INTRODUCTION TO BASICS

SOLAR THERMAL

&

SOLAR PHOTOVOLTAICS

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The ***SUN*** – The celestial glory

He constitutes created beings, he is the life-breath, the source of the seasons, the store house of light, the courser in the heavens, the nourisher, the possessor of rays, the golden, the brilliant, the one energy that constitutes the seed of the universe and the maker of the day.

ADITYA HRUDAYA

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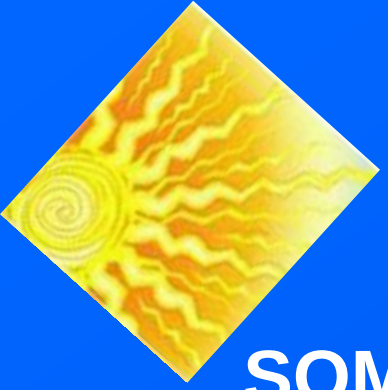

SOME FACTS

- Is a middle aged mid sized star 4.5 bn yrs old
- 600,000,000 tons of hydrogen nuclei into helium nuclei
- Will run out of nuclear fuel in about 5 bn yrs
- Loses 4 million tons of mass each second.

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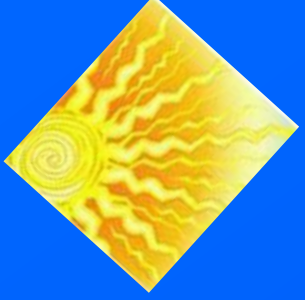

Sun radiates heat and light continuously.

We can trap the sunlight to either generate heat or use it to generate electricity.

We do the former by what are known as Thermal systems and the latter by Photovoltaic systems

The story unravels …..

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Recall the fundas we learnt early in school..

to understand thermal systems

FUNDA 1

Sun is colourful (Spectrum)

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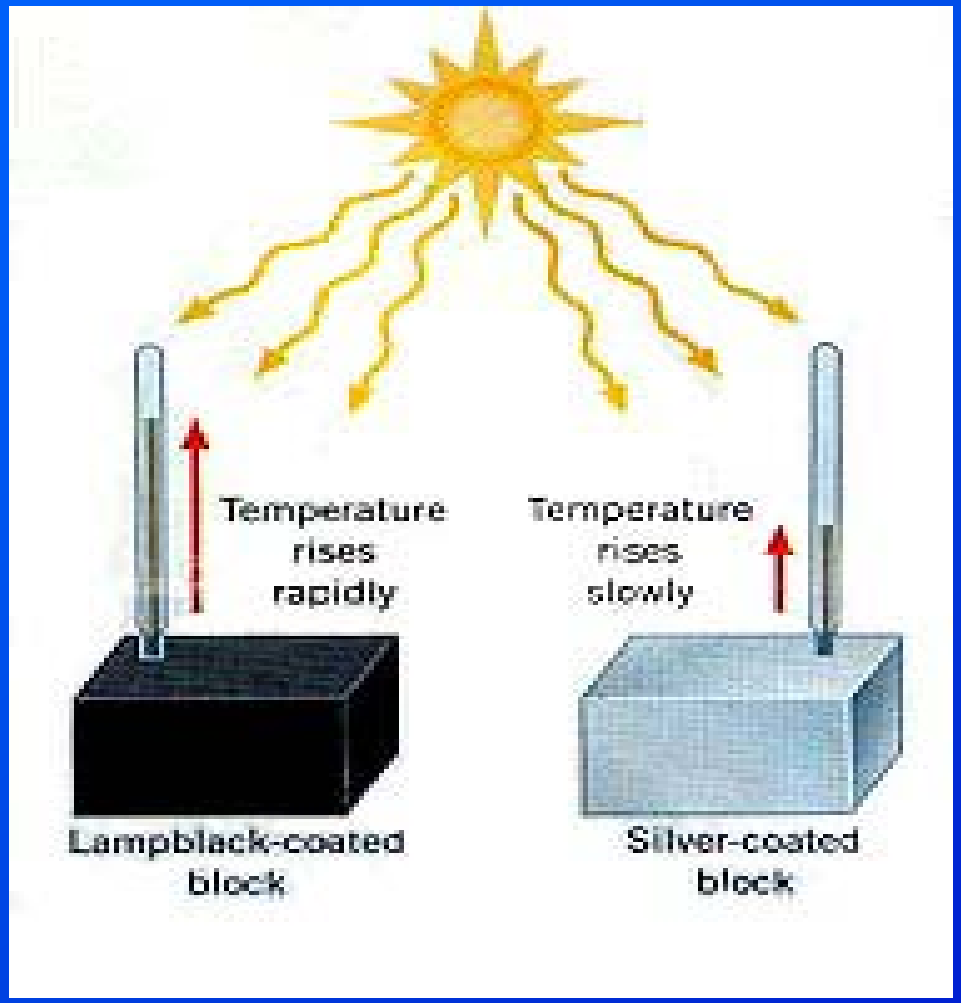
Recall the fundas we learnt early in school

