

STERLING & WILSON



DESIGNING BIFACIAL PV PROJECTS IN AUSTRALIA

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**RANKED WORLD'S #1
SOLAR EPC COMPANY**

by IHS Markit

*OUTSIDE CHINA

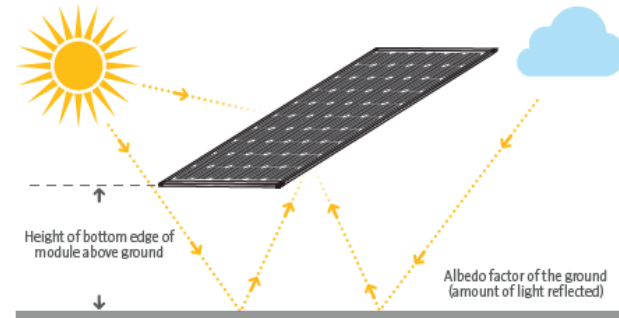
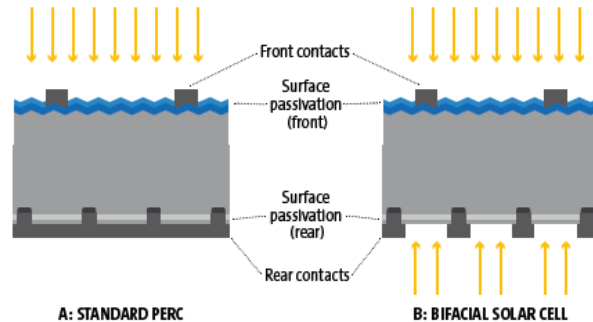


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INTRODUCTION TO BIFACIAL

- Bifacial technology converts light captured on both the front and back of the module
- The front side of the module works as a standard monofacial module, converting sunlight energy to voltage and current.
- The active back side module receives light reflected from ground surface and diffused from surrounding, increasing current at the cell level

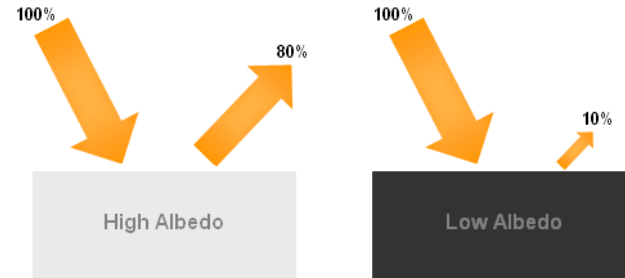


- Bifacial added effect depends on light [W/sm] received from module backside and all rules for the optimum installation are focused to maximize this contribution

ABOUT ALBEDO

- Albedo is defined as the ratio of the diffuse reflection of solar radiation to the total incoming solar radiation, it is dimensionless and expressed as a number between 0 and 1. Where 0 is total absorption and 1 is total reflection
- Earth naturally reflects 8% of total solar radiation received from Sun
 - *Corrugated roof: 0.1 - 0.15*
 - *Colored paint : 0.15 - 0.35*
 - *Trees: 0.15 - 0.18*
 - *Asphalt: 0.05 - 0.2*
 - *Concrete: 0.25 - 0.7*
 - *Grass: 0.25 - 0.3*
 - *Ice: 0.3 - 0.5*
 - *Red/Brown roof tiles: 0.1 - 0.35*
 - *Brick/Stone: 0.2 - 0.4*
 - *Oceans: 0.05 - 0.1*
 - *Old snow: 0.65 - 0.81*
 - *White paint: 0.5 - 0.9*
 - *Fresh Snow: 0.81 - 0.88*

$$\text{Albedo } (\rho) = \frac{\text{Reflected radiation}}{\text{Global radiation}}$$



- An albedometer is simply two similar pyranometers measuring simultaneously, one looking up and one looking down, either back-to-back or in a single housing

YIELD PARAMETERS

- **Geographic location**
 - *Ground albedo*
 - *Clearness Index*
- **Module technology**
 - *Bifaciality factor of the module*
 - *Annual degradation rate*
- **System configuration**
 - *Elevation*
 - *Azimuth*
 - *Tilt*
 - *Height: Width*
 - *DC:AC*

COST PARAMETERS

- **Modules Cost:** *Depending on specific bifacial technology*
- **BoS cost :** *Increase in tracker cost, cables, combiner boxes (added no. of inputs), addition of clamp cost*
- **Installation Cost:** *Increase in foundation length, cable trenching cost*
- **Land cost:** *Optimum row-to-row distance is higher for bifacial compared to monofacial PV systems, leading to a lower ground cover ratio for bifacial PV systems*
- **O&M cost:** *If measures have been taken to artificially increase the ground albedo, CAPEX and O&M cost might be increased*
- **Financing:** *Depending on the maturity (and track record) of a given bifacial PV technology (and the specific module supplier*
- **Land preparation**
- **Project development**

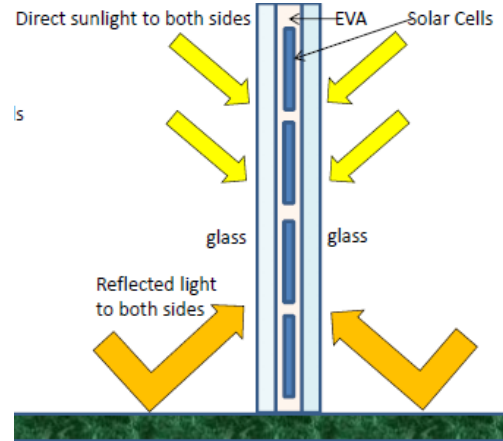
ADVANTAGES

- **Higher Efficiency** - *The Bifacial solar modules ensure that indirect light of reflected sun rays is captured from the rear of solar cells and therefore, they achieve a higher efficiency*
- **Extended durability** - *By embedding of solar photovoltaic cells in a glass composite, they are highly protected against environmental and mechanical influences and therefore last longer*
- **More flexibility in solar PV system designs** - *With the use of bifacial solar modules, the direction that the modules are facing is of less importance*
- **Extended Warranty** - *Mostly these panels often come with an extended warranty of 30 years*
- **Lower Degradation** - *Annual degradation rate is 0.5%*
- **PID Free**
- **No Grounding required** - *The frameless panels are devoid of Aluminum frames. Hence, there is no need to ground these modules.*

ISSUES/ DISADVANTAGES

- **Heavy** - *Bifacial solar modules are made of double glass, which makes the module heavier*
- **PV modules are typically sold in price per Wp**
 - *How to address the bifacial gain on the PV module label or in the data sheet?*
- **Maintaining Albedo**
 - *Albedo depends on the properties of the surface under the module such as color, thickness, surface finish or type of vegetation. All these factors can change over time due to environmental influences like aging, soiling or the natural alteration of ground conditions*
- **Whether framed bifacial panels or unframed glass-glass bifacial panels**
 - *Unframed modules tend to cause less backside shading*
 - *However , total BOS costing is more compared to using framed module*
 - *Framed bifacial modules can trap sand or other soiling materials*
- **Mismatch between front and rear surface**
 - *Irradiance > Rear side irradiance lies in the range 130-140 W/m²*
 - *Cell Temperature*
 - *Current*
 - *Soiling*

GOING FORWARD



Vertical installation

- ~100% yield compared to south-facing
- Noon peak shaving
 - Better matching with electricity need
- “Rectangle” solar power generation



Double Peak Profile

- 50% panels face eastwards to create a generation peak in the morning
- 50% is tilted westwards to also allow for a generation peak in the afternoon



Floating on Bifacial

- Contribute to natural ecosystem
- Bifacial energy gain up to 30%



Thank You