



Course: Sustainable Energy Technology 1
12110598

Title: PV TECHNOLOGY –L11

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PV System –RECENT TRENDS

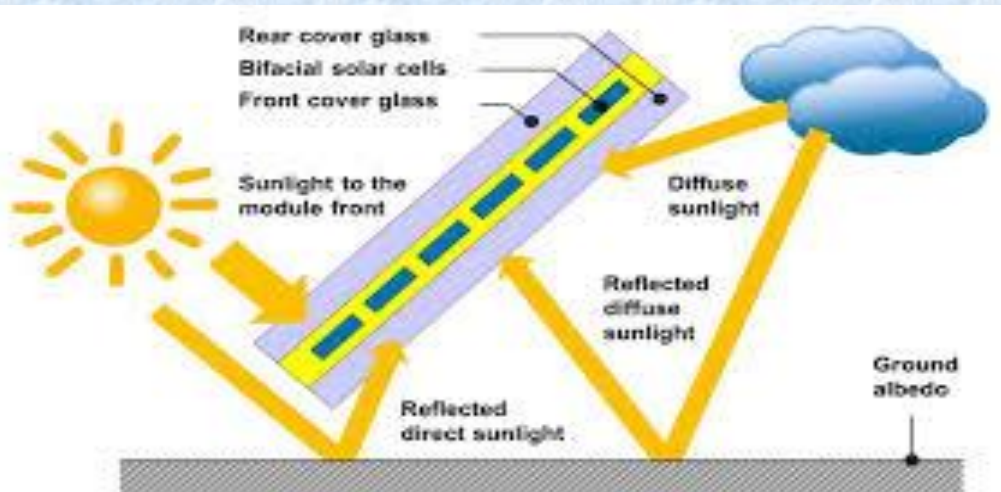
Bifacial PV Modules

Bifacial solar panels are one of the newest product trends in the **PV industry**. In fact, unlike the mono facial cells, bifacial cells are is light sensitive on both sides. In monofacial back surface field solar cell, the rear surface is covered with aluminum.

Bifacial solar modules offer many advantages over traditional solar panels. Power can be produced from both sides of a bifacial module, increasing total energy generation.

They're often more durable because both sides are UV resistant, and potential-induced degradation (PID) concerns are reduced when the bifacial module is frameless.

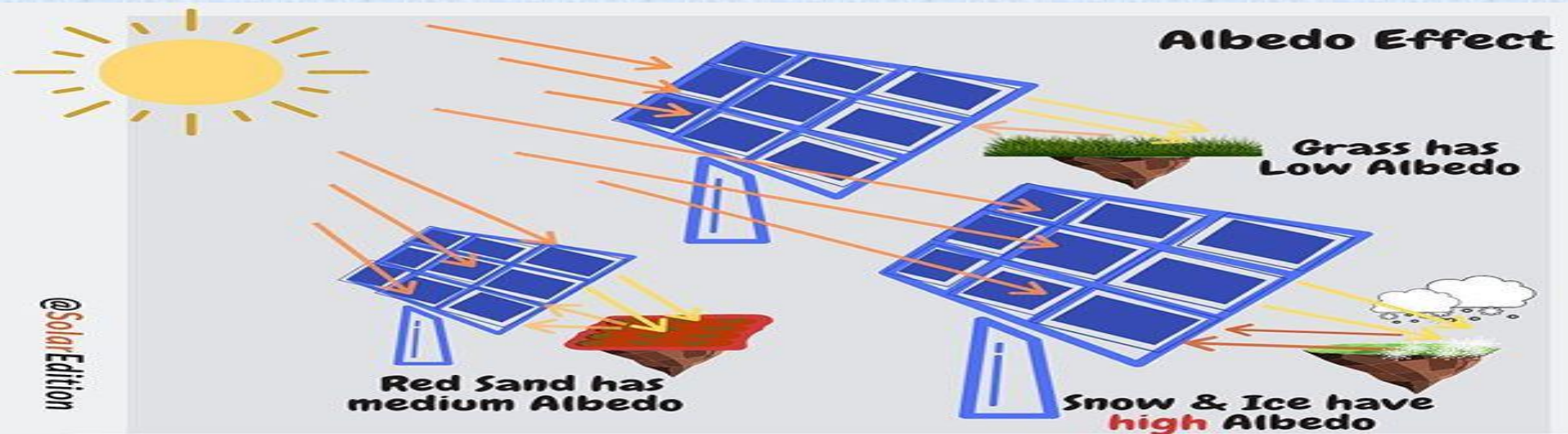
Balance of system (BOS) costs are also reduced when more power can be generated from bifacial modules in a smaller array footprint.