FUNDA 2



Black is beautiful and HOT

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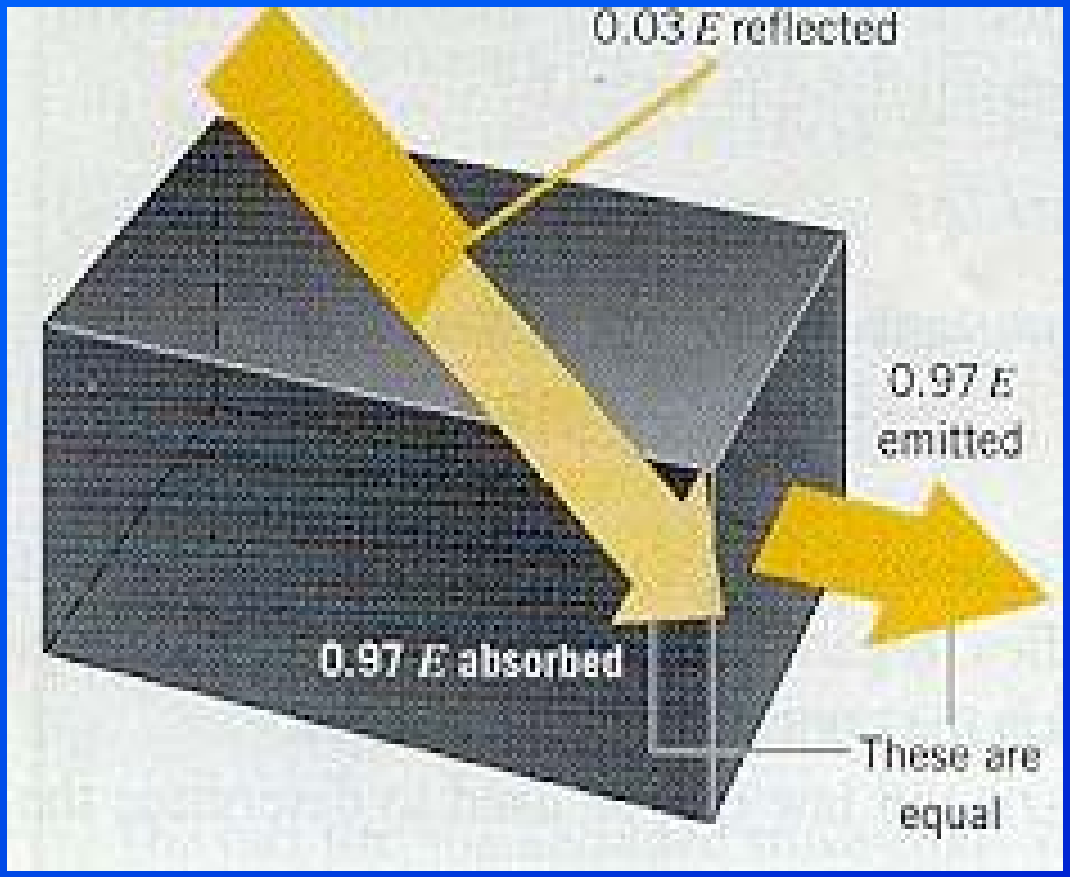
Recall the fundas we learnt early in school

