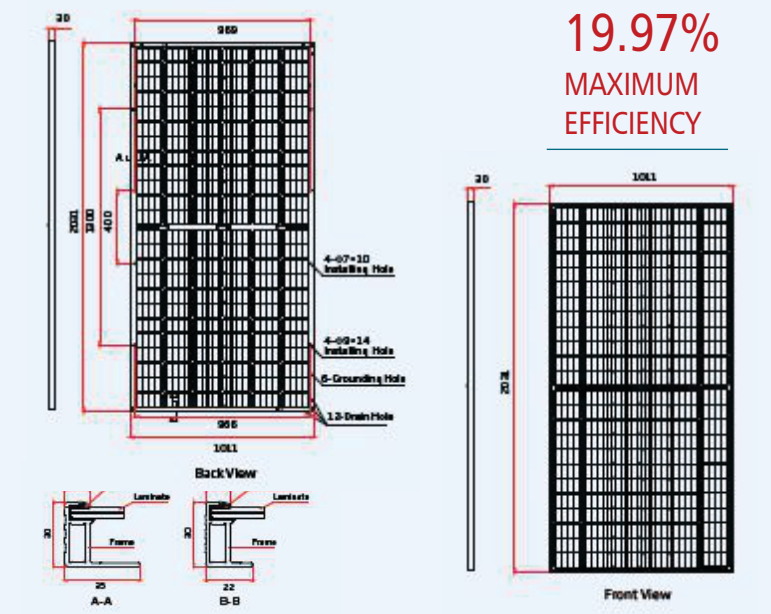
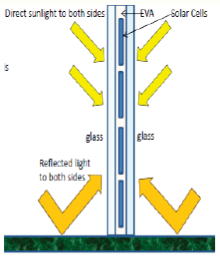
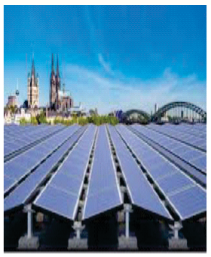
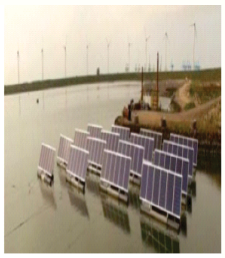


KOSOL ENERGIE







VERTICAL INSTALLATION

- ~10-20% yield compared to south-facing
- Noon peak shaving
- Better matching with electricity need
- Rectangle" solar power generation

DOUBLE PEAK PROFILE

- 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

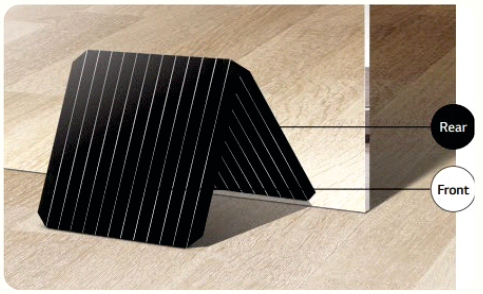
FLOATING ON BIFACIAL

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

ELECTRICAL DATA (STC)

Pmp/W*	380	385	390	395	400	405	410
Vmpp/V	40.3	40.4	40.5	40.6	40.7	40.8	40.9
Impp/A	9.43	9.53	9.63	9.73	9.83	9.93	10.03
Voc/V	49.2	49.4	49.6	49.7	49.9	50.1	50.3
Isc/A	9.99	10.09	10.19	10.29	10.39	10.49	10.59
Eff. %	18.5	18.7	19.0	19.2	19.5	19.7	19.97

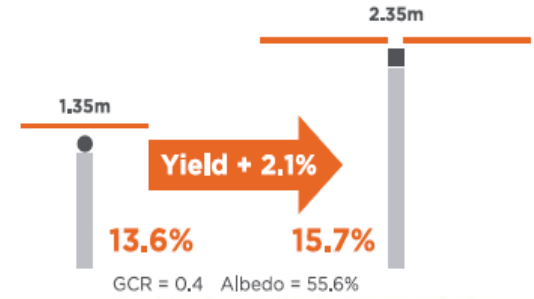
STC: Irradiance 1000W/m2, Cell Temperature 25°C, Air Mass AM1.5
*Measurement tolerance: ±3%



ELECTRICAL CHARACTERISTICS 400 Wp front

Pmax(Wp)	420	440	460	480	500
Vmpp/V	40.7	40.7	40.7	40.7	40.7
Impp/A	10.32	10.81	11.3	11.8	12.29
Voc/V	49.9	50.0	50.0	50.0	50.1
Isc/A	10.91	11.43	11.95	12.47	12.99
Pmax gain	5%	10%	15%	20%	25%

