Whitepaper

The Technical White Paper - Tiger Module

GLOBAL PM, JINKOSOLAR

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Tiger Module Introduction

1.1 Background of Tiger Series

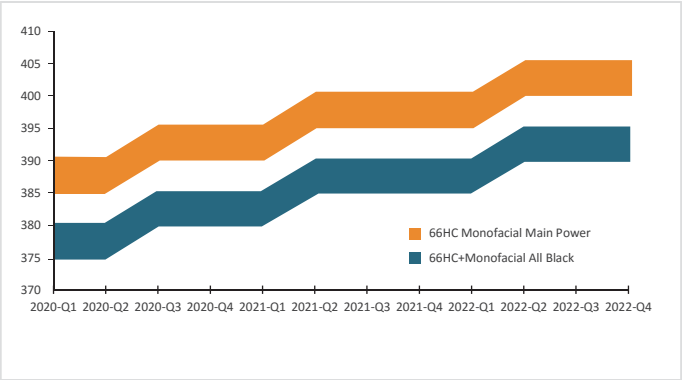
Along with the globally declining trend of PV subsidies and PPA, the LCOE is objectively demanded to be reduced. With the promotion of Eagle, Cheetah and Swan modules, the high-power, high-efficiency characteristics combining with bi-facial technology can bring higher power generation per unit area and lower BOS costs at the system end. Therefore, "high energy density" has become a significant technology direction for Jinko. Under this direction, JinkoSolar launched the Tiger series of high-efficiency tiling ribbon module at the All Energy Exhibition in Australia on October 23, 2019. The Tiger module adopts the advanced technology of multi-busbar + Tiling Ribbon + half cut, with the high-efficiency Jinko cell, the maximum power output of Tiger could reach to 475W, and the efficiency could reach to 21.16%.

Tiger series include mono-facial and bi-facial types. The bi-facial Tiger modules currently promote transparent back sheets with DuPont Tedlar. While ensuring a 5% -30% backside energy gain, the light-weight feature of transparent back sheet also effectively reduces the LCOE effectively.

1.2 Tiger Module Introduction

Tiger has mono-facial & bi-facial series. Mono-facial module s includes standard 66 pcs, all black 66pcs (for Distribution Market) and standard 78 pcs module; bi-facial modules includes 78 pieces with transparent back sheet and dual-glass. Figure 1 is product classification and power roadmap of Tiger modules. In 2020, the main-stream power output could reach to 465w.

Module Type	Tiger 66pc Standard Mono-Facial Module	Tiger 66pc Mono-Facial All Black Module	Tiger 78pc Mono-Facial Module	Tiger 78pc Bi-Facial Module
Dimention	1855 x 1029	1855 x 1029	2182 x 1029	2205 x 1032
2020 Mainstrain Mass Production Power	395W	385W	465W	460W
Power Efficiency	20.69%	20.17%	20.71%	20.21%



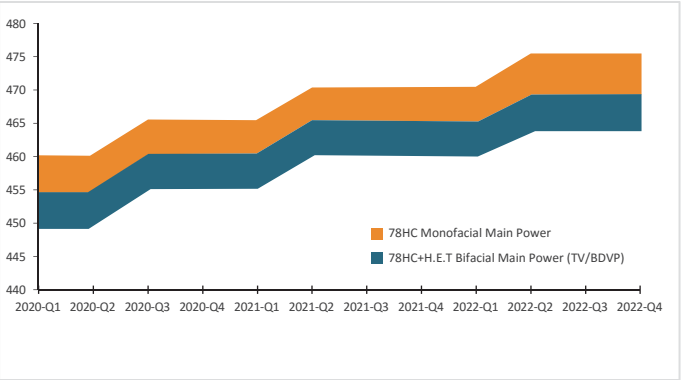


Table 1 Tiger Module power roadmap

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1.3 Core technology of Tiger Module