FUNDA 3



The more you take the more you give

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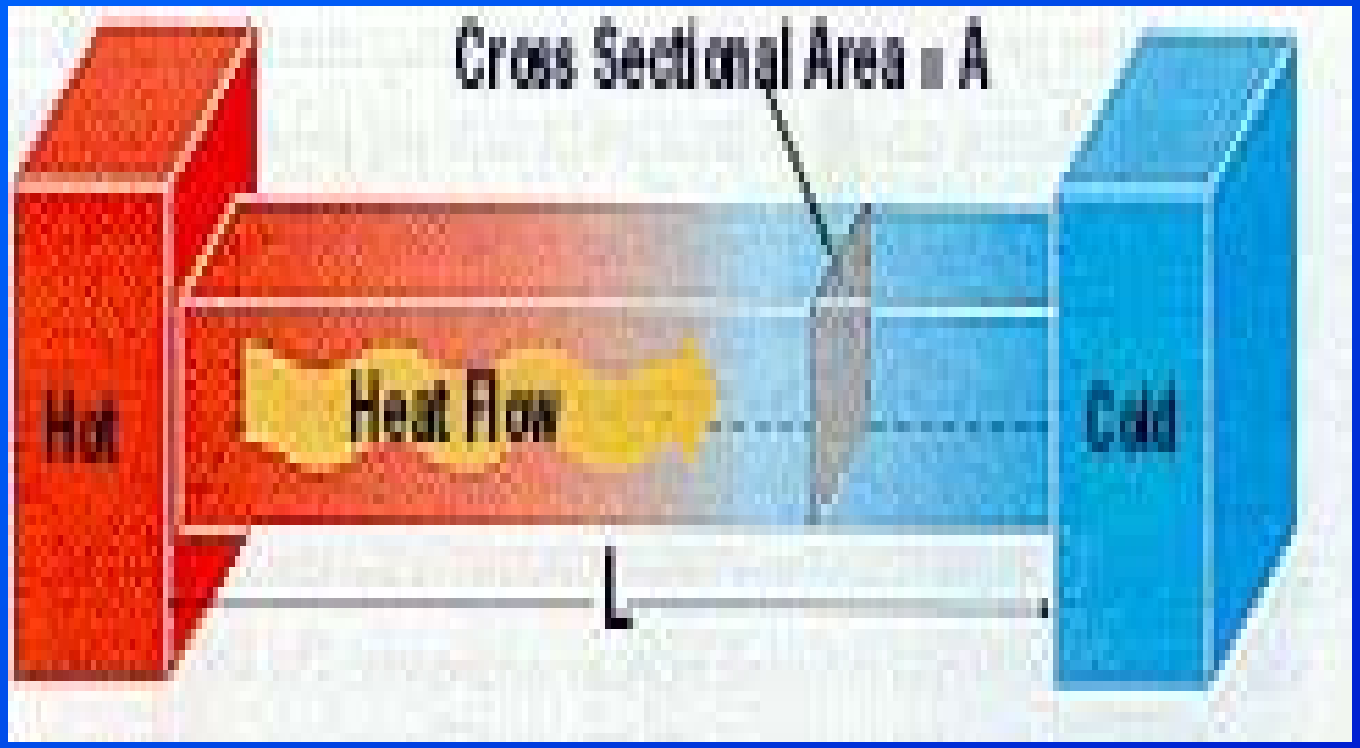
Recall the fundas we learnt early in school

FUNDA 4



Reach out to blue if it is hot

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Recall the fundas we learnt early in school

FUNDA 5

When hot and high dance to die

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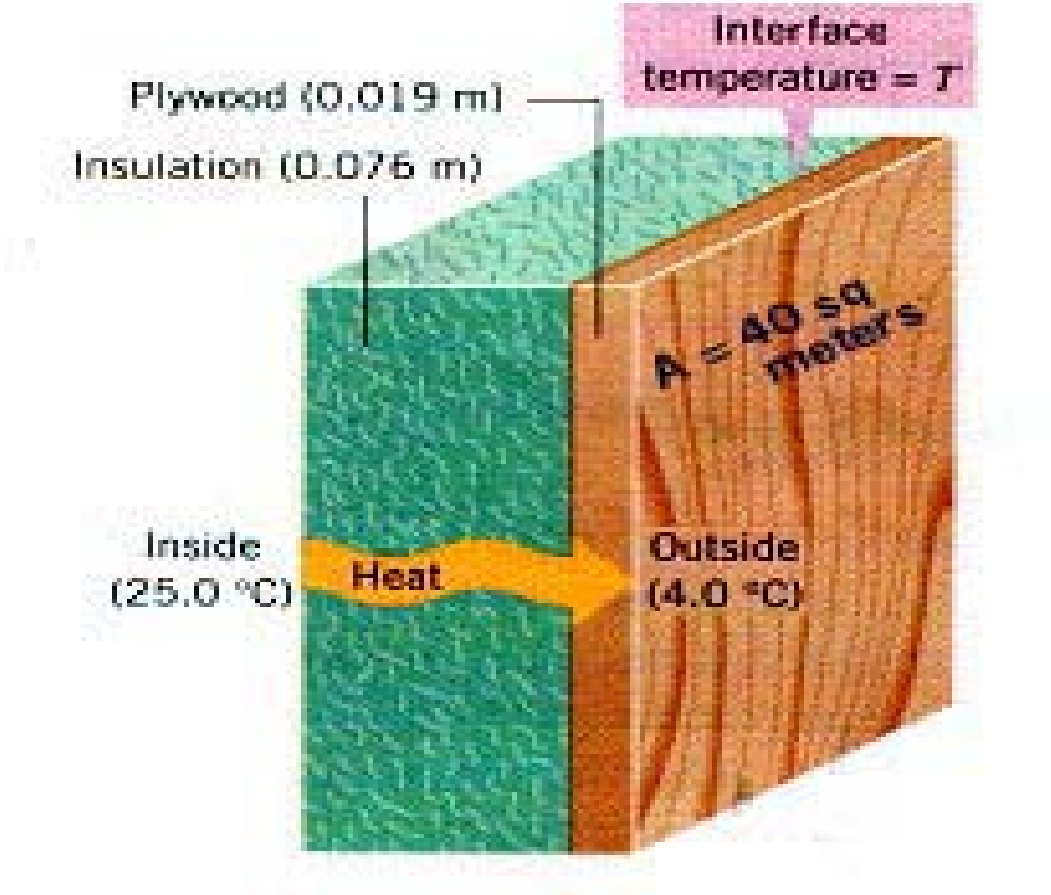
Recall the fundas we learnt early in school