Electrical characteristics with different rear side power gains (referenced specific to 400 Wp front)**
Bifaciality Factor: 70±5%.
** Back-side power gain varies depending upon the specific project albedo



MECHANICAL DATA

Solar Cells	Monocrystalline
Cell Orientation	144 cells (6 x 24)
Module Dimensions	2031 × 1011× 30 mm (79.96×39.80 × 1.18 inches)
Weight	26.8 kg (59.1 lb)
Front Glass	2.0 mm (0.08 inches), High Transmission, AR Coated Heat Strengthened Glass
Encapsulant Material	EVA/POE
Back Glass	2.0 mm (0.08 inches), Heat Strengthened Glass
Frame	30 mm (1.18 inches) Anodized Aluminium Alloy
J-Box	Photovoltaic Technology Cable 4.0 mm2
Cables	Landscape: 1900/1900 mm (74.80/74.80 inches)

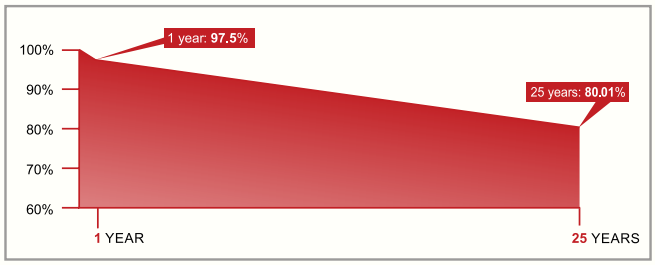
TEMPERATURE RATING

NMOT (Nominal Module Operating Temperature)	41 °C (± 3 °C)
Temperature Co-efficient of Pmax	-0.35%/ °C
Temperature Co-efficient of Voc	-0.25%/ °C
Temperature Co-efficient of Isc	0.04%/ °C

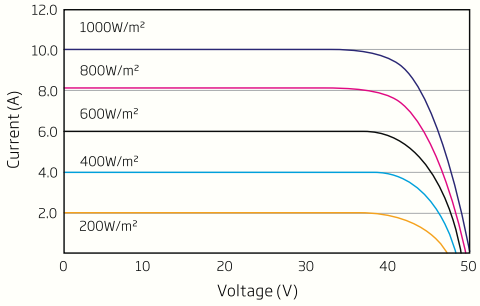
MAXIMUM RATING

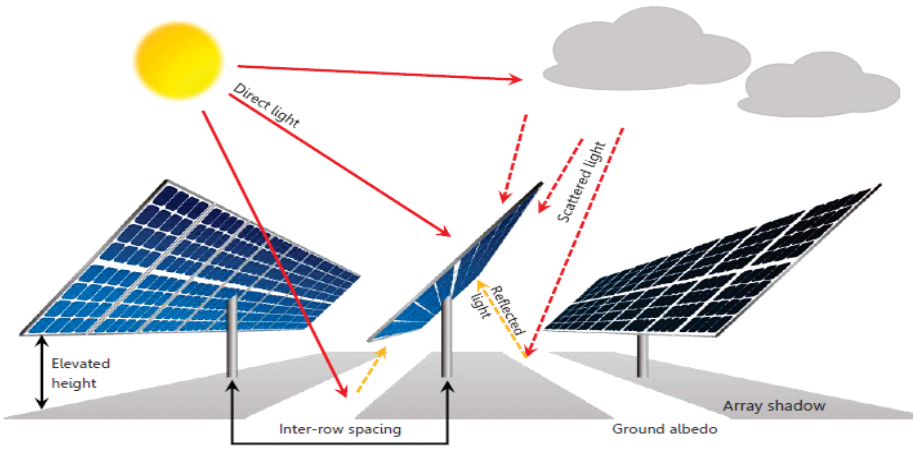
Operational Temperature	– 40~+85 °C
Maximum System Voltage	1500V DC (IEC)
	1500V DC (UL)
Max Series Fuse Rating	20A

PERFORMANCE WARRANTY



IV CURVES OF PV MODULE (400W)

