



JinkoSolar Bifacial - Antonio Ruta

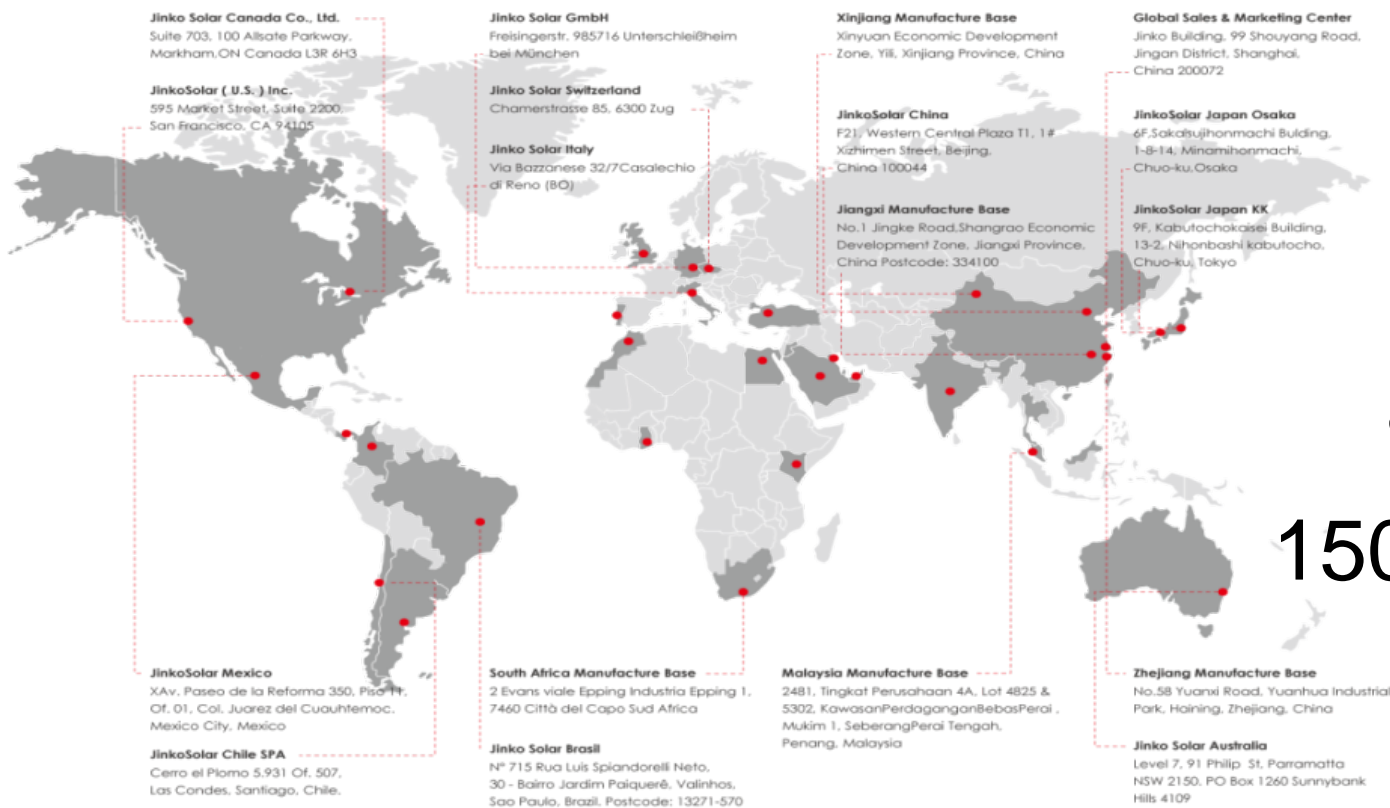
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JinkoSolar Co., Ltd.



- 1 Jinko Solar Introduction**
- 2 Diversified and widest portfolio**
- 3 Bifacial modules: Tech concepts**
- 4 Summary**