FUNDA 6



Shut the door to keep the inmate in

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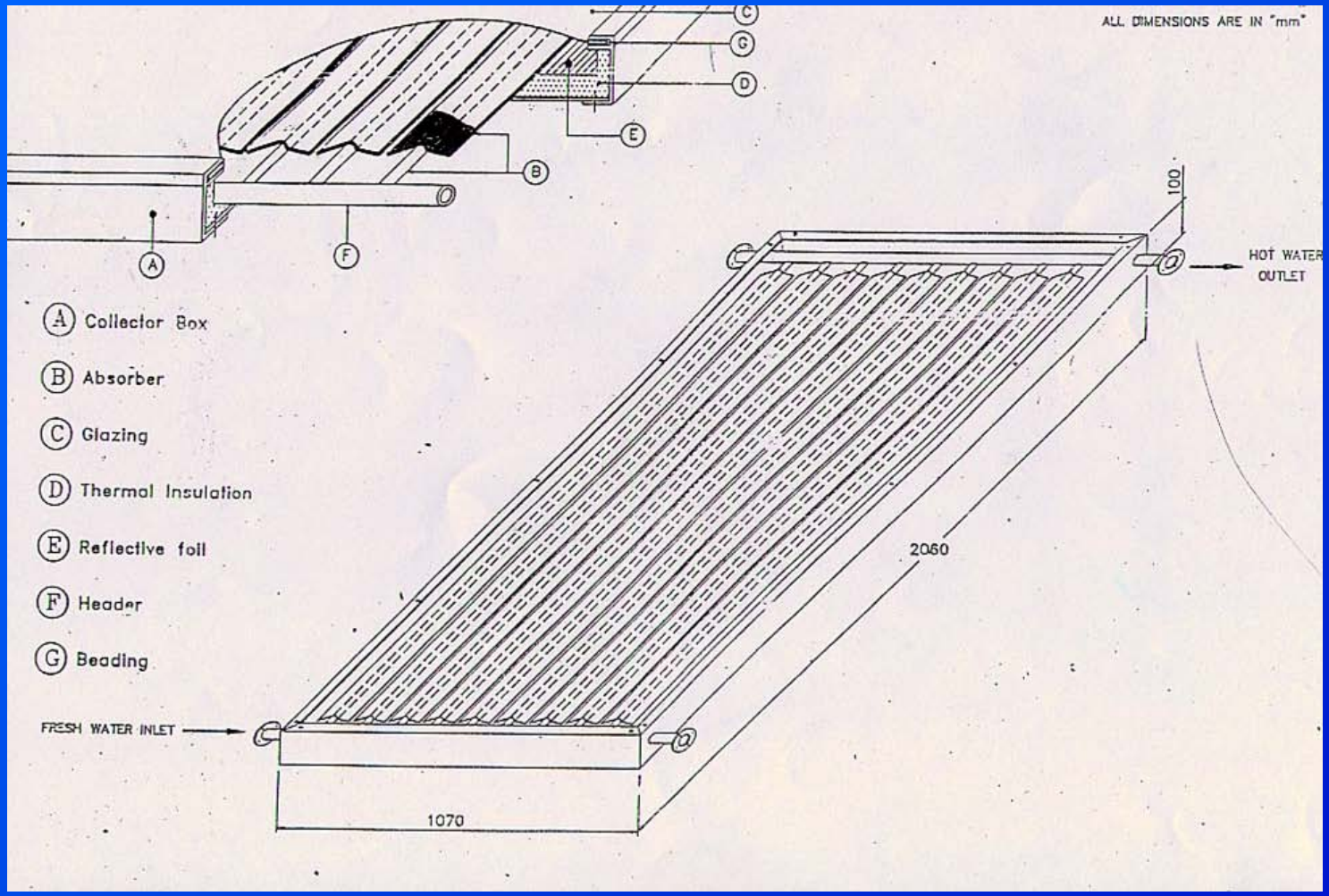
If the fundas numb you … recalling your bullying teacher … Relax

