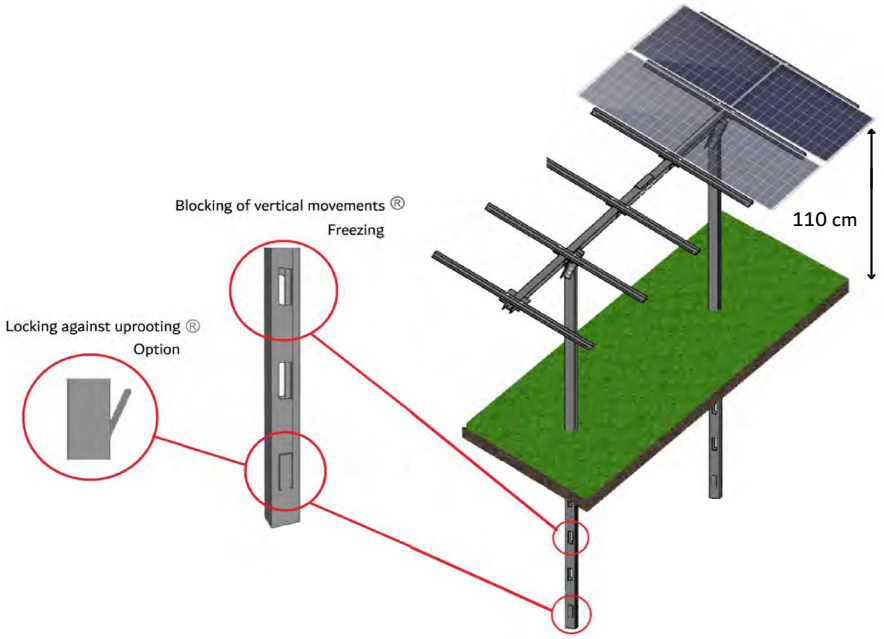
Greatness PV BIFACIAL MAX®

1x5 BiFacialMAX Ground PV

BIFACIAL MAX 1x5 ground structure is made of high-quality closed profiles steel covered with an additional protective coationg that provudes long-term protection of the surface of steel elements, ensures high resistance to corrosion and abrasion and has self-regenerating properties.

BIFACIALMAX structures are manufactured in a Polish steel profiles factory located in Wolental according to the highest European standards confirmed by certificates.



Top quality closed profiles

1x5 vertical layout

Tilt angle 25'