1.3.1 Industry-Leading Multi-Busbar Technology

Jinko Tiger adopts innovative multi-busbar technology to bid farewell to the traditional five-busbar mode. It reduces the internal loss and enhanced the module power by adding the number of busbars on cell. The upgraded round wire ribbon, which can effectively reflect the oblique light twice to improve IAM significantly. Jinko has done many experiments with the number of busbars and the results are shown in Figure 2. The module power goes upwards first and then goes downwards along with the increase of the busbar number. The turning points were mainly at 9 busbar, therefore, the corresponding power is the optimal choice. Moreover, the increase of the busbar number will be greatly challenging to the precision and accuracy of manufacturing. In addition, yield of 9BB cell is the best comparing with other type MBB cell. Considering all of these, Jinko has selected 9 busbar as the technical route for Tiger series, to achieve the highest power output, meanwhile to effectively ensuring the module reliability.

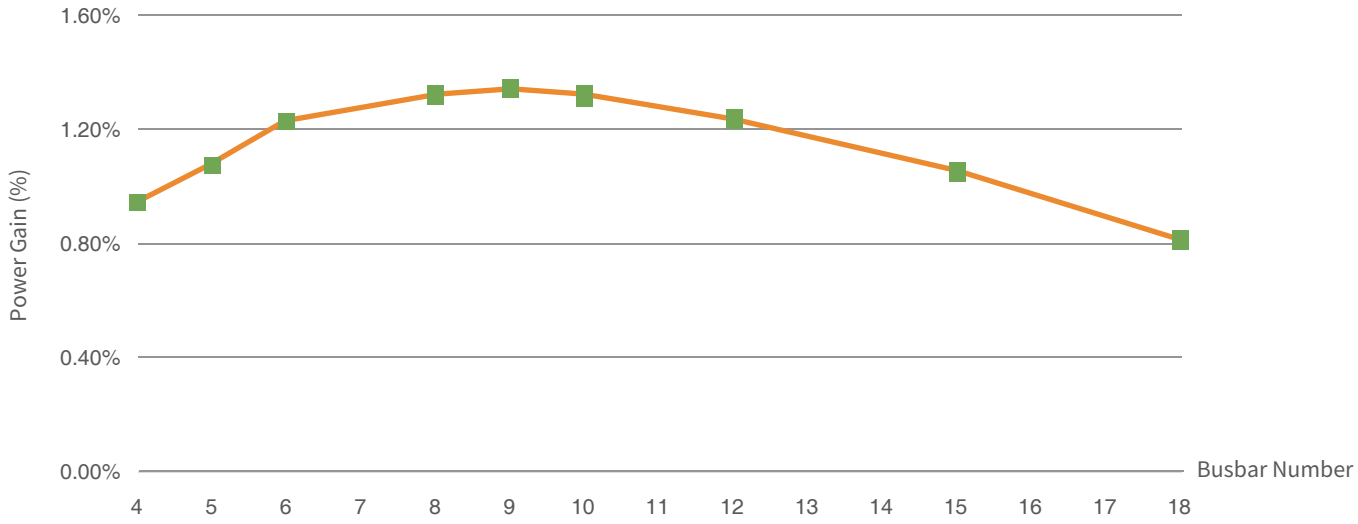

Figure 2 MBB power gain

1.3.2 Better Efficiency with Tiling Ribbon Technology

While improving the power output, Tiger Module innovatively uses the Tiling Ribbon technology, details are shown in the figure below. Jinko R&D has applied special process to overlap the cell edge. With eliminating the cell gap, module efficiency is higher than 20.7%. High power + high efficiency, which is following the trend of "high energy density" to help decreasing LCOE.