Sooth your nerves – assemble the collector



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And the tank

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And Have a Zing with hot shower

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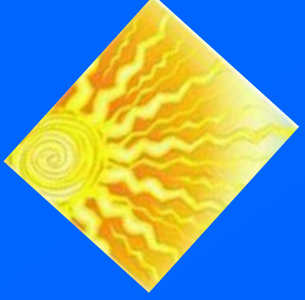

PV – the new funda

Photon – Energy the sun doles out in packets (of light)

Voltaic – The electricity which we are starved of

So Photovoltaics is process by which we use the merciful sun's energy to alleviate our misery arising out of the poverty of electricity.

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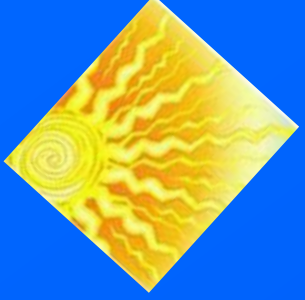

Let us now get serious

PV is the off-spring of the elite, modern and is from solid state (of technology) which currently rules the roost.

The elite and the powerful deserve to be treated with respect and no fooling around.. Let us stay put at the junction of P and N and quitely watch what it is all about.

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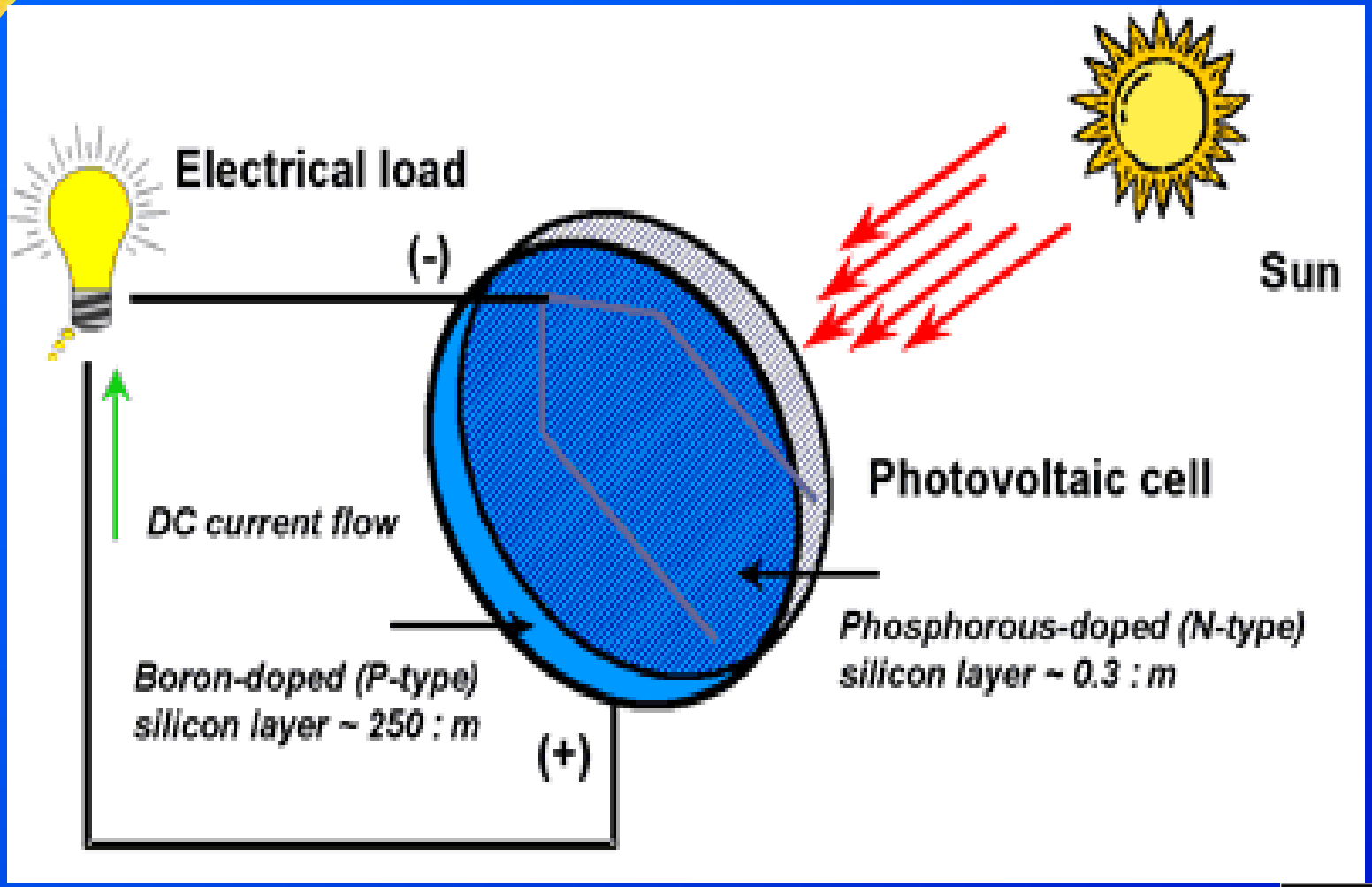
The PV Effect