Weight of the structure
119 kg for 5 modules

Modules start
H = 110 cm

For modules: Width 1134mm with bolt spacing 1100mm or 1400mm

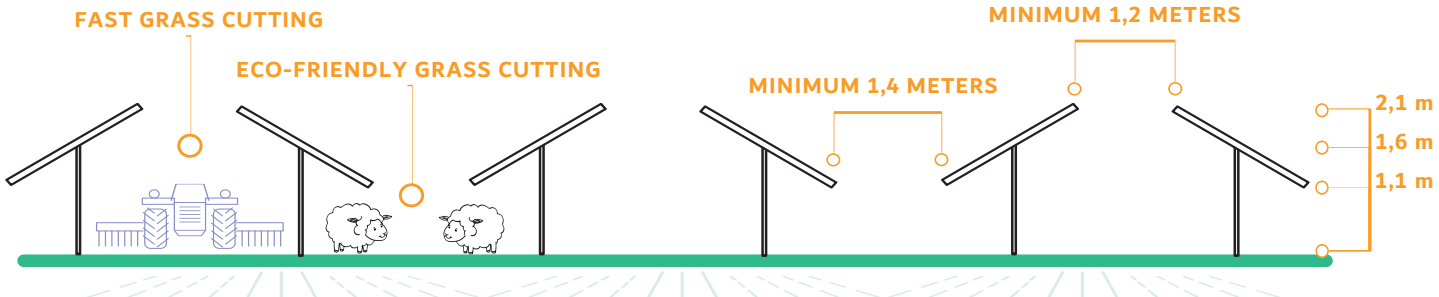
1,2,3,4
Snow Zone

1,2
Wind zone - 200 km/h Option

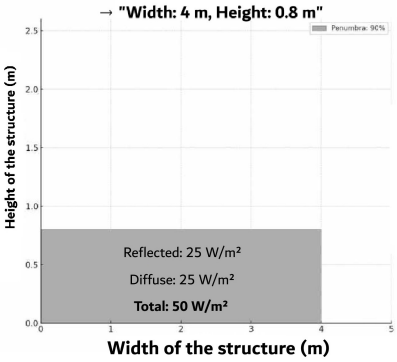
Modules length
L = 230 cm

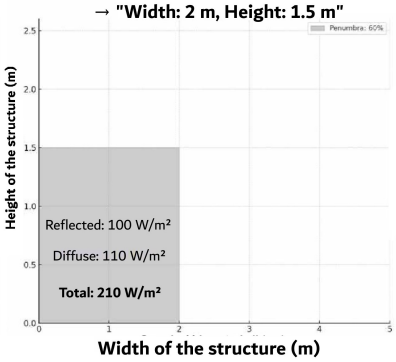
In accordance with European standards	Certificates
PN-EN 1991-1-1 Eurocode 1	EN 1090-5:2017
PN-EN 1991-1-3 Eurocode 1	EN 1090-2:2018
PN-EN 1991-1-4 Eurocode 1	EN 1090-4:2018
PN-EN 1993-1-3 Eurocode 3	EN 1090-3:2019
PN-EN 1993-1-8 Eurocode 3	

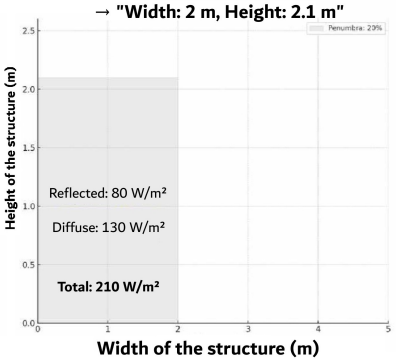
RECOMMENDED BIFACIALMAX® **TABLE LAYOUT EAST WEST 1P** STATIONARY SYSTEM-ALBEDO 26%
GUARANTEEING 20% MORE ENERGY GENERATION PER YEAR FROM THE BACK OF THE BIFACIALMAX MODULES

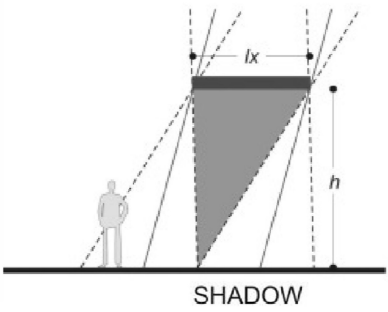


Level of irradiation reaching the rear side of the panels (W/m²)









