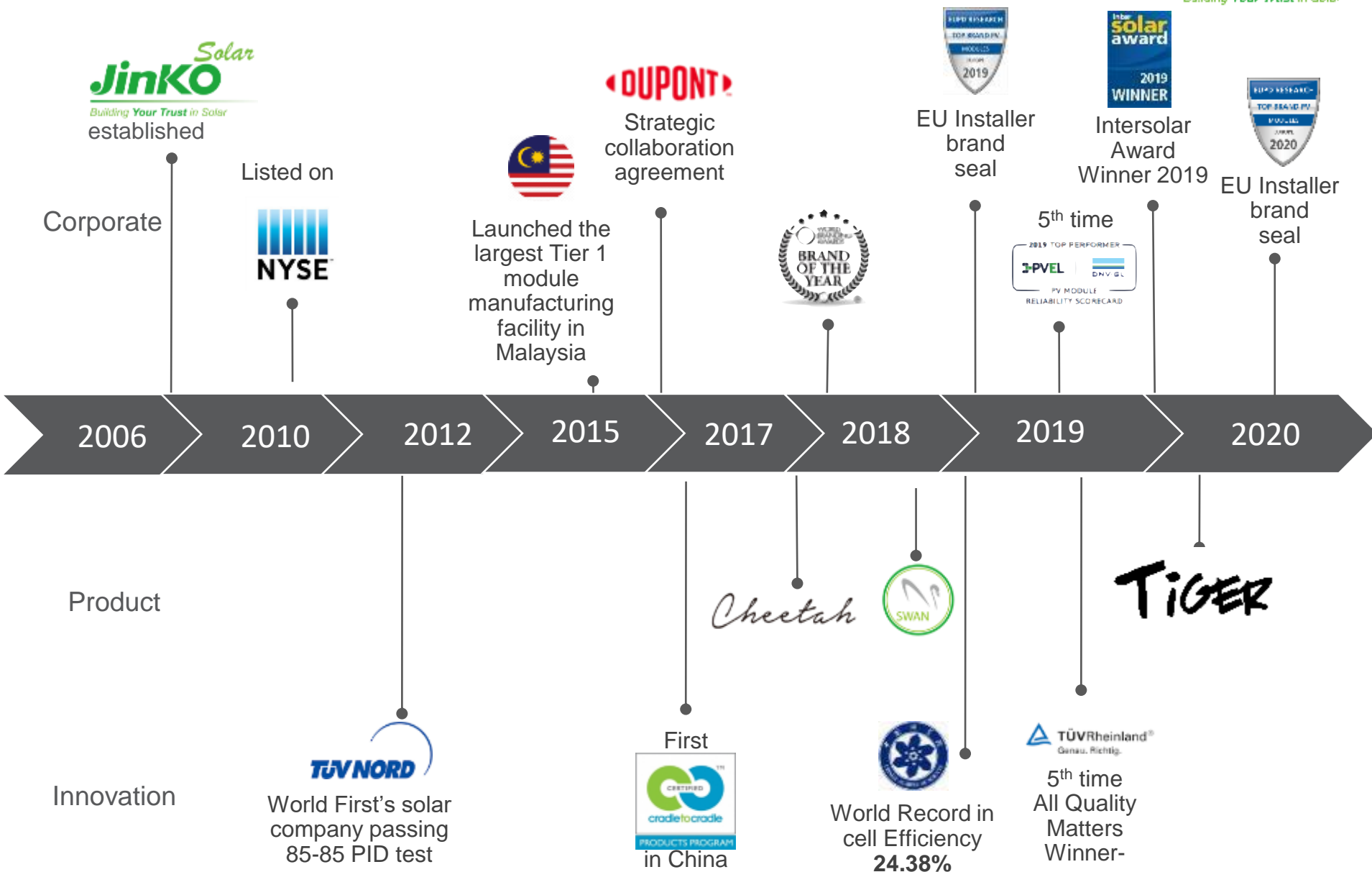




Módulos bifaciales y tipo N de alta eficiencia para la reducción garantizada del LCOE