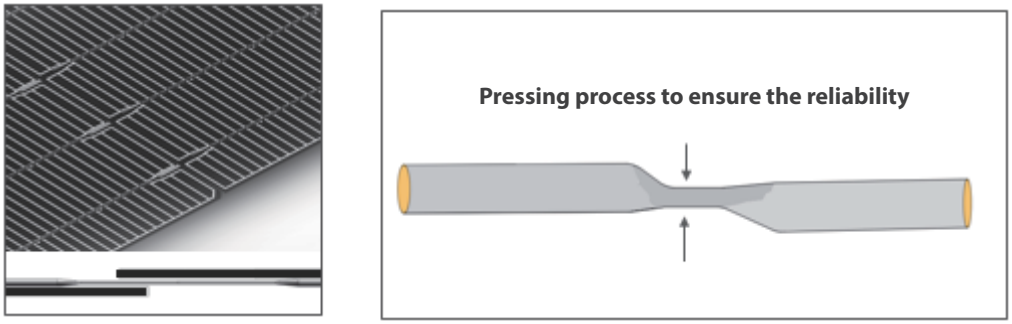

Figure 3 Tiling Ribbon Technology

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There are three key technical points of Tiling Ribbon modules:

1. Thinning Ribbon in overlap area: Tiger modules adopt flexible round wire ribbon which could be flattened in overlapping area to decrease the overlap stress to ensure the reliability.

2. Ribbon re-shape in the overlap region: Jinko reshaped the ribbon into “Z” shape, which can effectively solve the problem of little contact area between the cell and ribbon to avoid debris and defects.

3. Special EVA/POE fulfill the overlap region after lamination: in the lamination process, the special EVA / POE fulfill the gap between the cell and ribbon in the overlap area under high temperature to provide great buffer which will guarantee the reliability of the modules.

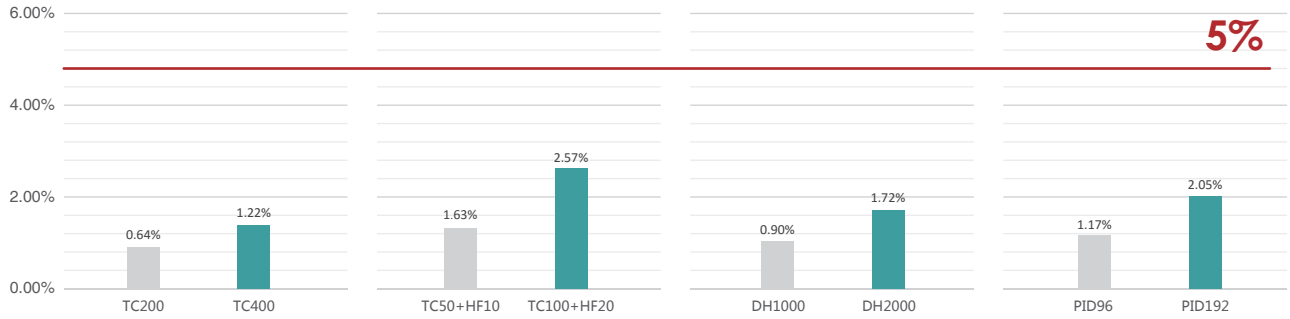

Figure 4 Tiger IEC testing

The results indicate that the degradation after IEC/double IEC test is much lower than 5%, which is required by the IEC standard. This result is even better than normal module. While improving the efficiency, the tiling ribbon technology ensures the excellent reliability of the modules as well as the stable and efficient operation of the customer's power station for 30 years.

Tiger module has excellent mechanical load while becoming large. In the dynamic mechanical load test, 1000 cycles are completed by dynamically applying ± 1000Pa pressure on the front surface of the module. The front-side power degradation rate is only 0.6%, and the back-side power degradation rate is 1.68%, which is far lower than the 5% required by IEC standard; in the static mechanical load test, the module is installed on the load test bench, the pressure on the front-side is 5400pa, the pressure on the backside is 2400pa, and the pressure is added 6 times and each time For 1h. The front-side power degradation is only 0.3%, and the back-side power degradation is 1.82%, which is far lower than 5% of IEC standard.