STEEL CLOSED PROFILE

S355
STEEL S355

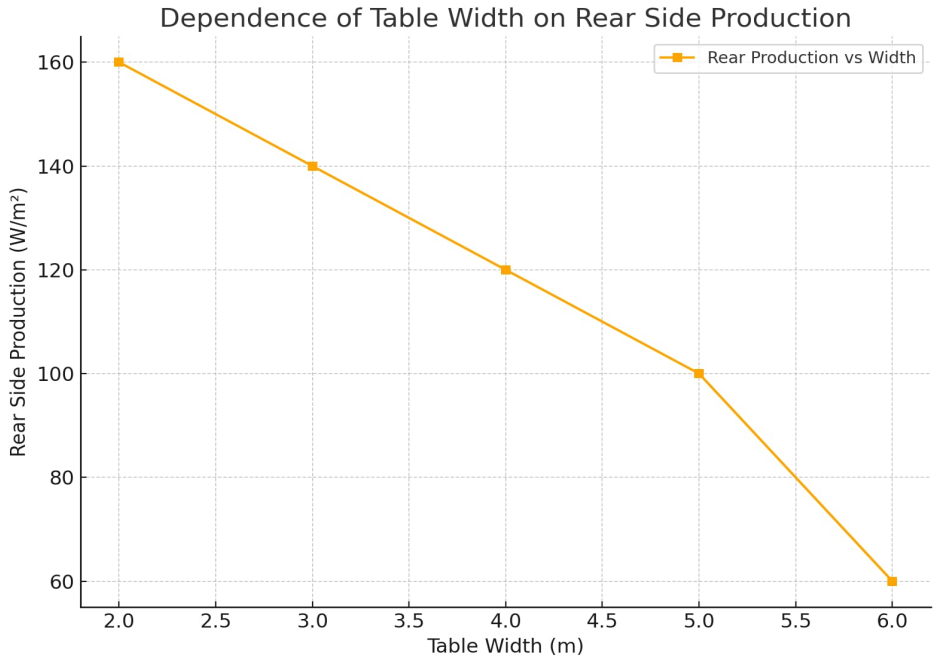
MAGNELIS 600
MAGNELIS 600 COATING

3 mm
THICKNESS WALL THICKNESS 3 mm

50 lat
DURABILITY DESIGN LIFE 50 YEARS

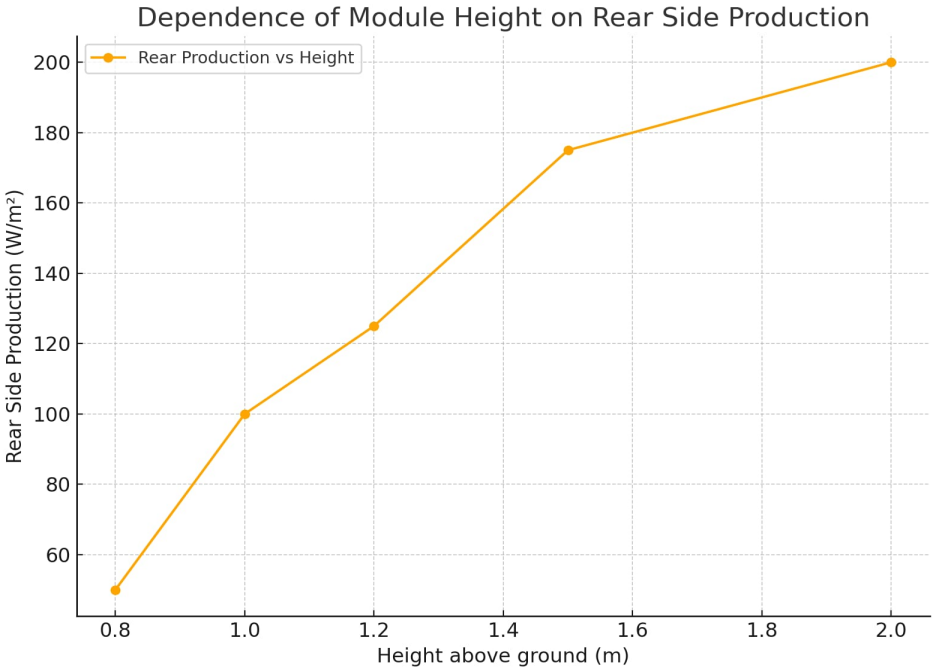
Effect of table width on illumination of the back side of the modules

- In narrow tables (e.g., the width of one row of panels, about 2 meters), reflected and diffused light is much more accessible to the back side of the panels. As a result, the back side works more intensively, which directly translates into higher system efficiency.
- For wide tables (e.g., 5-6 meters, where several rows of panels lie next to each other), the area under the panels is more shaded. Light finds it harder to reach the back side of the modules, as it is blocked by the top modules in the center of the table. This reduces the yield on the back side.