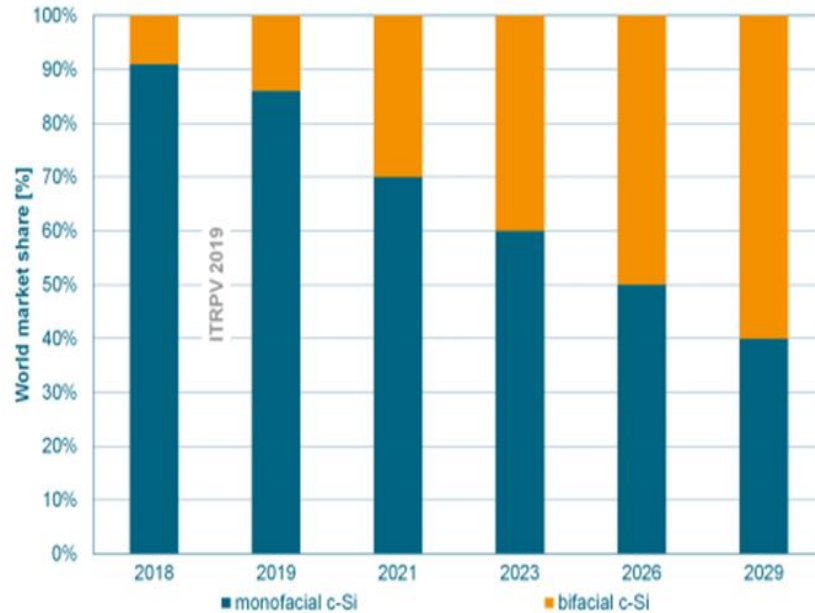
Carlos Magistris, Senior Technical Service Manager Europe
26.05.2020

JinkoSolar's Major Milestones



Tendencia del mercado: Bifacial & N-Type

Bifacial cell in world market



Trend: share of c-Si material types

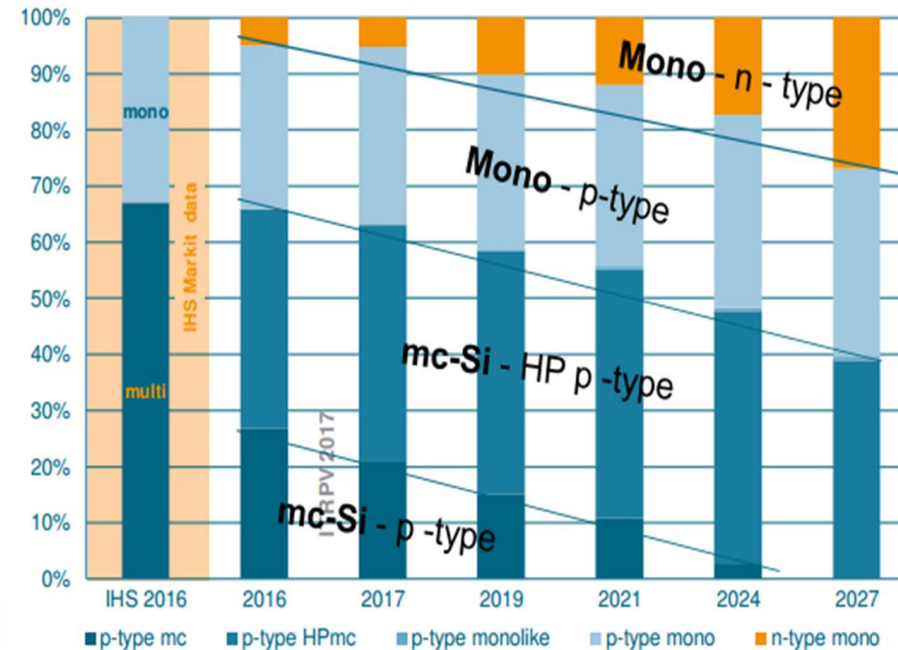
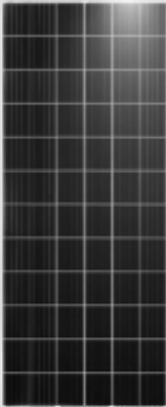



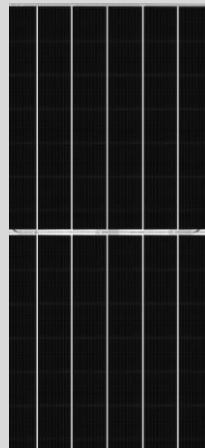
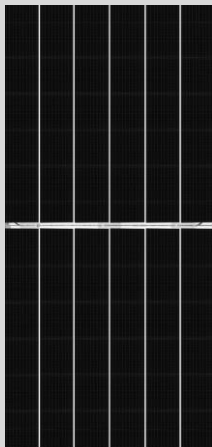


Fig. 42: Worldwide market shares for bifacial cell technology.

