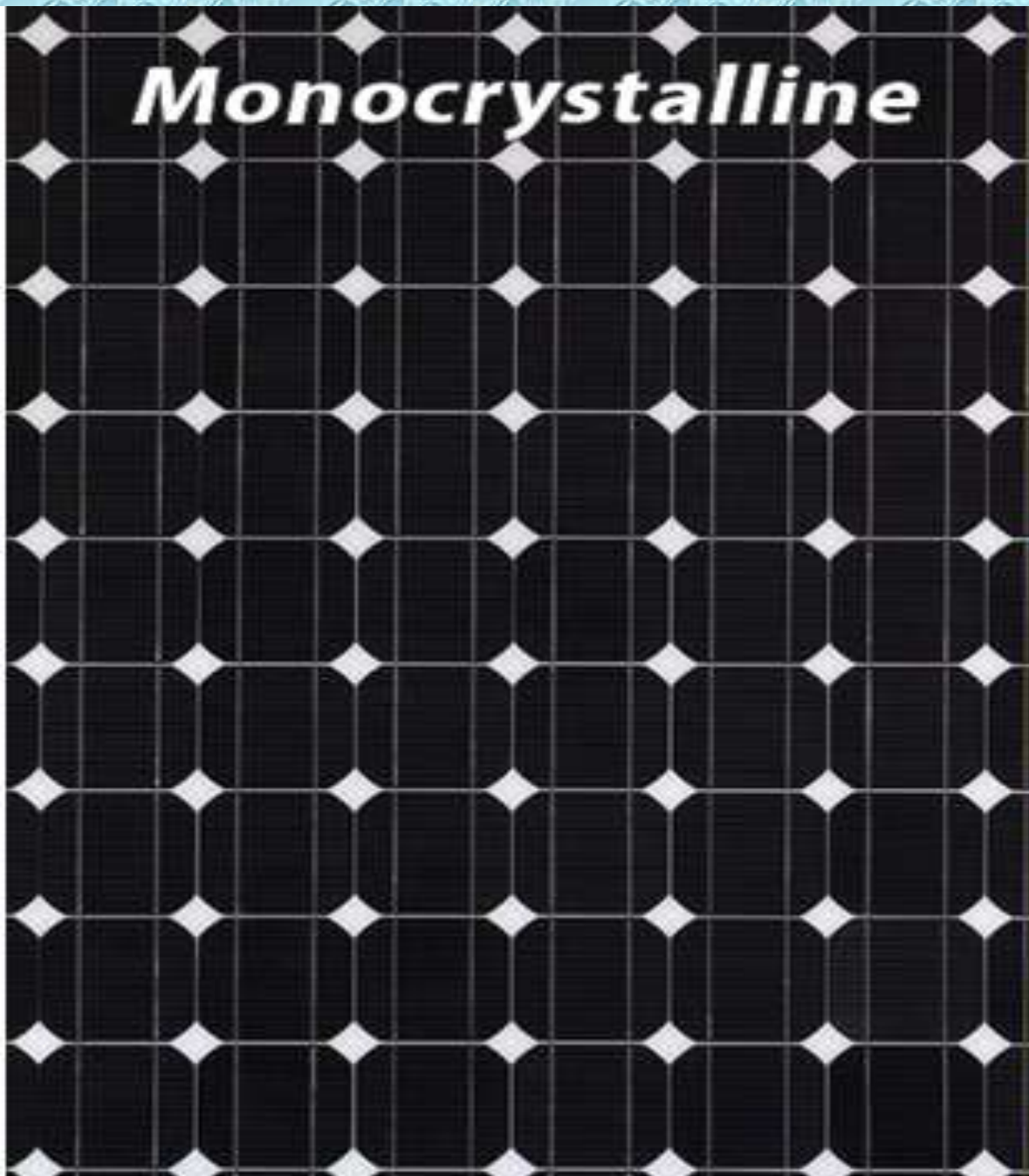
## MONOCRYSTALLINE

1. Monocrystalline solar panels have solar cells made from a single silicon crystal.
2. To make solar cells in a monocrystalline solar panel, silicon is shaped into rods and divided into slices.
3. monocrystalline panels more efficient.
4. Monocrystalline panels are more expensive.
5. Monocrystalline panels are black in colour.