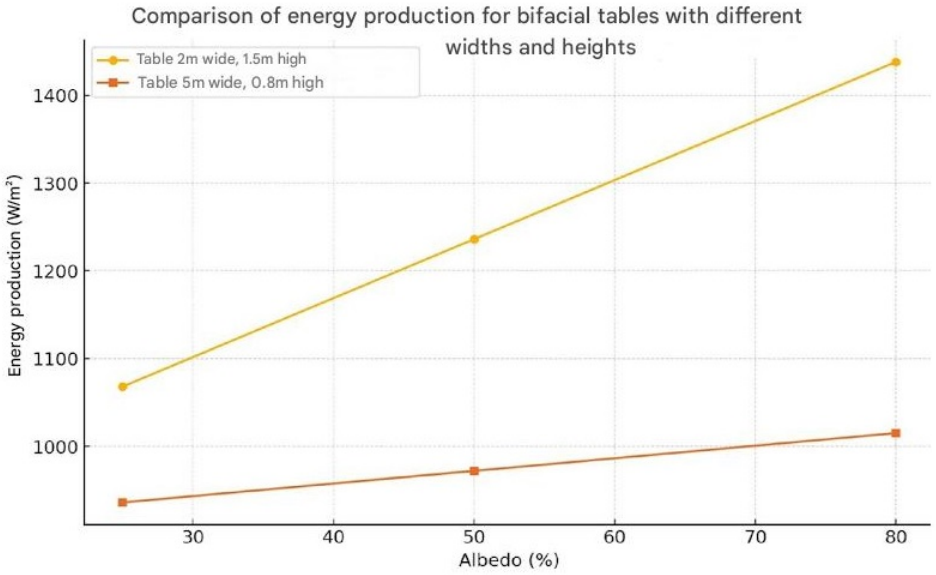
Impact of mounting height

- The higher positioning of the panels promotes better lighting underneath, as the sun's rays have more room to reflect and reach the back of the modules.
- In narrow tables, the high-mounted modules even allow direct sunlight to reach under the panels, significantly increasing the rear yield.



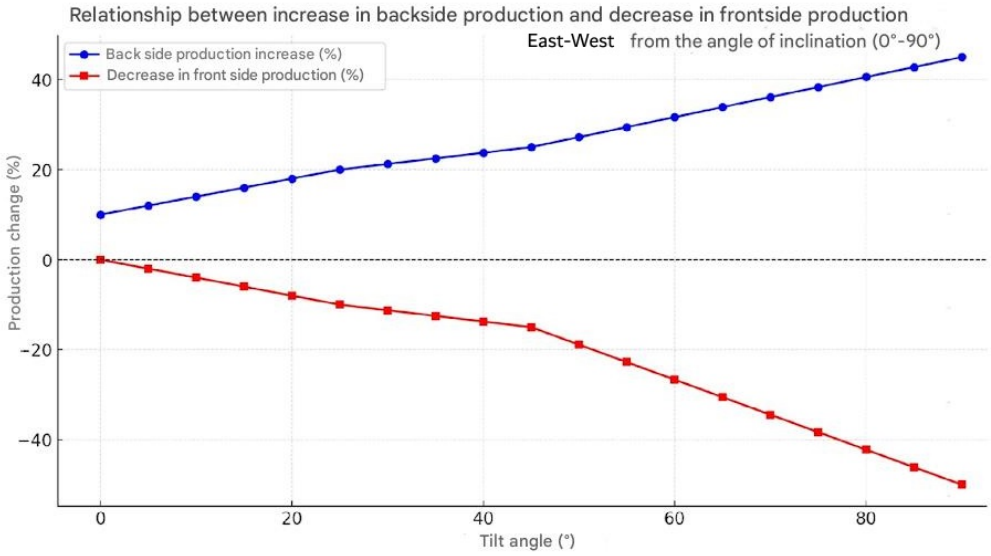
The importance of light reflection and scattering

- The substrate (e.g., light-colored surfaces such as snow or sand) has a big impact on the amount of reflected light reaching the back of the panels.
- With narrower tables and more light reaching under the panels, the albedo (ground reflection) effect is fully exploited.



Energy efficiency

- Narrow tables, especially high-mounted ones, provide up to several times the yield from the back of the panels compared to wide tables. This is due to better illumination and less light restriction.
- Wider tables are less effective for bifacial modules because they limit light access to the back of the panels, especially in the middle rows.



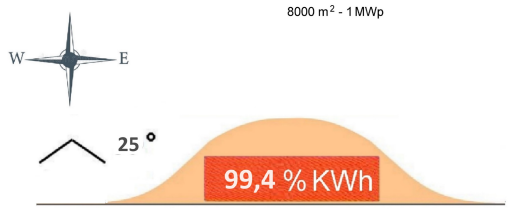
Summary:

For bifacial modules:

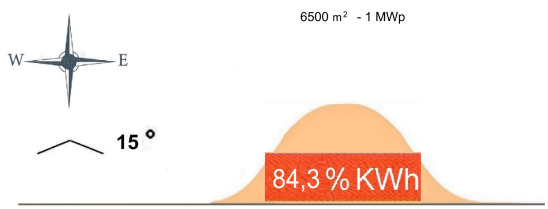
- Narrower tables are much more efficient than wider ones, as they allow better illumination of the back side of the panels.
- Mounting the panels high further increases the amount of reflected and diffused light, which raises energy yields.