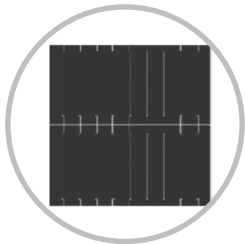
Catálogo de Producto 2020

Cheetah FC	Cheetah HC	Tiger Monofacial	Tiger Bifacial TB	Tiger PRO	Tiger PRO Bifacial
<ul style="list-style-type: none">• Mono PERC Full Cell• 5BB• Up to 400 Wp	<ul style="list-style-type: none">• Mono PERC Half Cell• 5BB• Up to 410 Wp	<ul style="list-style-type: none">• Mono PERC Half Cell• 9BB• Up to 470 Wp	<ul style="list-style-type: none">• Mono PERC Half Cell• 9BB• Bifacial with Transparent Backsheet• Up to 465 Wp (front only)	<ul style="list-style-type: none">• 72-TR• Up to 535Wp• MBB• 78-TR• Up to 580Wp• MBB	<ul style="list-style-type: none">• Up to 575 Wp• MBB• Bifacial with Transparent Backsheet
					
Cheetah		TIGER		TIGER Pro	

Tecnología Tilling Ribbon (TR) 2020

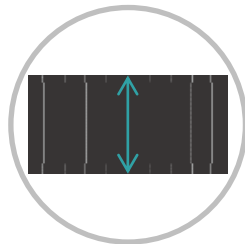
MBB

Decrease
power loss
effective



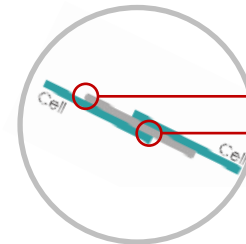
HC technology

Improve shading
tolerance because of
splitting a full-cell
into half



Tiling Ribbon (TR)

Eliminate cell gap to increase module
efficiency significantly.



Using circular ribbon

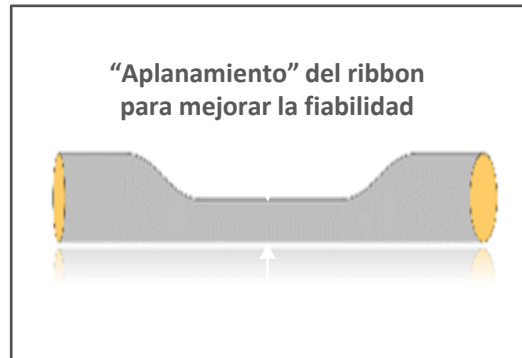
Overlap on each cell to
eliminate the gap



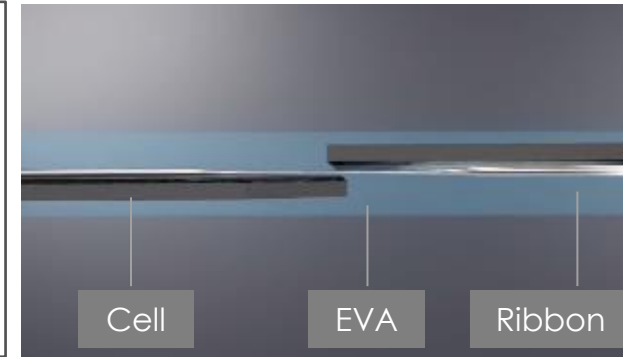
Tecnología Tiling Ribbon (TR)

➤ Mayor densidad de Energía:

- Incremento de la eficiencia.
- Reducción de posibles defectos de fábrica durante el laminado.
- Mejor comportamiento frente a cargas mecánicas durante la vida útil.

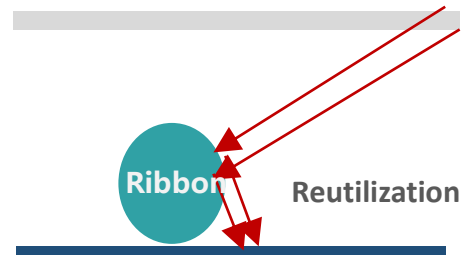


Esquema del solapamiento de las células

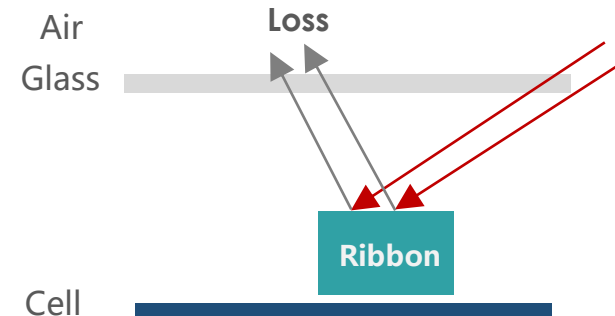


➤ Mejora de la absorción de luz:

- Recupera haces de luz que antes se perdían (forma circular)
- Aumenta el área de exposición de la célula (reducción de tamaño)