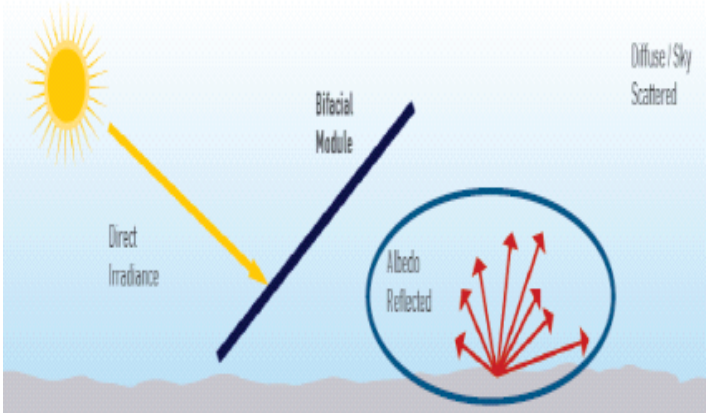


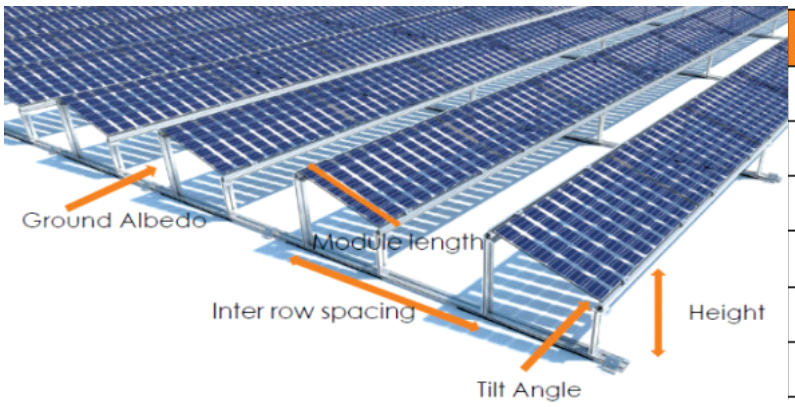


$$\text{Bifaciality} = \frac{\text{Amount of power generated by the rear side}}{\text{Amount of power generated by the front side}}$$

Energy yield gain increases almost linearly from GCR 0.5 to 0.25, while becomes slowly from 0.25 to 0.1. Based on the simulation, both increasing ground albedo and height can have more power gain.

- Increasing module height improves backside energy yield, as well as backside irradiancy uniformity.
- Module height (clearance from ground) of 1m and above is recommended.





Roof top PV Port Solution Advantages

- A PV module generates energy when light falls on its surface.
- For a bifacial module, it is necessary that light falls on its backside as well.
- The surface/ grounds nature to reflect (a proportional of) light falling on it is known as albedo.
- Different surface have different albedo.

- Once light falls on the module, its efficiency and bifacial come in to play.
- The rear side of module does not always generate the same power exactly equals front side.
- The ratio between rear side and front side power generation is known as module bifaciality.
- Bifaciality further varies with the kind of cell utilized in a solar module.

↑ ALBEDO:
- ↑ Main influence
- ↕ Seasonal variations

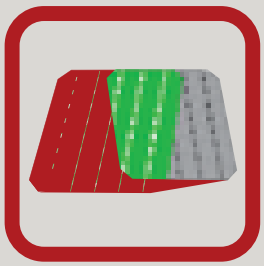
↓ GCR
- ↑ Tracking time
- ↑ Bifacial Ratio

↑ Height
- ↑ Rear irradiance
- ↓ Missmatch
- ↓ Temperature

Type of soil	Albedo
Urban enviornment	0.14-0.22
Grass	0.15-0.25
Fresh grass	0.26
Fresh snow	0.82
Wet snow	0.55-0.75
Dry asphalt	0.09-0.15

Type of soil	Albedo
Wet Asphalt	0.18
Concrete	0.25-0.35
Red tiles	0.33
Aluminum	0.85
Copper	0.74
New galvanized steel	0.35
Very dirty galvanized	0.08

Source: PVSyst

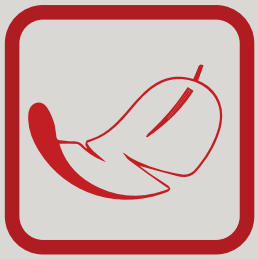


Yield

In actual practise, increased energy gain between 6% –15% versus mono-facial PV modules

PID Free

Glass backing has a lower permeability to moisture than mono-facial backing materials, which reduces risk from Potential-Induced Degradation (PID)

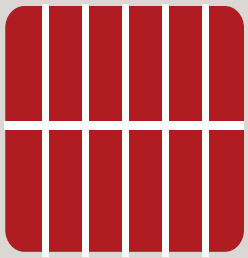


More flexibility in solar PV system design

With the use of bifacial solar modules, the direction that the modules are facing is of less importance

Warranties

Favourable warranties compared to mono-facial: 30 year lifetime warranty and 0.5% annual degradation are common



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

Vertical Installation

By installing PV solar panels vertically, heavy snow loads or sand will not inhabit the modules from generating electricity

Warranties

With the world moving from INR/Wp to INR/kWh ,bifacial module would be the next obvious choice for end customers/EPCs