PV System –RECENT TRENDS

Bifacial PV Modules

AMOUNT of REFLECTED BEAM (Albedo)



**Bifacial Solar panel's Market
Would Be taken **Ten-fold** & Be
Globally By **2024****

Water: 5%; Grass: 7%; Cement: 7%; Sand: 9%; White paint: 19%

PV System –RECENT TRENDS

Bifacial PV Modules

The purpose is **to utilize the albedo radiation** that reaches the back face of the PV module

This will increase the energy production of the PV module and hence reduces **LCOE**

The production may be increased by about **(5-25%)**.

Differences with mono facial

The **back side of the cell** of bifacial is **not coated**. The cell can receive radiation from two sides.

The **substrate of the PV module**. There are two types : **Glass to Glass (G G)** or **Glass to transparent back sheet (G B)**

Junction box mounting:

Factors that affect performance:

- 1- Bifaciality factor: $P_{mp\ rear} / P_{mp\ front}$ (70%-90%)
- 2- Albedo amount of reflected radiation
- 3- height of modules with respect to roof or ground (clearance) --- proportional
- 4- Tilt angle ---- proportional
- 5- Spacing --- proportional

PV System –RECENT TRENDS

Bifacial PV Modules

The substrate of the PV module. There are two types : Glass to Glass (G G) or Glass to transparent back sheet (G B)

Frame or Frameless

Comparison:

Warranty : about 30 years for each; degradation 0.45-0.65 % For GG
0.5-0.7% for GB

Weight: 30 kg for GG but about 20-22 kg for GB for 72 cell module

System cost: installation; mounting; clamps for frameless GG modules

Heat dissipation: better for GB

PV System –RECENT TRENDS

Bifacial PV Modules

Bifacial Gain = Rear Energy (kWh) / Front Energy (kWh)

LG N_eON[®] 2 BiFacial

LG395N2T-A5 | LG390N2T-A5

Electrical Properties (STC*)

		LG395N2T - A5	Bifaical Gain**				LG390N2T - A5	Bifacial Gain**			
			5%	10%	20%	30%		5%	10%	20%	30%
Maximum Power (Pmax)	[W]	395	415	435	474	514	390	410	429	468	507
MPP Voltage (Vmpp)	[V]	41.8	41.8	41.8	41.9	41.9	41.4	41.4	41.4	41.5	41.5
MPP Current (Impp)	[A]	9.46	9.92	10.39	11.31	12.26	9.43	9.90	10.36	11.28	12.22
Open Circuit Voltage (Voc)	[V]	49.3	49.3	49.3	49.4	49.4	49.2	49.2	49.2	49.3	49.3
Short Circuit Current (Isc)	[A]	10.19	10.70	11.21	12.23	13.25	10.15	10.15	11.17	12.18	13.20
Module Efficiency	[%]	18.7	19.6	20.6	22.4	24.3	18.5	19.4	20.3	22.1	24.0
Operating Temperature	[°C]	-40 - +90									
Maximum System Voltage	[V]	1,500(UL) / 1,000(IEC)									
Maximum Series Fuse Rating	[A]	20									
Pmax Bifaciality Coefficient***	[%]	76									
Power Tolerance	[%]	0 - +3									

The nameplate power output is measured and determined by LG Electronics at its sole and absolute discretion.

* STC (Standard Test Condition): Irradiance 1,000 W/m², cell temperature 25 °C, AM 1.5(Measurement Tolerance : ±3%, Electrical Parameter Tolerance : ±5%)

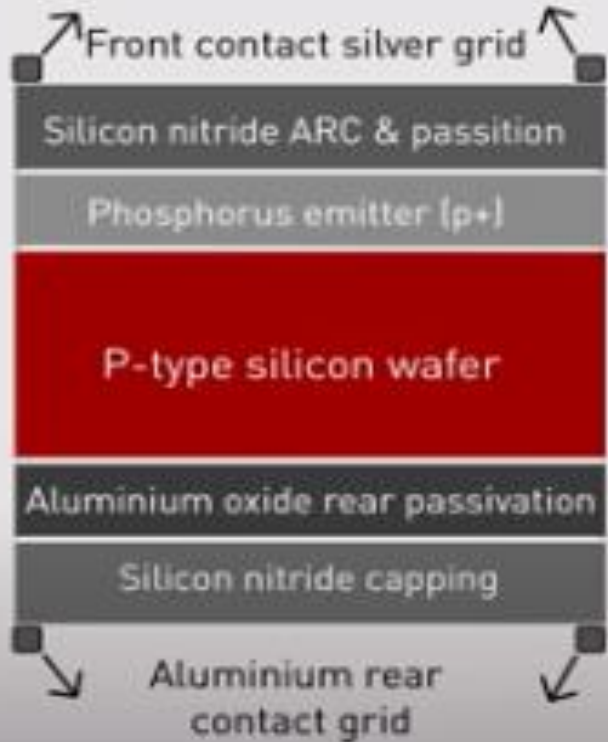
** Bifacial Gain: The additional gain from the back side compared to the power of the front side at the standard test condition. It depends on installation condition.