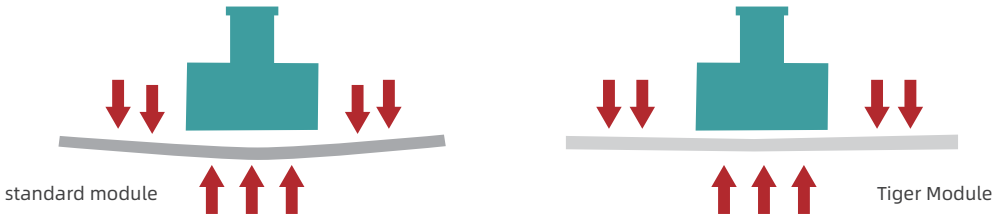

Figure 5 Tiger Loading tests

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1.3.3 Half Cell Technology

Jinko Tiger series keep half-cell design besides new multi-busbar and tiling ribbon technology. Half-cell technology helps to decrease internal current thus reducing internal power loss, and as a result the module has higher power output and better reliability. Compared with normal full cell module, front side power could reach 15 Wp improvement. Moreover, the hot-spot risk in outdoor environment is lower. As shown in Figure 5, the average temperature difference of half-cell is 1.8℃, lower than that of full cell module. The operating temperature is relatively lower than that of the full cell, to reduce hot-spot issue.

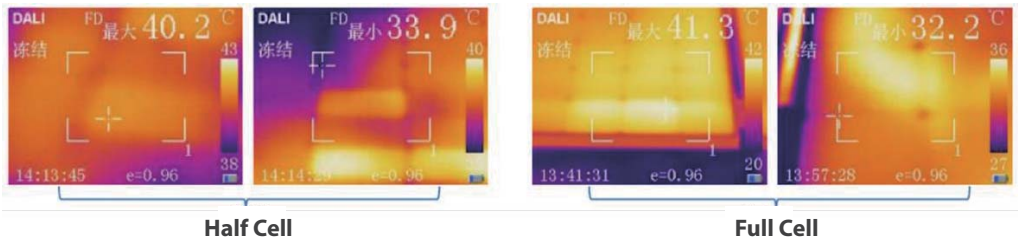

Figure 6 Working temp between Half cell & Full cell

When installed vertically, half-cell technology can effectively cut down the shading loss. In half-cell module, there is a parallel connection of the upper part and lower part. When 50% of the module surface is shaded like in the morning or evening, half-cell modules will still generate 50% of its nominal power while the power output of full-cell modules is 0. Moreover half-cell module has better temperature coefficient. The temperature coefficient of Jinko half-cell module is -0.35% W/℃, while that of full-cell module is -0.37% W/℃. Therefore, half-cell module has 5% higher power than full-cell module in hot area where the operating temperature of modules could be up to 75℃.

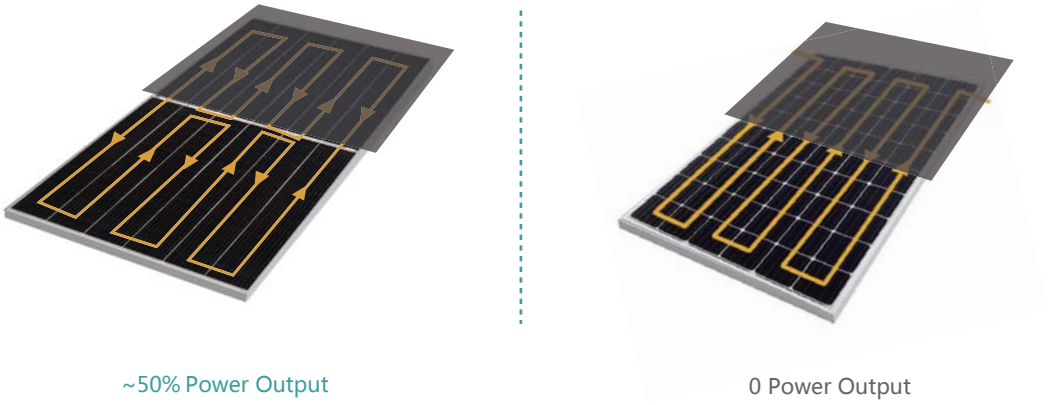

Figure 7 Module output under shading environment

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2 System design for Tiger module

2.1 1500V compatibility of Tiger module

Tiger module are produced in the optimized manufacturing process, so that it reduces the open circuit voltage while ensuring the power and efficiency advantages. Lower open circuit voltage ensures that more modules can be connected in a single string in order to save the cost of BOS. In different project sites, the number of modules that can be connected into astring is directly related to the local irradiation and cell temperature. Therefore, we have simulated and tested the open circuit voltage of 460W tiger monofacial module under different irradiance and cell temperature. The comprehensive results are shown in the table below.