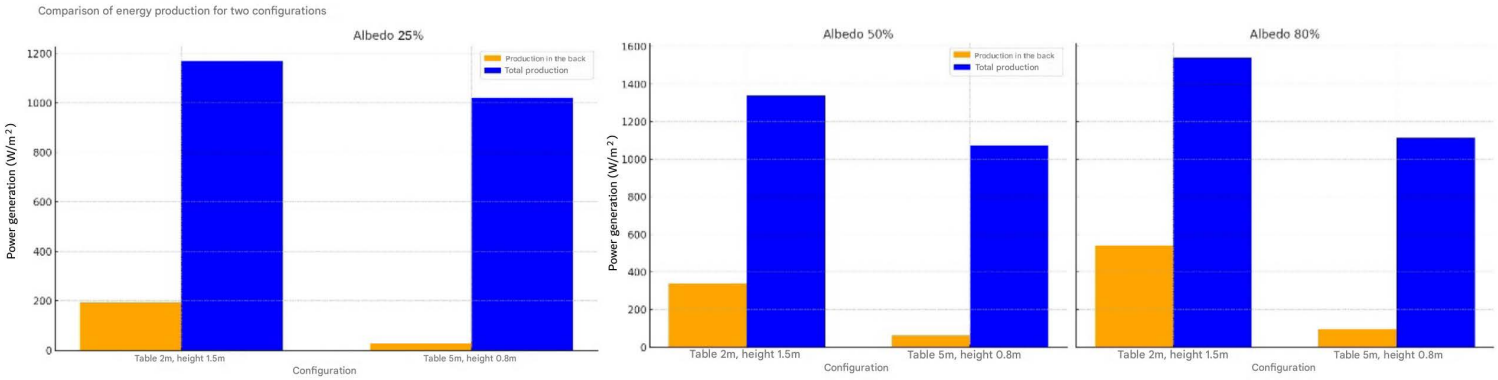
Comparison of energy production for two Wast-West 25° configurations
at different values of ground albedo: 25%, 50% i 80%.

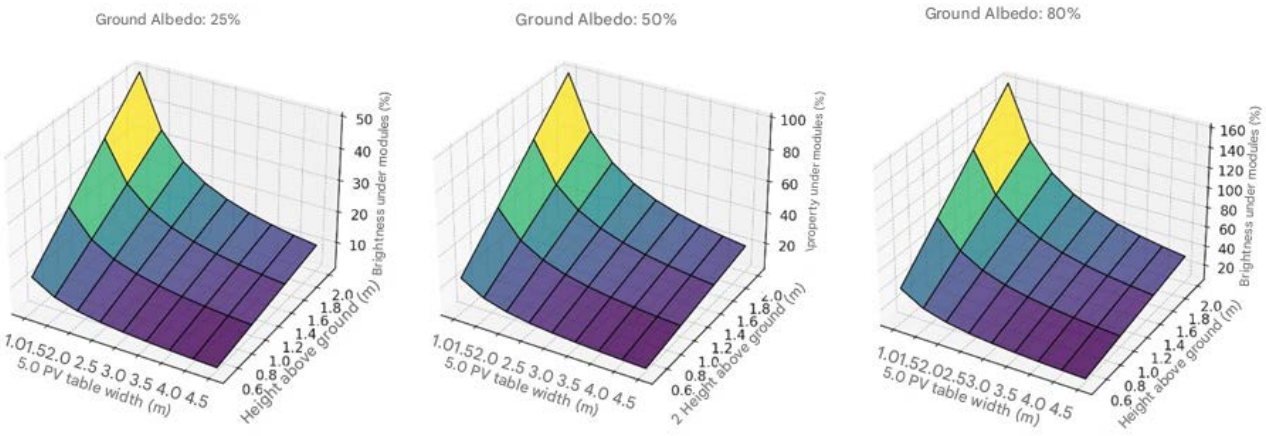
1. Table 2 m wide and 1.5 m high



2. Table 5 m wide and 0.8 m high







Comparison of energy production east-west 25°
at different values of ground albedo: 25%, 50% i 80%. Depending on the height and width of the table.