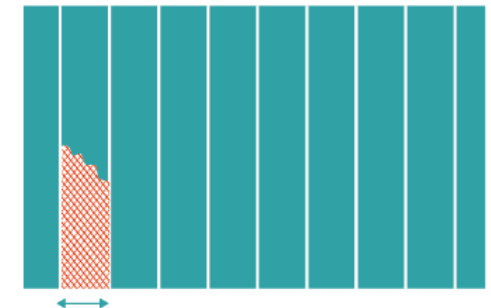
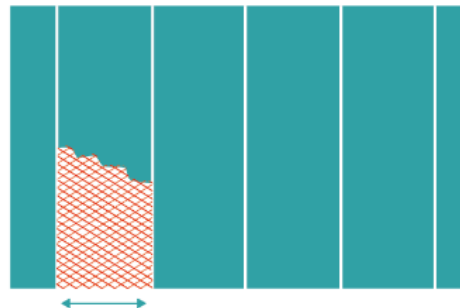
Tiger Module



Standard Module

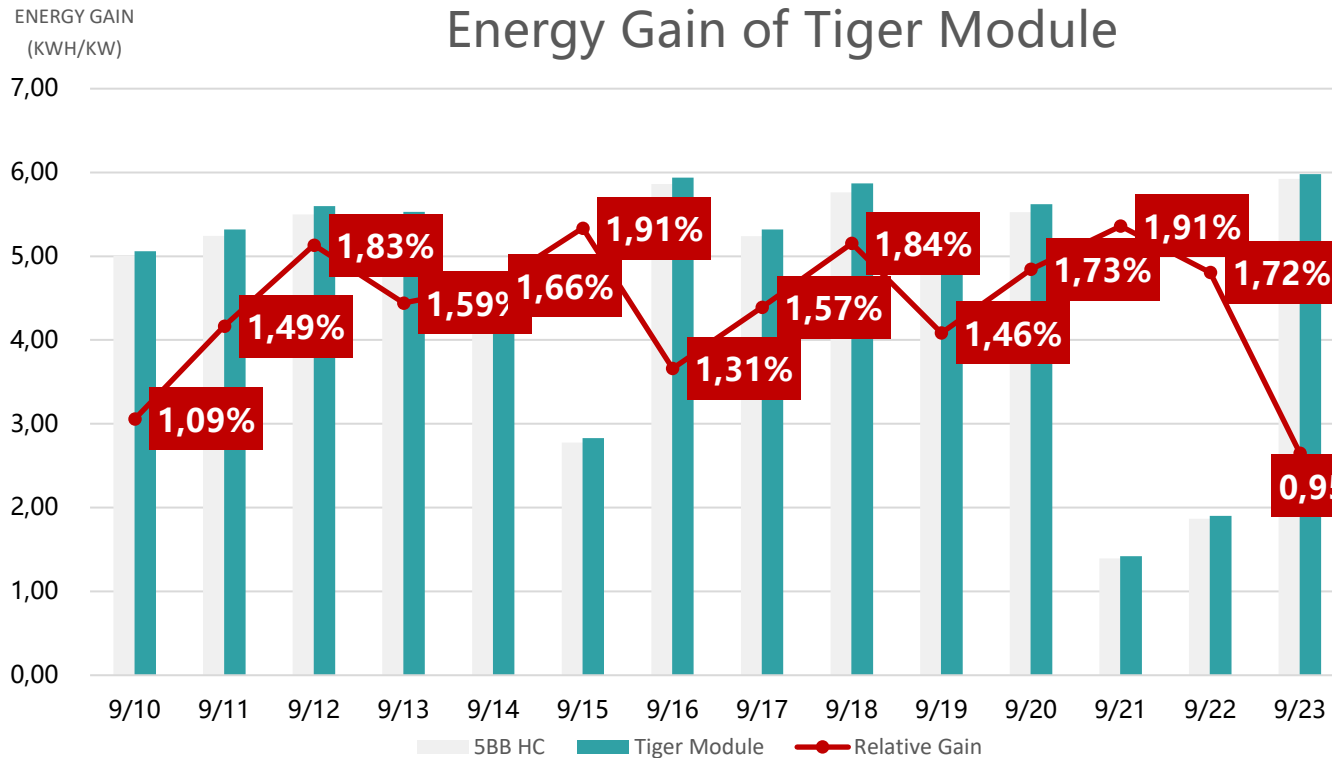
➤ Mejora de la recolección de Electrones

- Menos pérdidas internas.
- Mejor comportamiento frente roturas (micro-cracks)



More Energy Generation




Comparando con un módulo de 5BB HC, las mejoras de la serie Tiger **incrementan la generación de energía en aproximadamente 1.57%.**



Because of higher R_s and second reflection, 9BB shows excellent performance especially in low irradiance environment.