	-9℃	-6℃	-3℃	0℃	3℃	6℃	9℃	12℃	15℃	18℃	21℃	24℃	27℃
10W/m²	30.0	31.0	31.0	31.0	32.0	32.0	32.0	30.0	33.0	34.0	34.0	34.0	35.0
20W/m²	30.0	30.0	30.0	30.0	31.0	31.0	31.0	30.0	32.0	33.0	33.0	33.0	34.0
30W/m²	29.0	29.0	30.0	30.0	30.0	31.0	31.0	30.0	32.0	32.0	32.0	33.0	33.0
40W/m²	29.0	29.0	29.0	30.0	30.0	30.0	31.0	30.0	31.0	32.0	32.0	32.0	33.0
50W/m²	29.0	29.0	29.0	29.0	30.0	30.0	30.0	30.0	31.0	31.0	32.0	32.0	32.0
60W/m²	28.0	29.0	29.0	29.0	30.0	30.0	30.0	30.0	31.0	31.0	31.0	32.0	32.0
70W/m²	28.0	29.0	29.0	29.0	29.0	30.0	30.0	30.0	31.0	31.0	31.0	32.0	32.0
80W/m²	28.0	28.0	29.0	29.0	29.0	30.0	30.0	30.0	30.0	31.0	31.0	31.0	32.0
90W/m²	28.0	28.0	29.0	29.0	29.0	29.0	30.0	30.0	30.0	31.0	31.0	31.0	32.0
100W/m²	28.0	28.0	28.0	29.0	29.0	29.0	30.0	30.0	30.0	30.0	31.0	31.0	31.0
200W/m²	27.0	28.0	28.0	28.0	28.0	29.0	29.0	29.0	29.0	30.0	30.0	30.0	31.0
300W/m²	27.0	27.0	27.0	27.0	28.0	28.0	28.0	29.0	29.0	29.0	29.0	30.0	30.0
400W/m²	27.0	27.0	27.0	27.0	28.0	28.0	28.0	28.0	29.0	29.0	29.0	29.0	30.0
500W/m²	27.0	27.0	27.0	27.0	27.0	28.0	28.0	28.0	28.0	29.0	29.0	29.0	29.0
600W/m²	26.0	27.0	27.0	27.0	27.0	28.0	28.0	28.0	28.0	28.0	29.0	29.0	29.0
700W/m²	26.0	27.0	27.0	27.0	27.0	27.0	28.0	28.0	28.0	28.0	29.0	29.0	29.0
800W/m²	26.0	26.0	27.0	27.0	27.0	27.0	27.0	28.0	28.0	28.0	28.0	29.0	29.0
900W/m²	26.0	26.0	27.0	27.0	27.0	27.0	27.0	28.0	28.0	28.0	28.0	29.0	29.0
1000W/m²	26.0	26.0	26.0	27.0	27.0	27.0	27.0	27.0	28.0	28.0	28.0	28.0	29.0

Figure 8 Tiger voc under different Temp. and irradiance

Tcell = Tamb + (1/U) * G_POA* Alpha* (1-efficiency).

The part with green mark in the above table is the situation at least 29 modules could be installed in one string. According to the conversion formula of ambient temperature and cell temperature, U (heat transfer coefficient) = Uc+Uv*Vwind, Uc=system heat transfer coefficient, Uv= Wind heat transfer coefficient, Vwind=wind speed in project area, G_POA=actual irradiance (direct light+scattered light), Alpha=absorptivity, Efficiency=actual module efficiency.