BifacialMAX Sp.zo.o.
Ul. Jabłowska 75, 83-200 Starogard Gd, Poland
w w w . b i f a c i a l m a x . c o m .
E - m a i l : o f f i c e @ b i f a c i a l m a x . c o m .
T e l . (1) : + 4 8 5 0 5 - 0 3 1 - 7 3 3 . T e l . (2) : + 4 8 5 1 2 - 6 5 9 - 3 7 6

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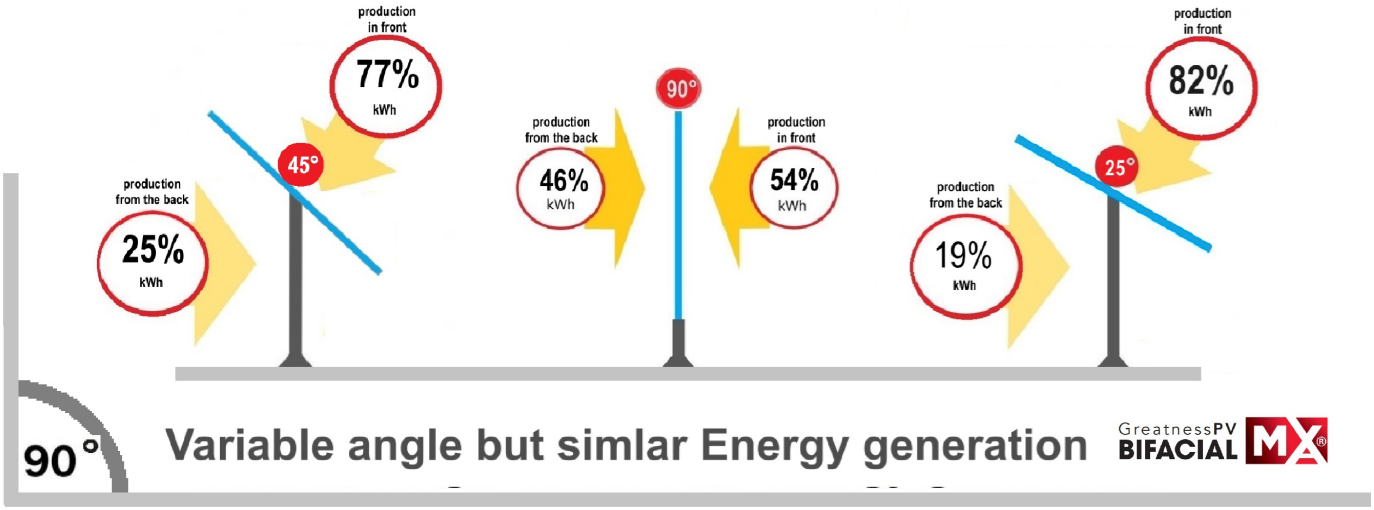
East-West PV orientation - more Energy then South-North

at the grass albedo 26%



Variable angle but simlar Energy generation

GreatnessPV BIFACIAL MAX

Durability of construction - advantages of BifacialMAX closed profiles

The BifacialMAX system further solves the problem of module durability by using closed profiles, which:

Are many times more rigid than open profiles.

Are more resistant to bending and torsion, eliminating lateral overloads that lead to cracking of the rear glass of bifacial modules.

They provide greater stability, which reduces the risk of failure of the entire structure.

Conclusion: BifacialMAX structures based on hollow profiles are much more resistant to lateral overloads and wind, which extends the life of the modules and reduces maintenance costs.

Bifacial Double Glass Module Durability Problems in Multi-Row Structures Why does the rear glass in bifacial modules break?

With multi-row structures, we have support on four legs:

The front legs are short and the rear legs are long.
Under the influence of strong wind, the rear legs have a greater amplitude of movement than the front legs.