LCOE Análisis: tecnología Tiger 9 Busbar

**Example* : Australia -
164MW Project

LCOE Analysis			
<i>Module</i>	<i>Normal PERC Module</i>	<i>Bigger size PERC Module</i>	<i>Tiger</i>
<i>Power</i>	405	445	470
<i>Efficiency</i>	20.13%	20.0%	20.93%
<i>EPC cost</i>	100%	96.5%	96%
<i>Land</i>	100%	101%	96%
<i>Opex</i>	100%	94%	88%
<i>1st Year Generation</i>	352085(MWh/year)	353374(MWh/year)	361017(MWh/year) 
Result			
<i>LCOE(US cents/kWh)</i>	2.67	2.63	2.58 
<i>IRR</i>	11.06%	11.27%	11.56% 

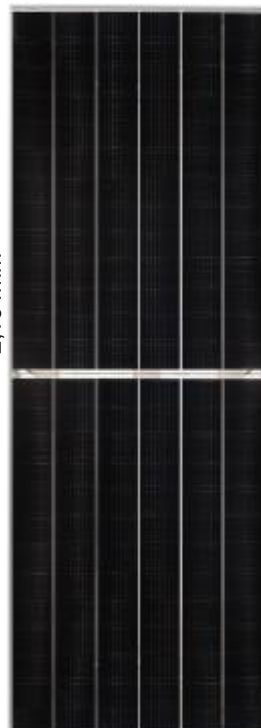
2020 Principales parámetros – Serie Tiger

**Tiger
Monofacial**



1,021mm

**Tiger Bifacial
Transparent Sheet**

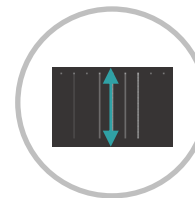


1,034mm

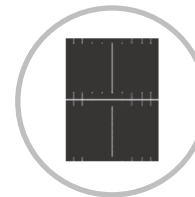
2,168mm

2,194mm

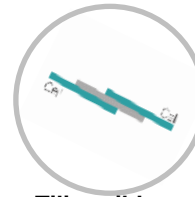
- ✓ El cost EPC puede reducirse 1.1%+ comparado con un módulos PERC de 430W
- ✓ El coste del terreno puede reducirse un **6.9%+** comparado con un módulos PERC de 430W
- ✓ La generación de energía puede incrementarse un 1.6%+ comparado con un módulos de 5BB HC.



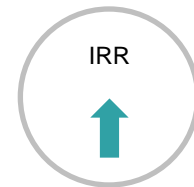
Half cell technology:
Mejor comportamiento frente a sombras



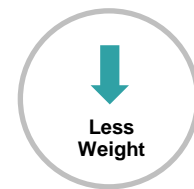
Nine bus bars:
Menos pérdidas por recombinación



Tiling ribbon:
Eliminando los espacios entre células para incrementar la eficiencia



Electricity generation from the rear side (bifacial products): mayor IRR

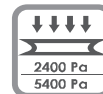
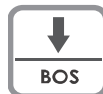


Less Weight

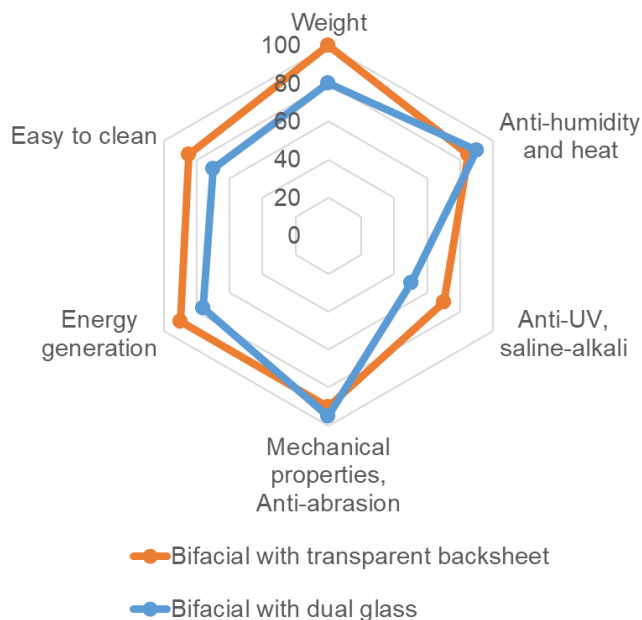
Peso de módulos bifaciales parecido al de los módulos monofacial