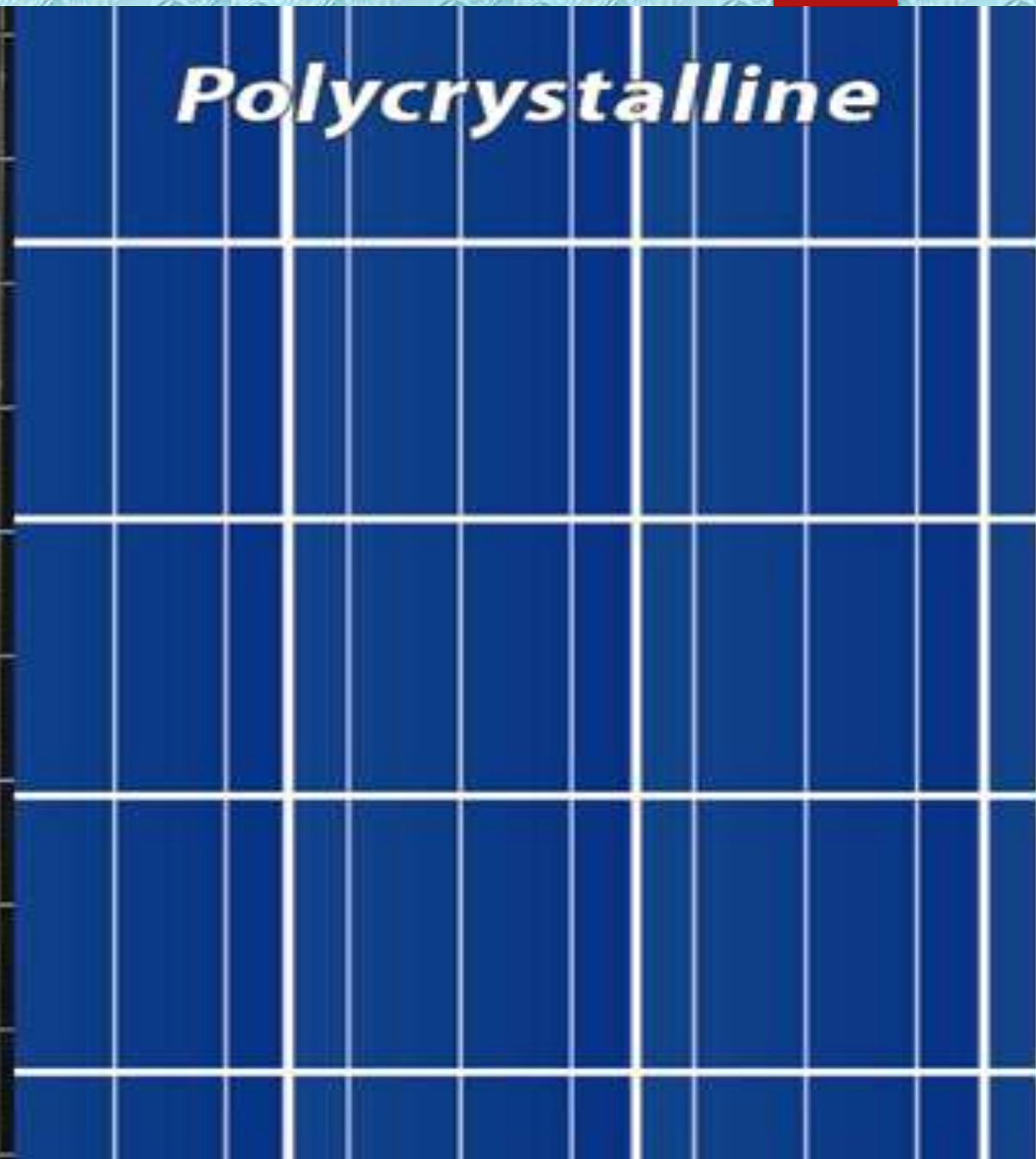
## POLYCRYSTALLINE

1. Polycrystalline solar panels have solar cells made of many pieces of silicon melted together.
2. Polycrystalline solar panels are also made in silicon ,instead of a single silicon crystal multiple pieces of silicon are melted together to form a solar cell.
3. Polycrystalline panels are less efficient than monocrystalline.
4. Polycrystalline panels are less expensive.
5. Polycrystalline panels are mostly blue in colour.