Key Facts of JinkoSolar



8 Global Factories

31 Subsidiaries

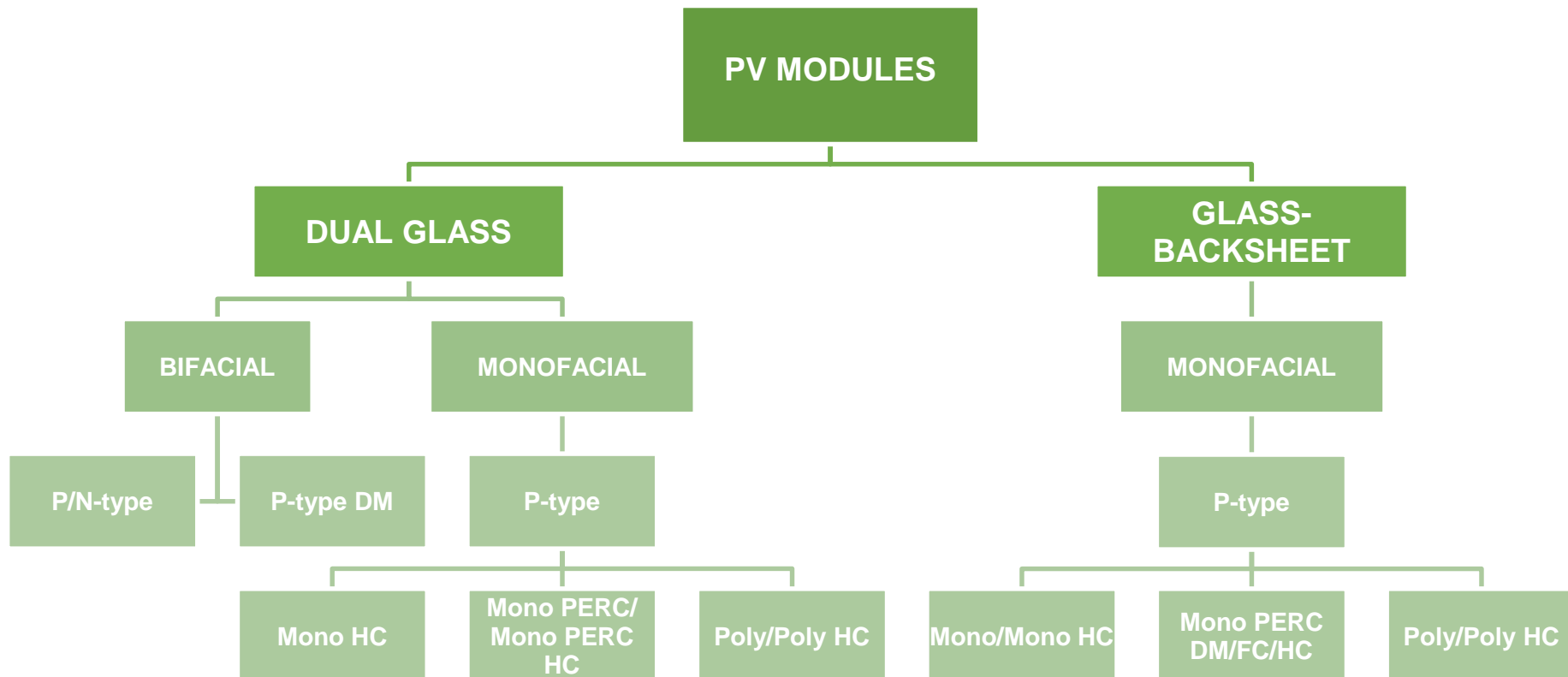
80+ Countries

15000 Employees

9.5 GW | 11,5 - 12 GW
Capacity 2017 | Capacity 2018

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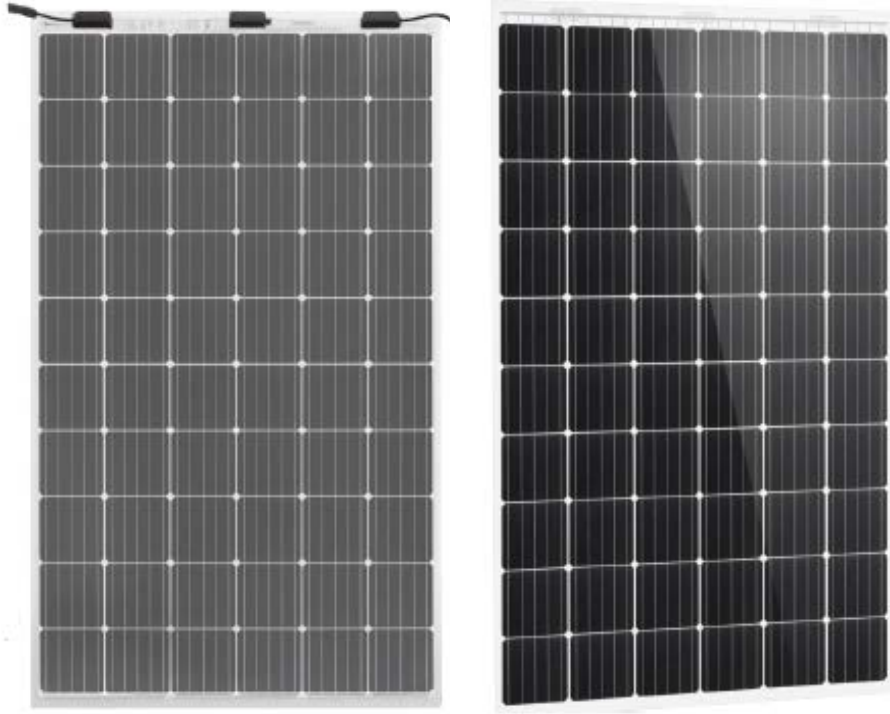
Diversified Module Portfolio



* More than 230 BOM combinations of different cell tech, module type, add-on solutions