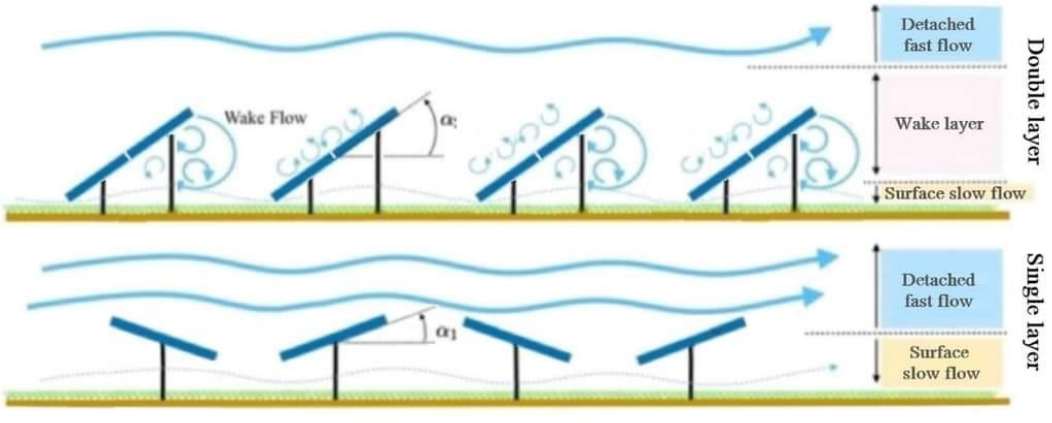
This causes trapezing (lateral movement of the whole structure), which causes uneven pressure on the modules.
The effect of stretching and compressing glass in Bifacia Double Glass modules:
The front glass is compressed - the compression resistance of tempered glass i**s 900 N.**
The rear pane is tensile - the tensile resistance is **only 90 N.**

As the glass bends downward under its own weight, the rear glass is further stretched, leading to cracking.

Conclusion: cracking of the rear glass is a major durability problem in multi-row systems, because the forces acting on the modules are uneven, leading to faster failure of the bifacial modules.

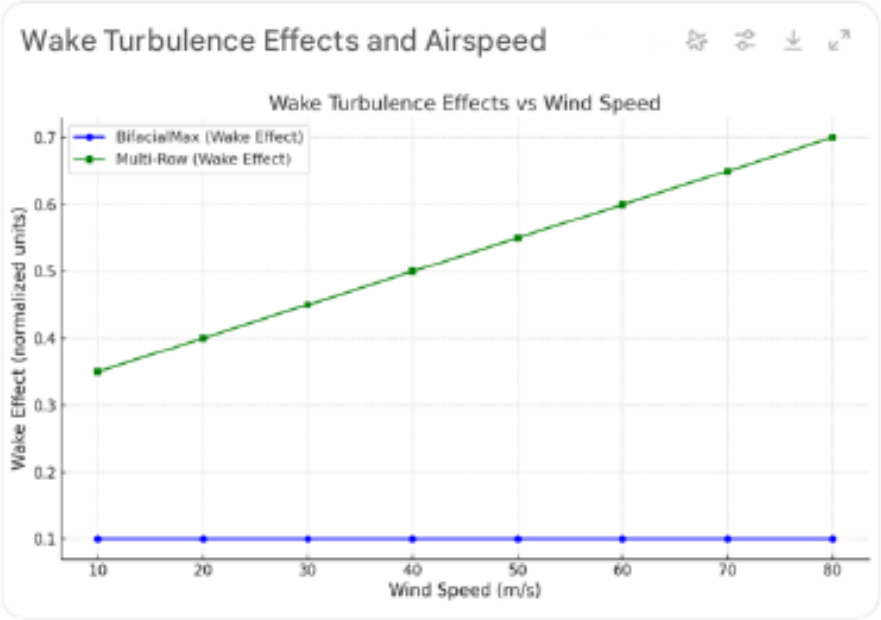
Why doesn't the problem occur in single-row designs?
In single-row structures we have support on two support points.
There is no trapezoidization - the entire structure moves as a rigid whole.
Uniform loading prevents tensile stresses on the rear glass of the module.

Conclusion: the single-row design provides greater durability for bifacial modules by eliminating the problem of trapezing and reducing lateral overloading