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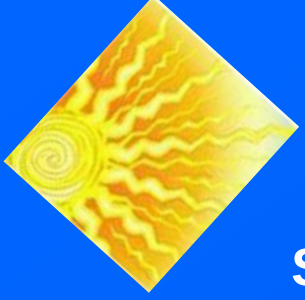

Solar cells

Silicon Cells are the most common ones. (Silicon is the same material used in Computer chips)

Have two layers – Negative top and positive bottom

An electric field is created between the layers

Light (photon) creates equal no. of electrons and holes

Electric field separates the charges and the wire connected between the top and bottom carries the electron and causes a current to flow

Solar Cells generate DC Power

Solar cells can not store energy

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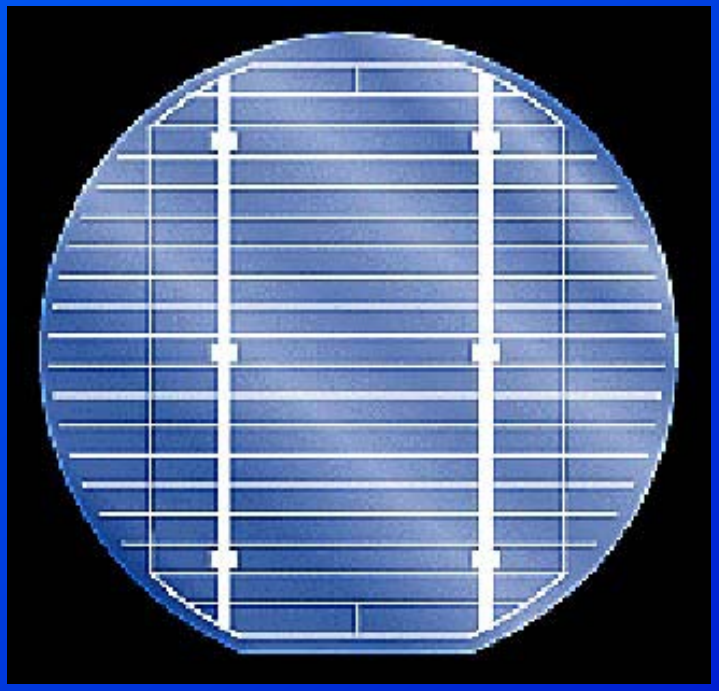
Solar cells – Multi and Mono



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Solar cells – Electrical Properties

Current

- Depends on incident light
- Depends on Cell area

Voltage

- Reaches full attainable voltage at low light levels
- Does not depend on cell area
- Affected by rise in temperature of solar cells

Power

- Power is generated only when sunlight is available and varies through out the day necessitating the use of battery for storage.
- Generated power is pure DC

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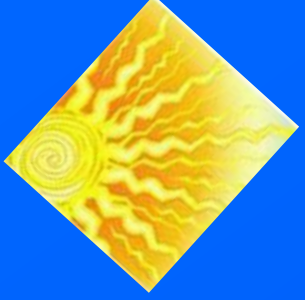

Power Generation from Solar cells

Individual solar cells generate low power at very low voltage. So solar cells are connected in series.

Typically 36/18nos. of identical solar cells are connected in series so that they can charge 12V/6V battery.