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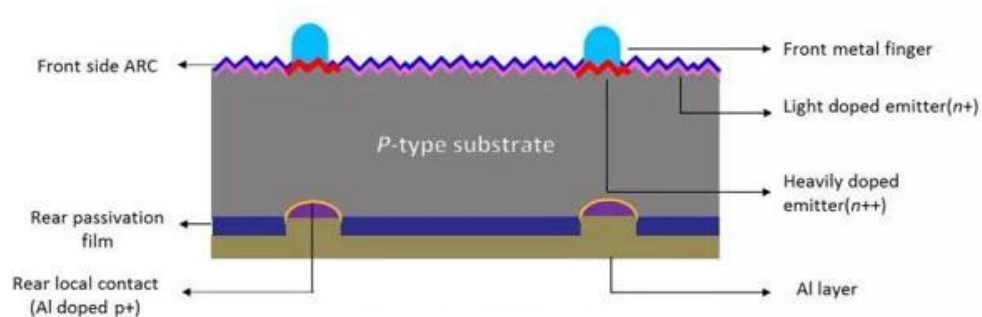
BiFacial Technology



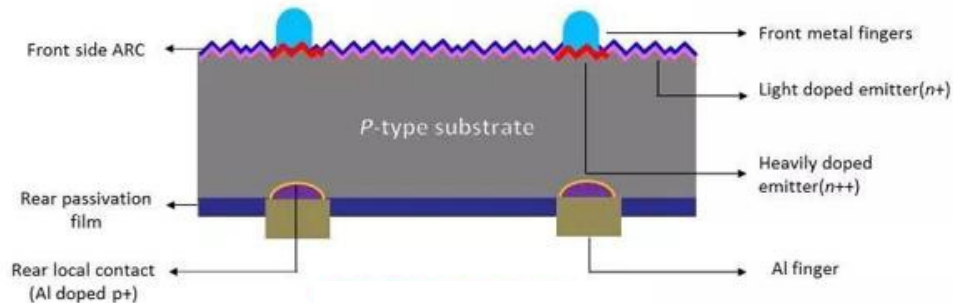
Jinko Bifacial:

- Full score bifacial module has won the bidding of China “Top Runner”.
- Power keep leading in the industry.
- Bring extremely low LCOE and high IRR