***Monocrystalline***

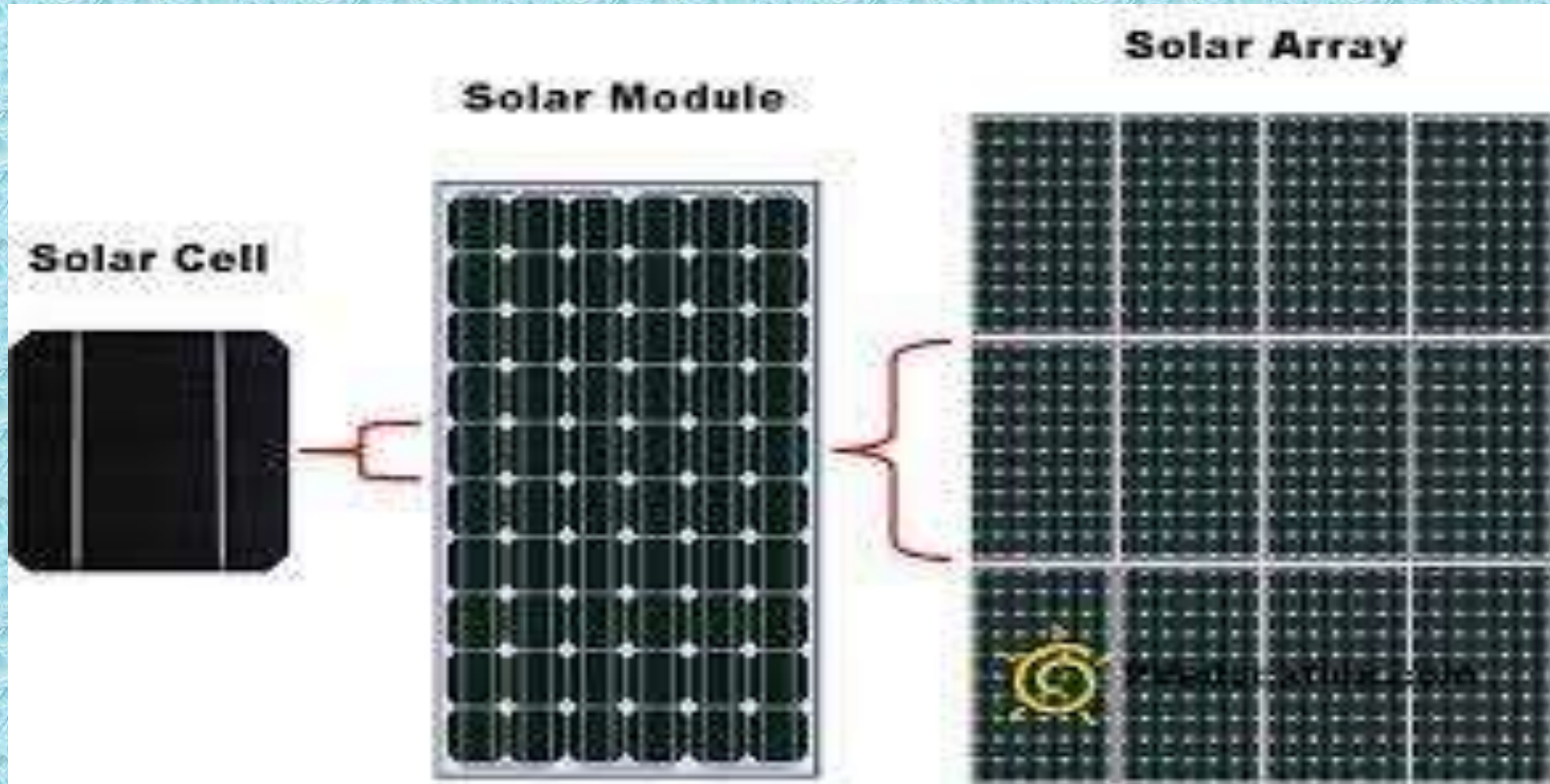


***Polycrystalline***



## DIFFERENCE BETWEEN SOLAR CELL, MODULE & ARRAY

- ✓ A cell is defined as the semiconductor device that converts sunlight into electricity.
- ✓ A PV module refers to a number of cells connected in series
- ✓ In a PV array, modules are connected in series and in parallel.





**THANK YOU**