Tedlar transparent sheet (bifacial products): fácil de limpiar



Bifacial Modules con Backsheet Transparente



Type	Bifacial with Transparent Backsheet	Bifacial with Dual Glass
Recommended application area	<ol style="list-style-type: none"> Most on-ground PV station in not very hot and humid area. High labor cost area, like EU, Japan, Australia (can effectively receive labor cost). Commercial roof-top project 	<ol style="list-style-type: none"> Most on-ground PV station. In very hot and humid area as well as high wind speed area, bifacial with dual glass is a better choice
Limitation	<ol style="list-style-type: none"> High wind speed area Very hot and humid area 	<ol style="list-style-type: none"> Places with hail weather High UV region Saline-alkali corrosion region

Tiger Bifacial with Transparent Backsheet

- El promedio de transmisión de los rayos UV (280-380nm) de un cristal (glass) es del 40%-50% → El backsheet transparente (con las dos caras con materiales fluorídicos) es de menos del 1%
- En su parte posterior, los módulos bifaciales usan materiales POE de alta transmitancia. Por ello, después de una exposición a rayos UV, los módulos bifaciales DG muestran una degradación en la parte posterior de hasta un 50% mayor que los módulos bifaciales TV.
- Módulos bifaciales con un backsheet transparente muestran una mejor fiabilidad en ambientes con altos niveles de exposición UV.