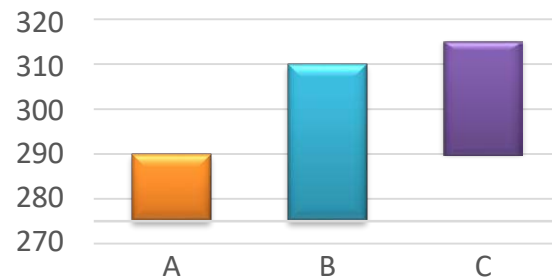
BiFacial: Tech. Concept



Normal PERC



Bifacial PERC



A. Industry Normal Mono

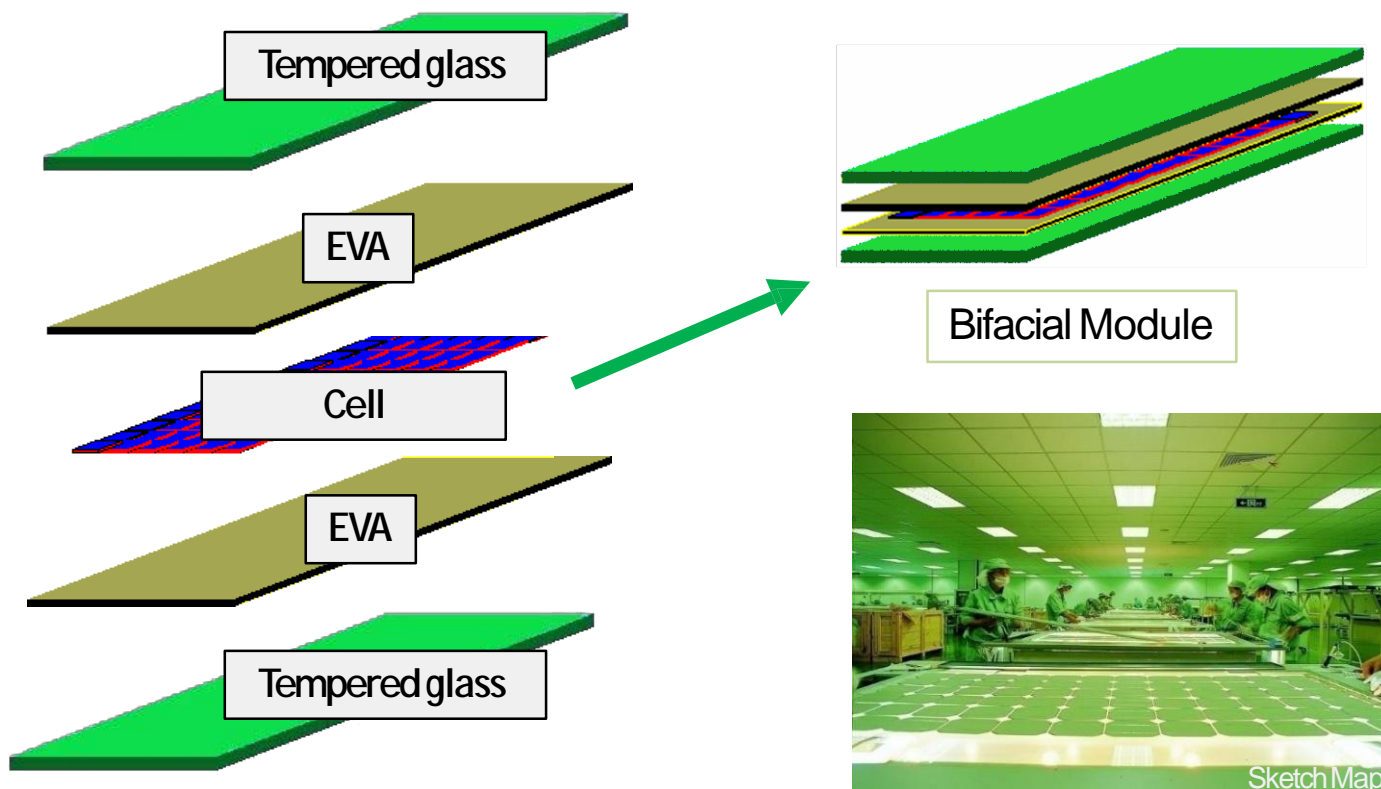


B. Industry PERC Mono



c. Jinko PERC Mono

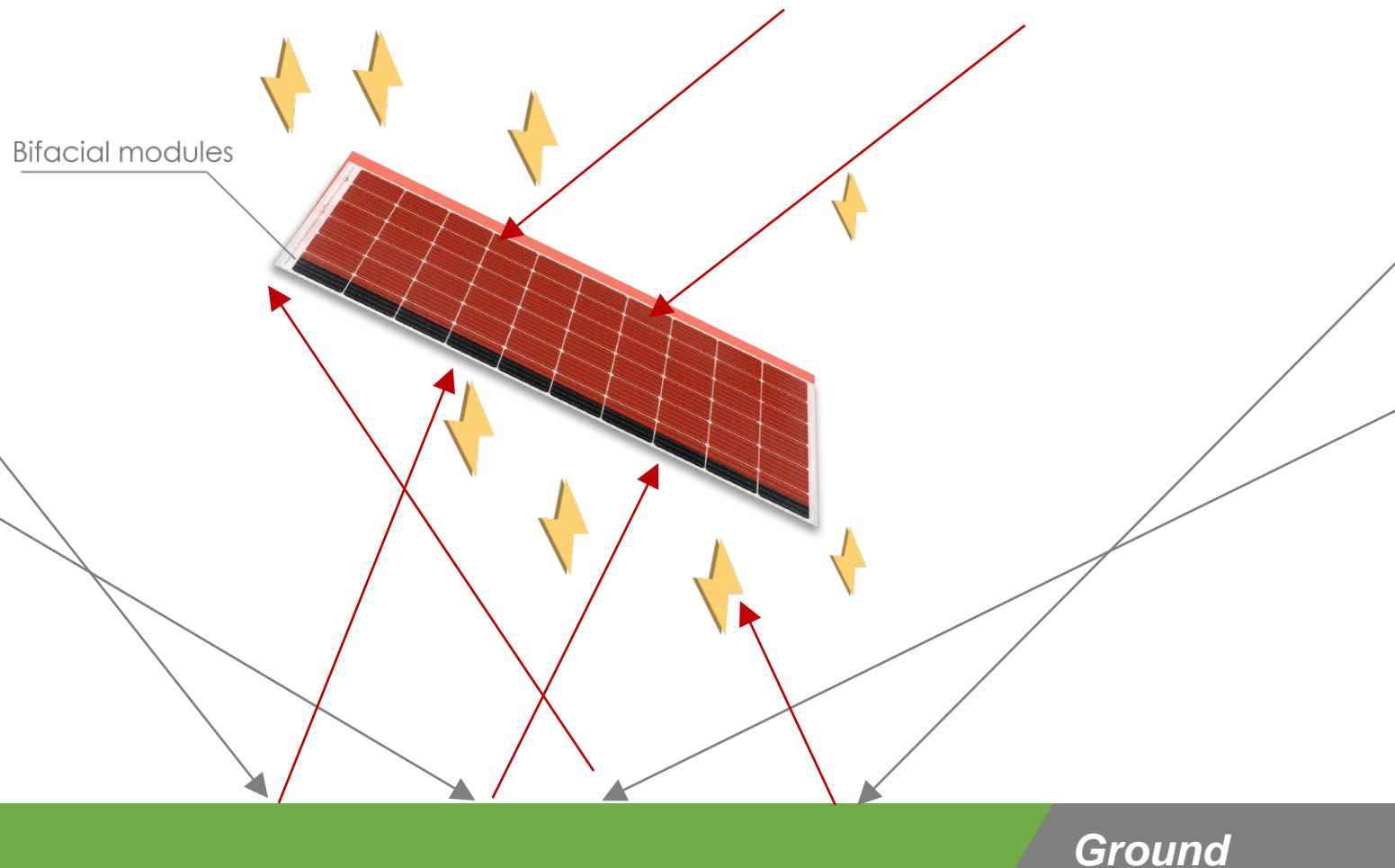
BiFacial: Structure of Module



BiFacial: Gaining more energy

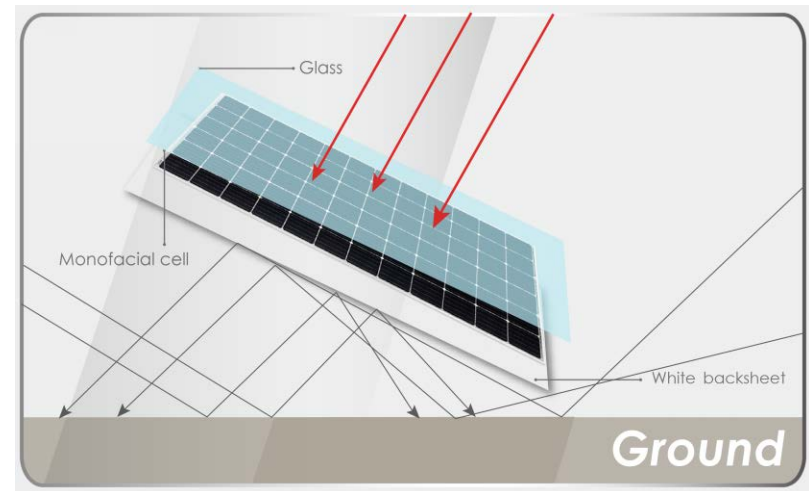
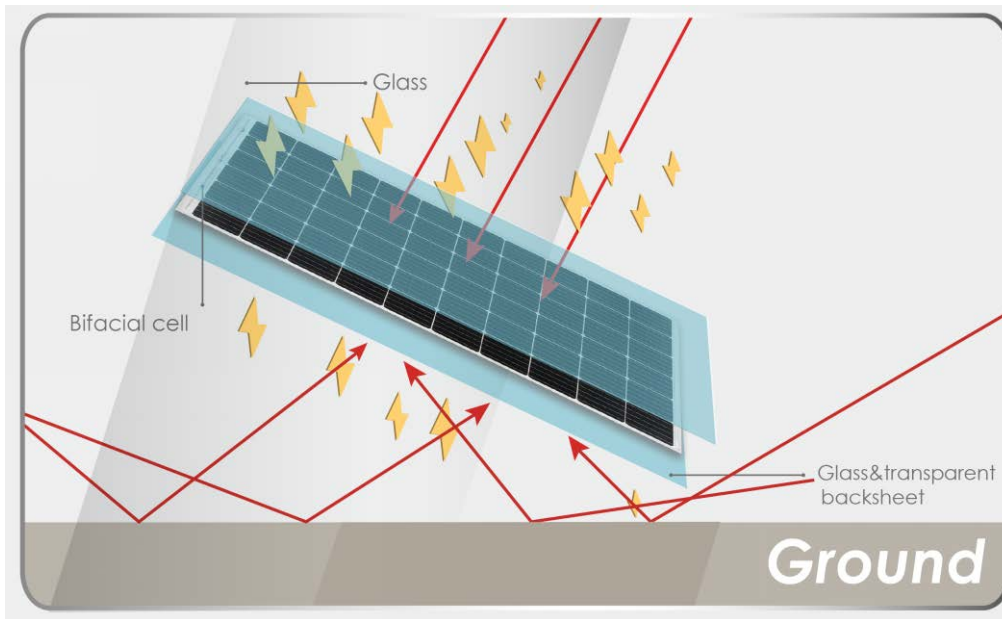
Use bifacial modules for more sunlight