Take the Australian project for example, when the inverter reaches to starting voltage, we assume the irradiance is 200W/m², environment temperature is 0℃, cell temperature could be calculated via the formula. Uc=29W/m²k, Uv=1.6W/m²k, Alpha=0.9, efficiency=20.71%, we calculated that the cell temperature is 6.28℃, from the table, it could be concluded that 29pcs/string is available and safe.

Customer could use this formula to design Tiger 1500V system according to the irradiance, wind speed, temperature for specific project to develop the advantages of Tiger module. Jinko will do technology review with inverter supplier to ensure the safety standard.

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2.2 Compatible for Tiger module and tracker

Tiger module is compatible with main stream trackers and fixed structure, which will decrease the cost effectively.

Fixed tilt is highly customized according to the specific project, and the core part is how to design the loading area in high wind & snow location. If customer wants to keep same energy generation, Tiger module area could be saved significantly because of higher energy density and energy generation in unit area. If there is less module area, loading area could be saved as well. Considering less loading area, cost of fixed structure for Tiger module is lower than normal module which is benefit to LCOE and IRR. For example, if there is a 100MW project, we use normal PERC module, module area will be 100MW/19.6%=510000M^2, however, if we use 20.7% Tiger module, module area is only 100MW/20.7%=483091m^2, there is 5.3% loading area saving, total steel usage will be 5.3% lower as well. Furthermore, considering fixed structure needs higher loading ability in strict weather condition, decrease of total area is benefit to the design to avoid safety issue which will saving cost significantly.

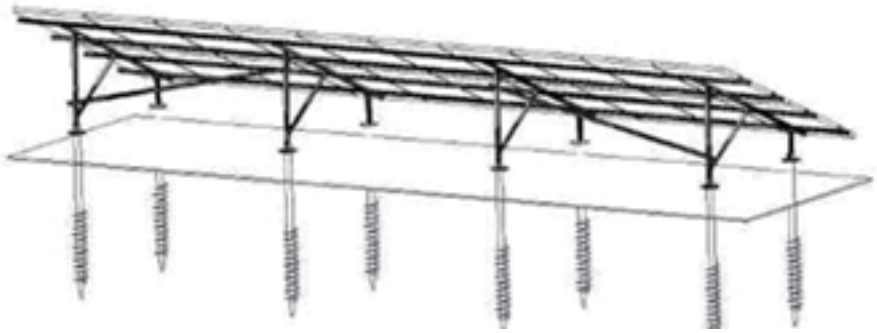

Figure 9 Fixed

Tracker: We have done a lot of work with tracker company for tiger product and get positive response that tiger is compatible with all main stream trackers well. Although tiger is longer than normal module, increasing efficiency will decrease the loading area effectively which aims to decrease the tracker cost. For example, if we choose 1P structure tracker and normal 405w module with 19.78% module efficiency with 30pcs/string, whole string power output is 12.15kw, loading area is 12.15kw/19.78%=61.4m^2, and if we choose tiger 465w module, there is only 26pcs/string to achieve 12.15kw and the loading area is 12.15kw/20.43=59.5m^2. Comparing with these 2 options, we keep the same power output per string and the loading area will decrease 3%, steel usage will be decreased, tracker design will be updated as well. Meanwhile, tracker has the ability of rotation, they can adjust the angle in high wind loading area effectively; for high snowing loading area, tracker could increase the dip angle to decrease the snow deposition to decrease snow loading which is benefit to saving tracker cost.