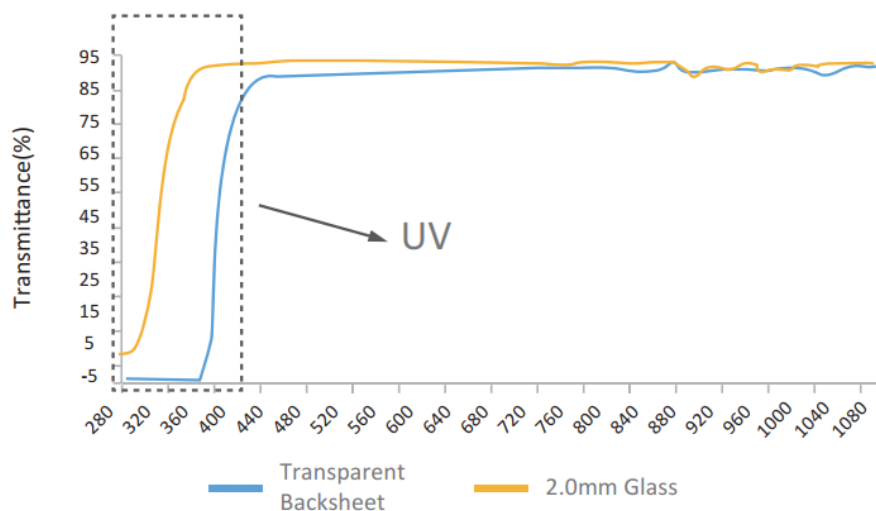


Figure 4 Transmittance of transparent backsheet and 2.0mm glass

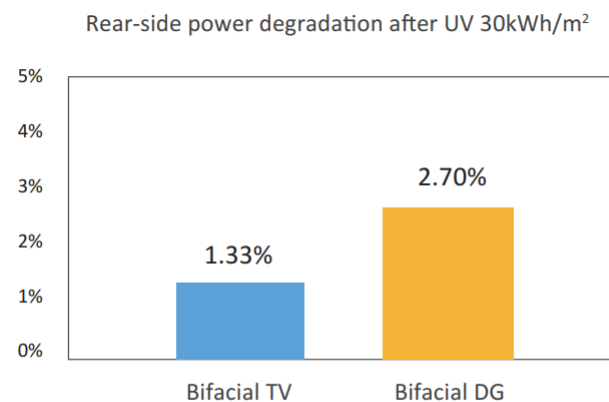


Figure 5 Rear-side degradation after 30 kWh/m² UV exposure

N-type Catálogo de Producto 2020

66pcs N-type Tiger Monofacial

- 395 Wp
- 9BB
- Efficiency 20.69%
- 1st year: 1%
- 2-30 year: 0.4%



66pcs N-type Tiger All black

- 405 Wp
- 9BB
- Efficiency 21.22%
- 1st year: 1%
- 2-30 year: 0.4%



78pcs N-type Tiger Monofacial

- 480 Wp
- 9BB
- Efficiency 21.38%
- 1st year: 1%
- 2-30 year: 0.4%



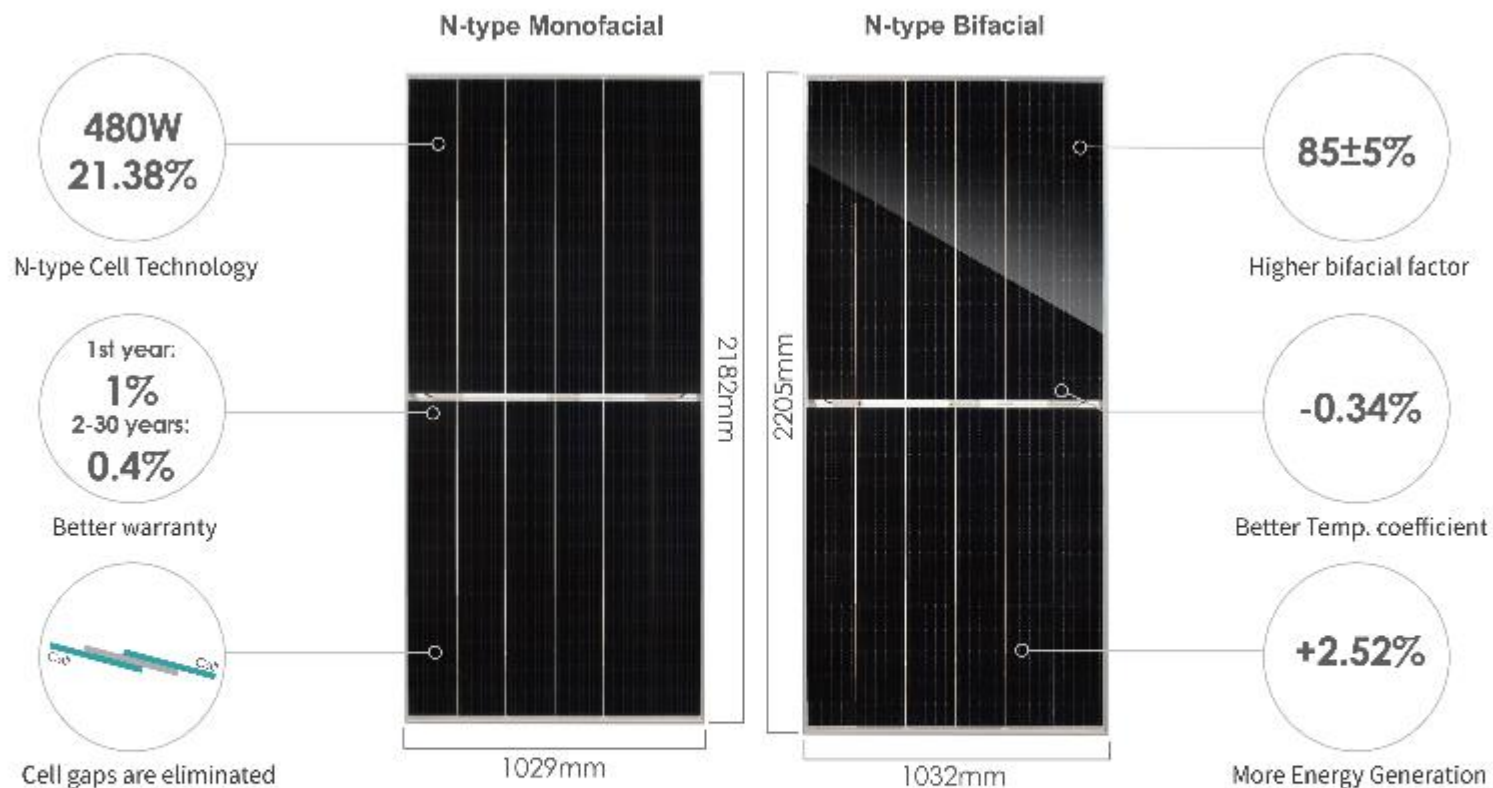
78pcs N-type Tiger Bifacial

- 470 Wp
- 9BB
- Efficiency 20.65%
- 1st year: 1%
- 2-30 year: 0.4%



TIGER