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PV Modules

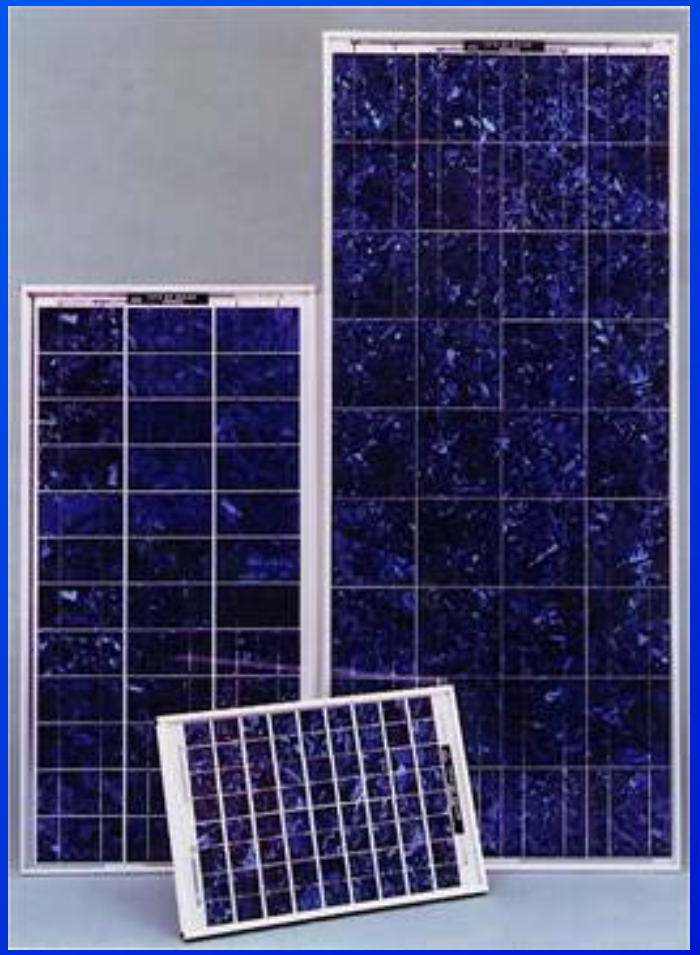
Solar cells are

- **Brittle**
- **Will degrade if unprotected**

Solar Cells are therefore sandwiched between:

Glass Top
&
Ethyl Vinyl Acetate (EVA)
Tedlar

To form a MODULE



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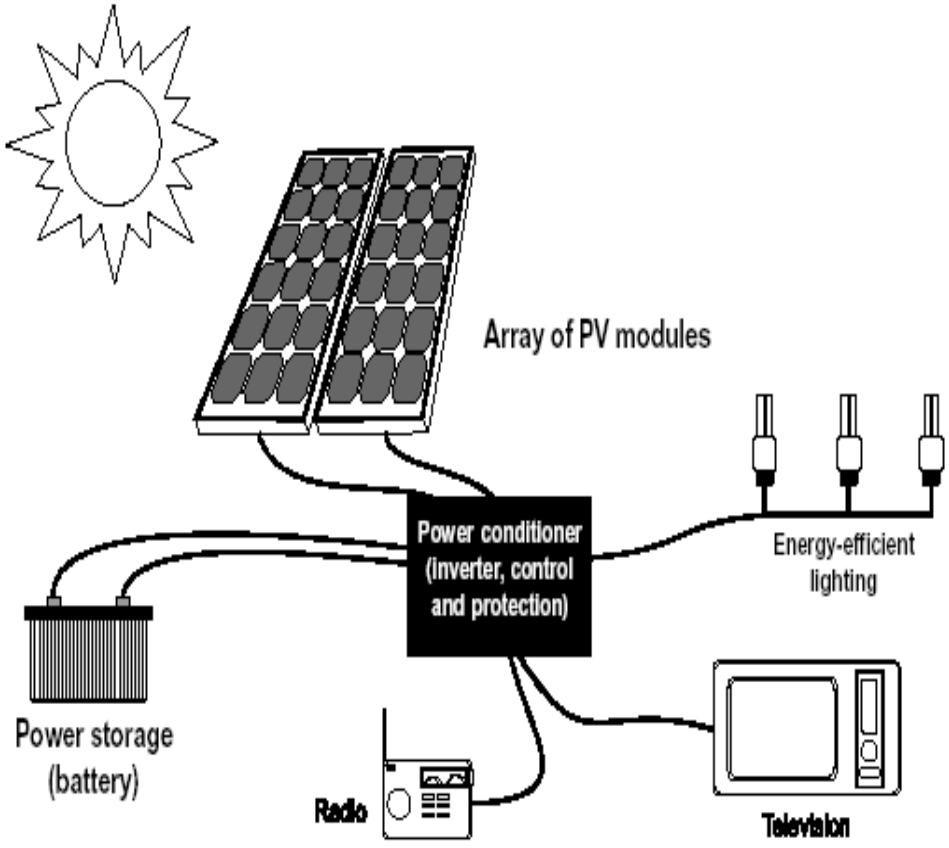
PV System Configurations



Typical Components of a PV System

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PV System Components

- SPV Modules
- Module Mounting Structure
- Charge Controller
- Batteries
- Inverter
- Cables, connectors, protective devices
- Loads

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Batteries

- Used with Controllers to enhance life
- To be located in well ventilated place
- Are expensive – next only to module
- Requires minimum maintenance
- Life depends on the proper use.