Absorb sunlight and produce more energy from front and back



BiFacial: Bifacial vs Monofacial

When optimized, Bifacial module generates **20~25%** more energy than conventional monofacial module.



Bifacial module: double-sided generation

Standard module: front-sided generation

BiFacial: Module Gain

Bifacial Gain Definition:

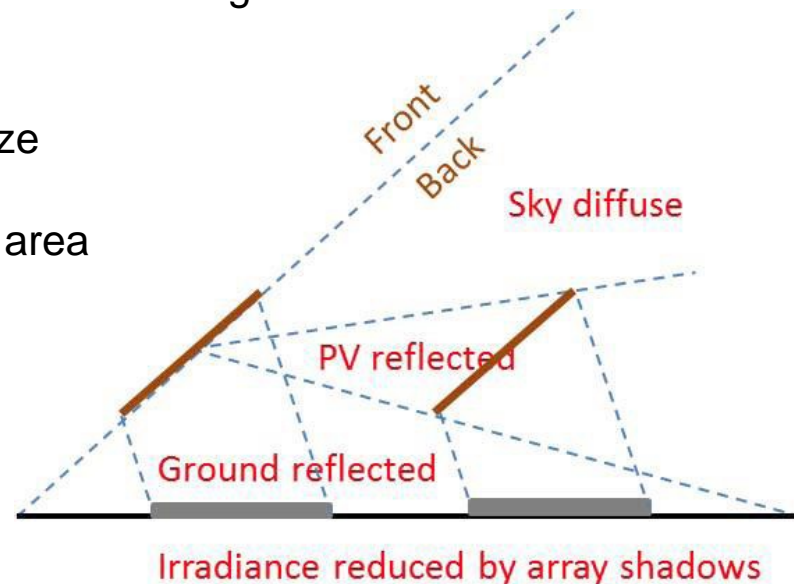
$$Gain_{BiFi} [\%] = \frac{E_{BiFi} - E_{MoFi}}{E_{MoFi}} \times 100$$