Product Introduction: Utility Projects



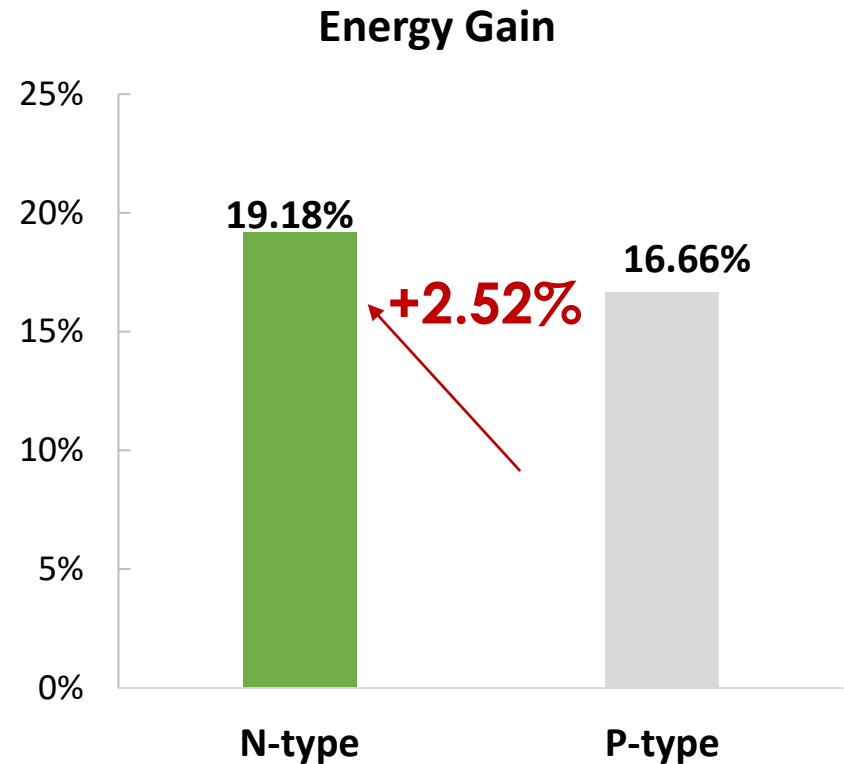
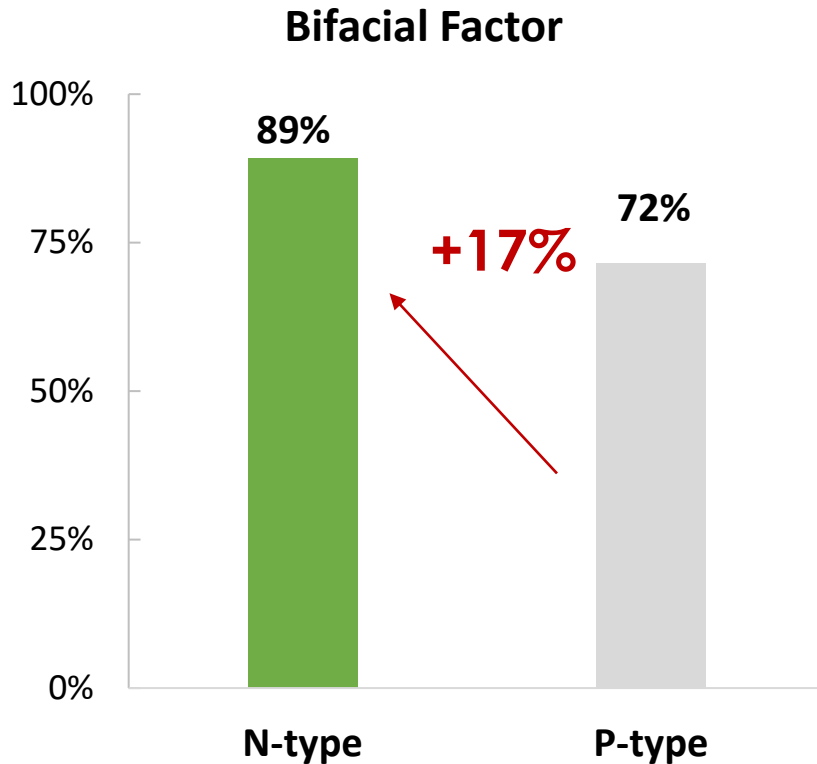
CONVERSION



30 YEAR WARRANTY






Better Bi-facial Factor



Los módulos bifaciales N-type generan **2.52%** más energía que los módulos bifaciales p-type, principalmente por su mayor factor de bifacialidad (89% vs 72%)

LCOE Análisis

**Example* : Australia - 164MW Project

LCOE Analysis		
Module	P-type module	N-type module
Power	455	470
Efficiency	20.19%	20.93%
1 st Degradation	2.5%	1%
Linear Degradation	0.55%	0.4%
Bifacial Energy gain	9%	10.9%
1 st Year Generation	392783(MWh)	406530(MWh) 
Result		
LCOE(US cents/kWh)	2.42	2.28 
IRR	12.34%	13.15% 



Thank you !