*** Pmax Bifaciality Coefficient 25years warranty based on front output warranty. tolerances:7%

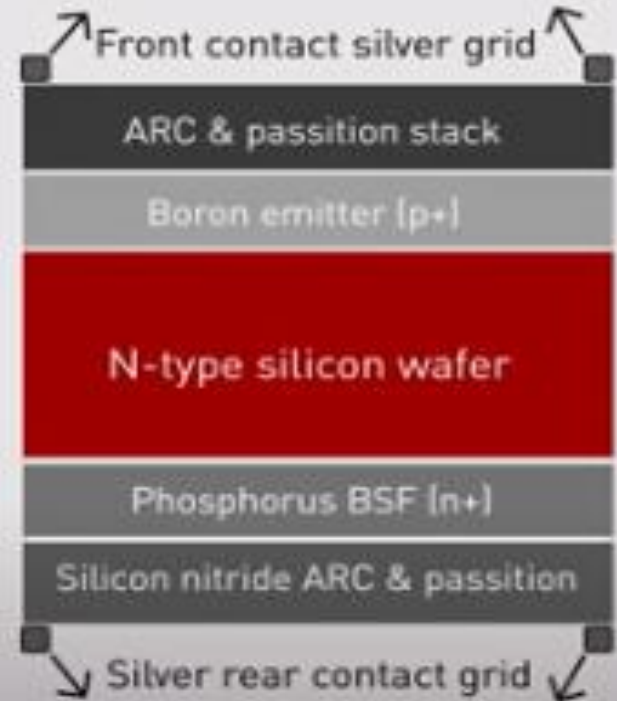
PV System –RECENT TRENDS

Bifacial PV Modules

Technologies



P-TYPE

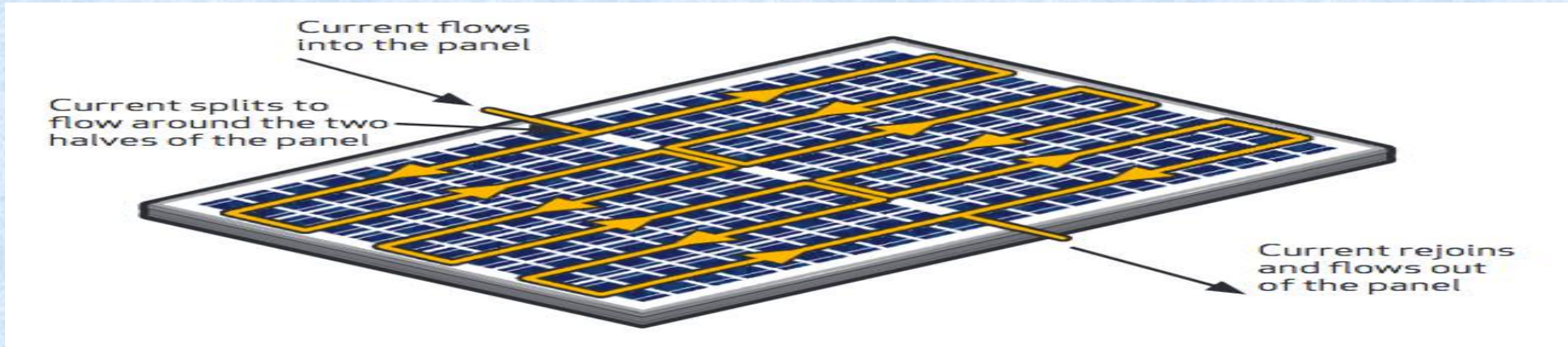


N-TYPE

PV System –RECENT TRENDS

Half-Cut Solar Cells

In a half-cut solar cell, each solar cell is **cut in two**. A panel that uses half-cut cells will have 120 half-cut cells instead of the typical 60.



A solar panel with **half-cut cells** has **two regions, doubling the electrical pathways through the panel**. If the top half of the panel is shaded, the bottom will be unaffected.

--Lower shadow effect

--Lower resistance in half-cut cells which means better efficiency. Reducing the current by half, the power loss drops by a factor of 4

-- Combined Technology: Bifacial and Half cut

--The main disadvantage of half-cut cells is somewhat higher costs due to increased manufacturing complexity

PV System –RECENT TRENDS

Half-cut solar cell

On average, a half-cut solar panel will have an absolute efficiency improvement of **about 0.5%**. This means that if you have a panel with 18% overall efficiency, switching to half-cut cells will get you to about 18.5% efficiency.