E_{BiFi} = specific energy yield (kWh/kWp) with bifacial modules

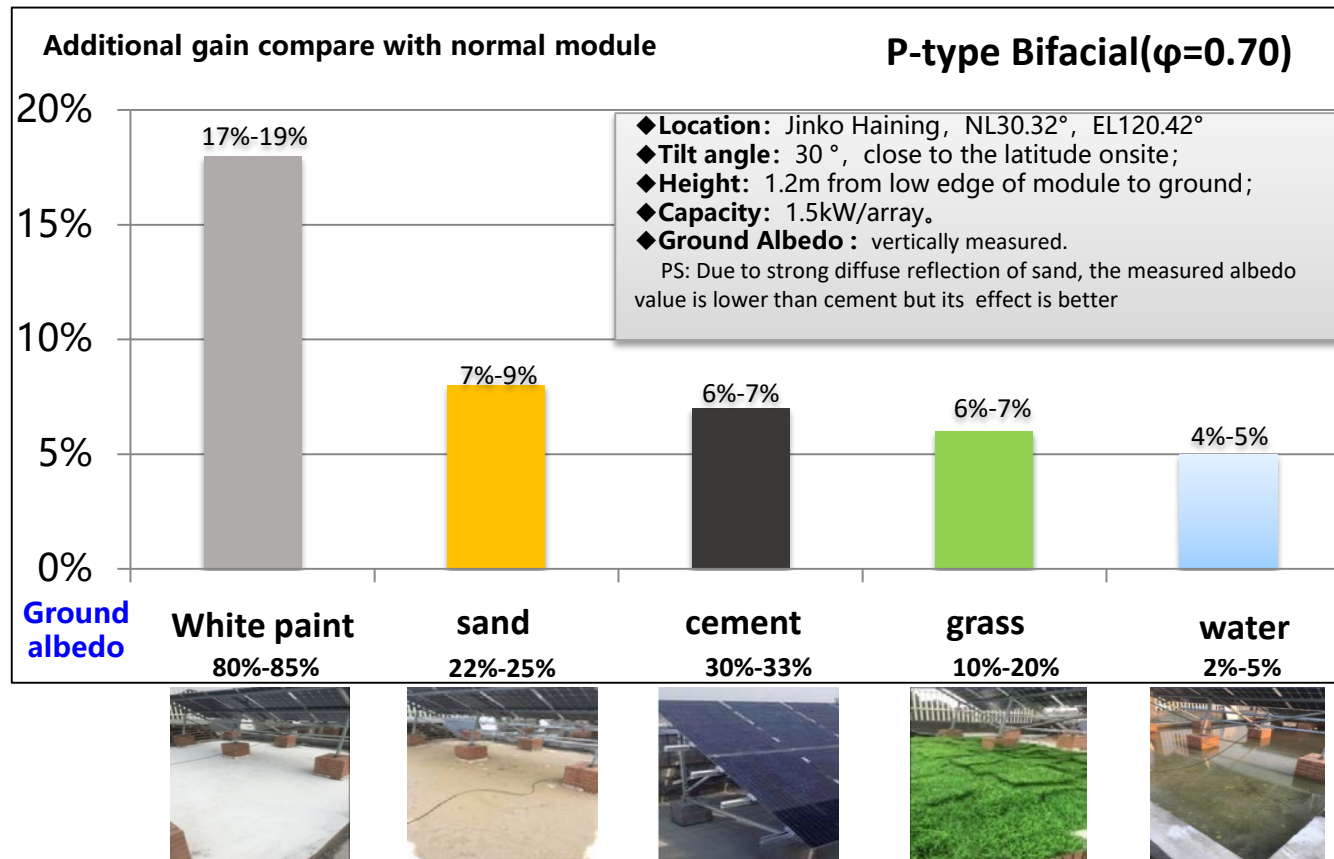
E_{MoFi} = specific energy yield (kWh/kWp) with monofacial modules on the same site, with the same configuration and during the same time period

Bifacial Gain parameters:

- Albedo
- Solar Radiation / Climate condition
- Height from ground level: Higher structure/tracker height increases the reflected area and the diffuse light.
- Rear shading: mounting structure/tracker and wiring should be designed to minimize the shading on the rear side.
- Distance between rows (pitch): reflecting area increases proportionally to the pitch.