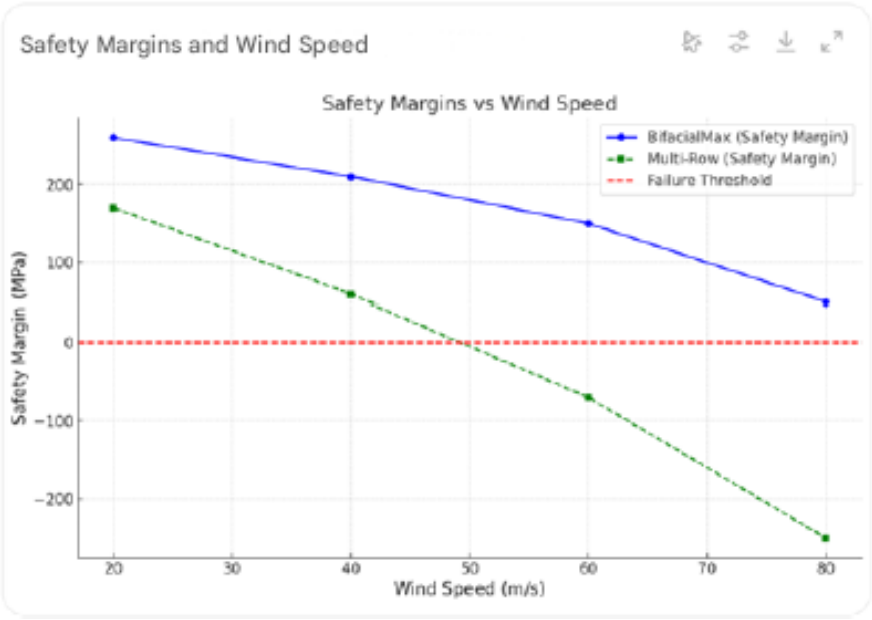
Effects of turbulence in the aerodynamic footprint :

For BifacialMax, the effect of turbulence in the aerodynamic footprint is negligible. For Multi-Row structures, turbulence increases as wind speed increases, reflecting the vulnerability of this multi-layer structure.



The table below compares the safety margins of the BifacialMax and Multi-Row systems at different wind speeds:

BifacialMax maintains a positive safety margin at all wind speeds, meaning it remains structurally safe even at 80 m/s.
Multi-Row exceeds the failure threshold (0 MPa margin) at 60 m/s, indicating a higher risk of mechanical failure in high winds.

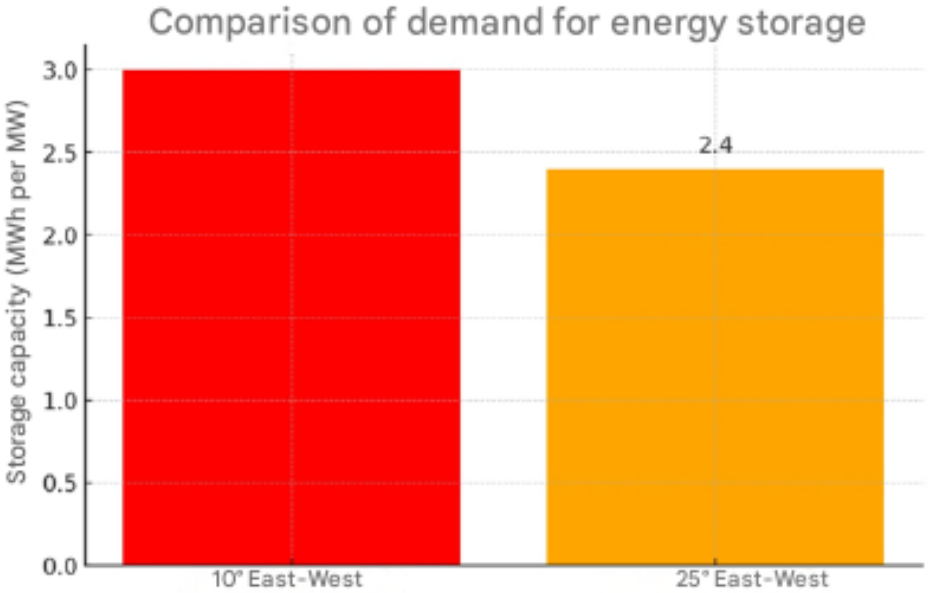


The solution: east-west BifacialMAX at a 25° angle
Increases energy production in the morning and evening - when energy prices are highest.

Optimizes energy sales - reduces dependence on midday hours and allows production to be better matched to required demand.
Reduces the risk of damaging energy - better distribution of production reducing the impact - the “duck effect”.

Reduction of storage energy consumption
Mounting bifacialMAX at an angle of 25° in an east-west arrangement flattens energy production, reducing the need for storage of vital energy.

Reducing storage energy consumption by **20%, which means:**
A savings of EUR 100,000 per MWp in capital costs on energy storage. Lower storage replacement costs (batteries need to be replaced every dozen years or so).
Lower maintenance and operating costs.



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