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Batteries

- Store electrical energy
- Are specified by the terminal voltage - 2V / 6V / 12V and Ampere Hours (AH).
- Capacity varies from few AH to several hundred AH.
- Higher capacity batteries come in 2 V blocks.
- Batteries should not be overcharged or over discharged to give it a long life.

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Charge Controllers

Enhances Battery life by

Cutting out loads when bat. is low

Cutting out module when bat. is high

Also

It is used as power centre &

Incorporates Dusk to Dawn controllers

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Inverters

Inverters convert DC into AC.

AC loads are connected to inverter output.

Inverters are specified for the input DC, out put AC, power handling capacity and efficiency

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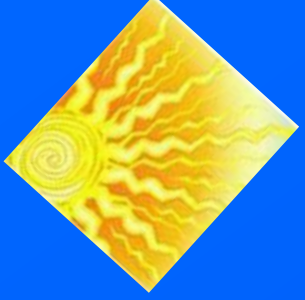

Benefits of Solar PV Systems

- Sunlight is the fuel and is available for free
- No running cost
- No transportation cost
- No harmful gas emission – green power
- Highly reliable
- No moving parts hence no noise
- Low maintenance
- System can be easily moved/expanded

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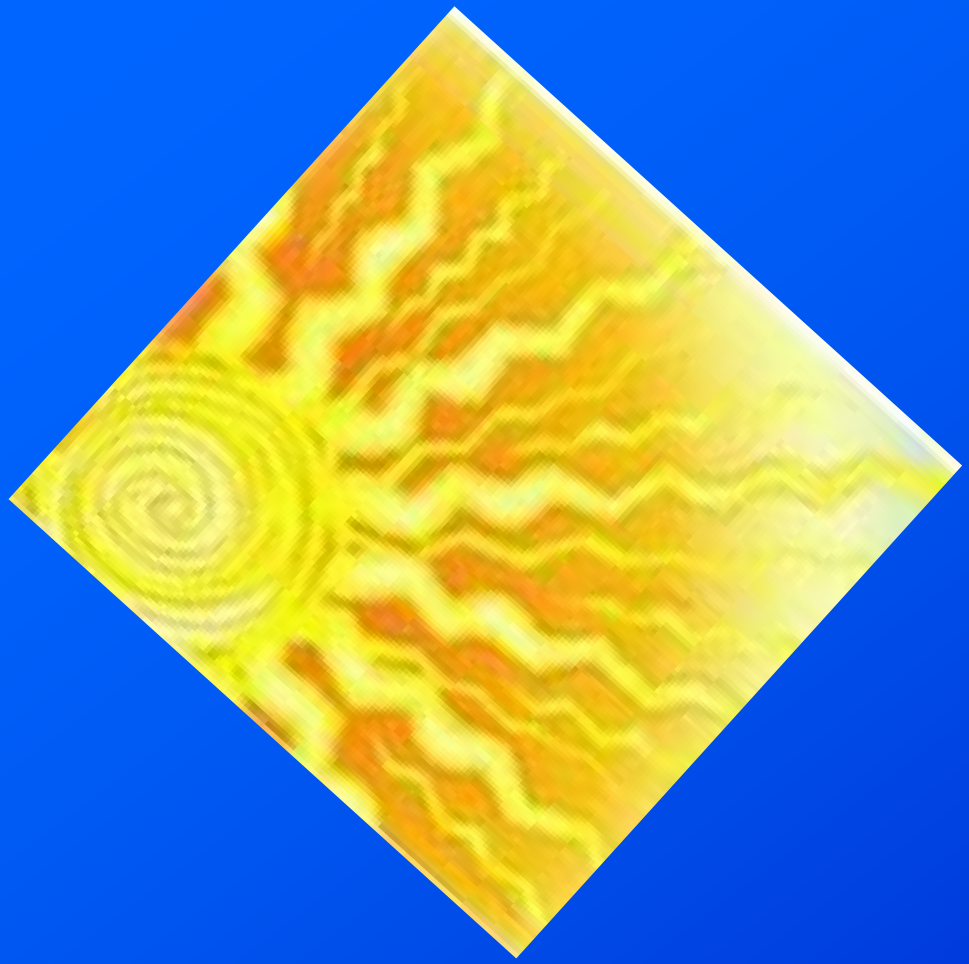

Together let us offer the solution in the sun

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