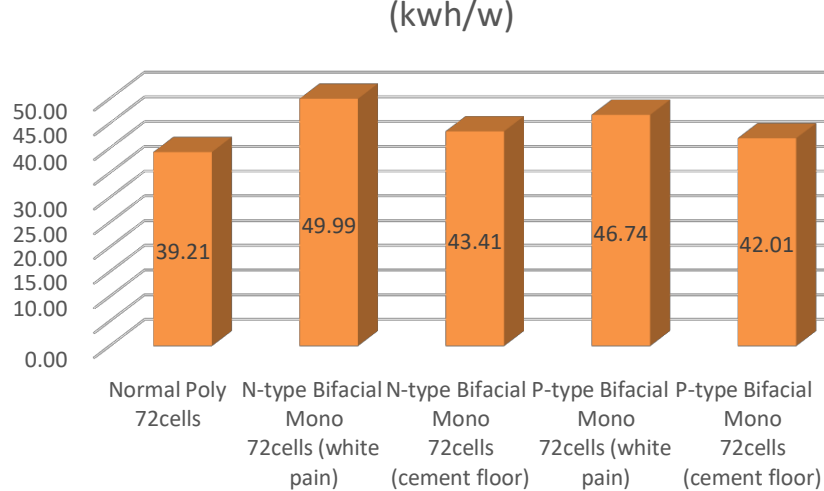
BiFacial: Albedo effect on PV Project Application



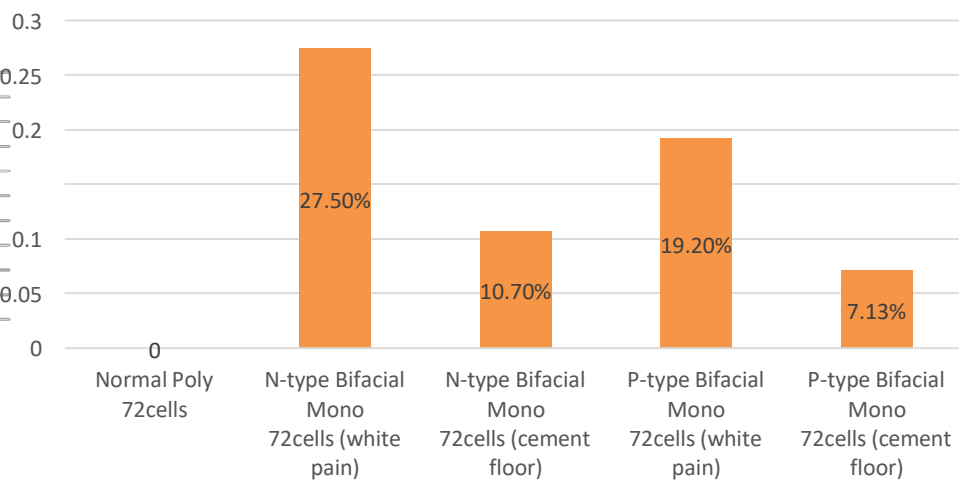
- Increased ratio of project energy output depends on ground reflectivity.
- All simulation must be done according to current PV system design.

BiFacial: Module Yield Performance

yield gain
(kwh/w)



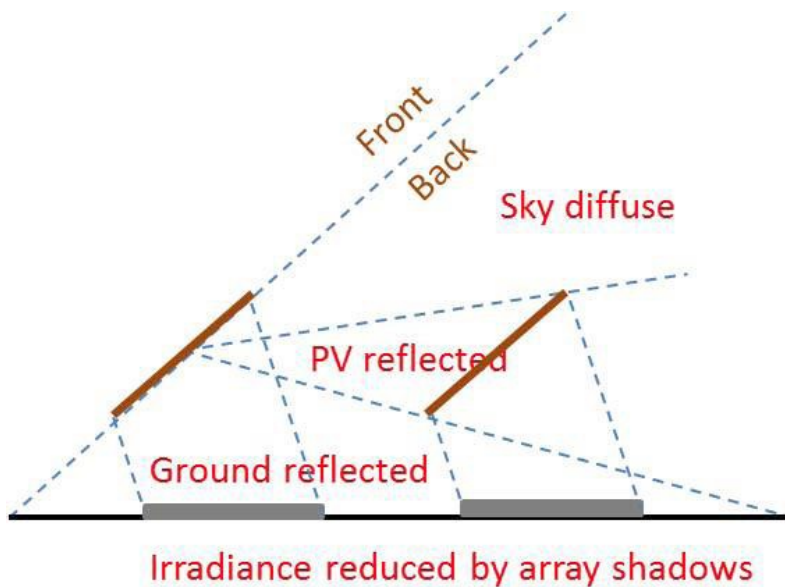
Extra yield



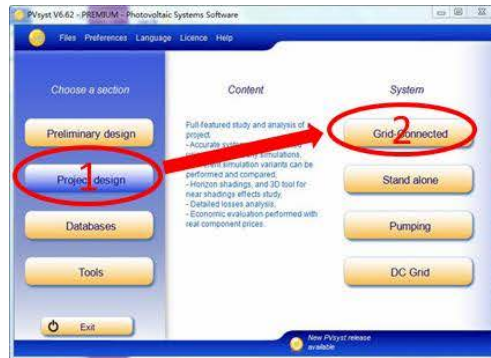
BiFacial: Other Gain parameters

Bifacial Gain parameters:

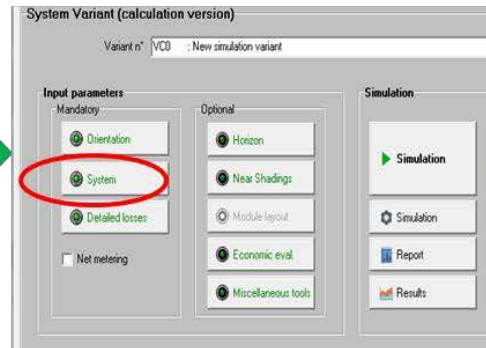
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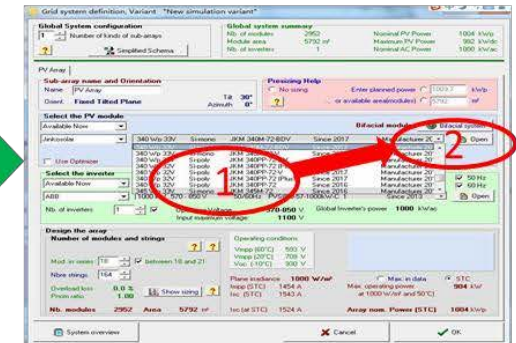
BiFacial: how to simulate by PVsyst



[1] Start PVsyst



[2] Choose 'system'



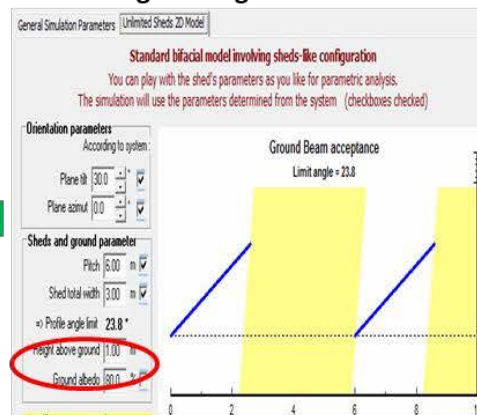
[3] Aimed Bifacial Pan.file, to press 'bifacial system'

[6] Finish setting, simulate

New simulation variant
Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray MWh	E_Grid MWh	PR
January	152.4	57.42	24.00	190.5	188.2	163.0	160.6	0.840
February	135.5	72.18	26.20	152.4	149.8	130.9	129.1	0.844
March	168.8	83.75	28.51	173.8	170.6	148.3	146.2	0.838
April	158.9	84.87	29.50	147.2	144.0	126.9	125.0	0.846
May	174.7	83.90	28.78	148.3	142.7	128.5	126.6	0.862
June	162.7	86.25	28.29	133.0	129.6	118.4	116.5	0.873
July	175.6	80.88	28.31	144.4	140.8	127.8	125.9	0.889
August	159.1	82.04	28.01	141.6	138.4	124.3	122.4	0.861
September	136.8	81.44	27.08	133.5	130.8	117.0	115.2	0.859
October	140.6	72.22	27.11	151.4	149.0	130.1	128.1	0.843
November	136.7	66.72	25.02	162.2	159.8	139.7	137.7	0.846
December	147.3	58.39	24.23	188.3	185.9	161.6	159.4	0.843
Year	1849.2	909.87	27.09	1864.6	1829.5	1616.7	1592.5	0.851

[5] Set parameters, especially height and ground albedo



[4] Choose 'use 2D'

Bifacial Model

☒ Don't use in the simulation

☒ Use 2D - unlimited sheds model and pedagogic tool

Other models are currently under construction:

- General scene defined in the 3D editor
- Bifacial vertical wall or rows

Incident irradiance on the ground

Beam ground factor: From sun's position, 2D model

Diffuse ground factor: 53.7 % From 2D model

Module transmission factor: 0.0 % (0 = opaque)

Ground albedo: 80.0 %

Reflected irradiance on backside

Reemission form factor: 54.4 % From 2D model

Structure shading factor: 5.0 % (0 = no shadings)

PV array behavior

Mismatch loss factor: 10.0 %

Module bifaciality factor: 70.0 % From PV module

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BiFacial: Bifacial vs Monofacial

	Standard	Bifacial
		
Concept	Front irradiance only	Backside reflection irradiance increase power output
Power	-	less 5Wp solution, due to glass-glass lamination Up to 25% more energy depending on ground reflectivity No international standards have been yet released to measure total power (front + back)
BIPV	Not suitable	Glass-Glass Aesthetic added value
BOS cost	1000V or 1500V	1500V (less strings, faster installation)
Installation	Framed	Frameless / Frame
Performance warranty	0.7%/year for 25 Years	0.5%/year for 30 Years
PID resistance	Limited power degradation by PID test is guaranteed for mass production	Anti-PID
Durability	Certified against extreme environmental conditions	Dual glass reduces micro-cracking, snail trails, corruptions caused by moisture, sand, salt mist, acid, alkali

Thanks

Q/A

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