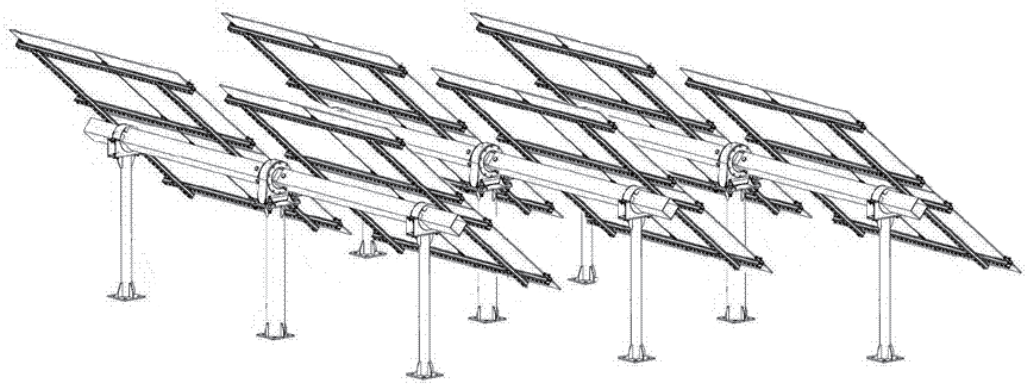

Figure 10 Tracker

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3 Tiger energy generation performance

3.1 IAM advantage

Tiger module is using 9BB + Round wire ribbon design as the picture below. Round wire ribbon will reflect the light from different side to the cell which aims to increase energy generation effectively. However, normal 5BB module can not reflect side light effectively and brings energy generation loss.

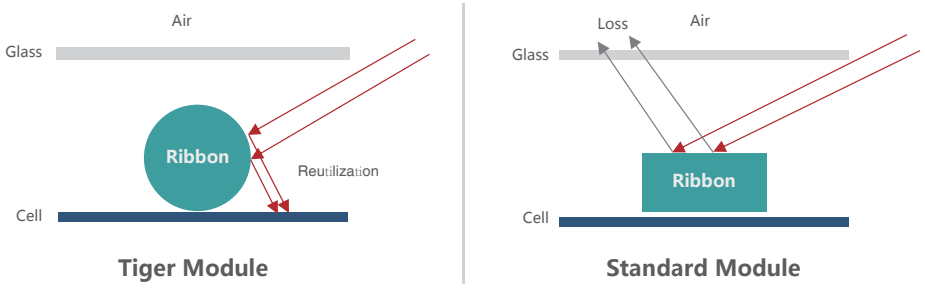

Figure 11 Round wire ribbon energy gain

There is an 3rd party panfile report for IAM value from SGS, the data shows that tiger module has excellent energy generation performance, especially on low irradiance environment.

TABLE: IEC61853-2 : 2016					—
Test Date [MM/DD/YYYY]:			02/14/2020		—
Sample #:			04		—
Angel(θ)	Isc(θ) [A]	Isc(θ)diffuse [A]	Isc(θ)corr [A]	Isc(θ)corr /cos(θ) [A]	relative transmission τ(θ)
85	0.612	0.201	0.223	2.125	0.857
80	0.788	0.332	0.469	2.845	0.932
75	1.378	0.533	0.863	3.408	0.963
70	1.961	0.749	1.256	3.718	0.982
65	2.510	0.871	1.652	3.954	0.991
60	3.214	1.102	2.073	4.065	1.000
50	3.876	1.262	2.789	4.265	1.000
40	4.722	1.335	3.391	4.298	1.000
30	5.294	1.423	3.878	4.451	1.000
20	5.676	1.511	4.193	4.462	1.000
10	5.887	1.542	4.415	4.398	1.000
0	6.053	1.581	4.503	4.622	1.000

Figure 12 3rd party IAM testing report

3.2 Advantages under Lower Irradiance

Tiger module uses an optimized circular ribbon, which can present a significantly reduced cross-sectional area compared to the previously flat ribbon. The reduction of cross-sectional area on the one hand can decrease ribbon shielding upon the cell to increase its light exposure area, thus the module power can be improved; On the other hand, according to the formula of R=ρl/s (R=Resistance, ρ=Resistivity, l=Ribbon Length, s=Ribbon Cross-Sectional Area), ribbon resistance will increase under the reduction of its cross-sectional area, resulting in a relevant increase in the string resistance of the module, as shown in Figure 12.

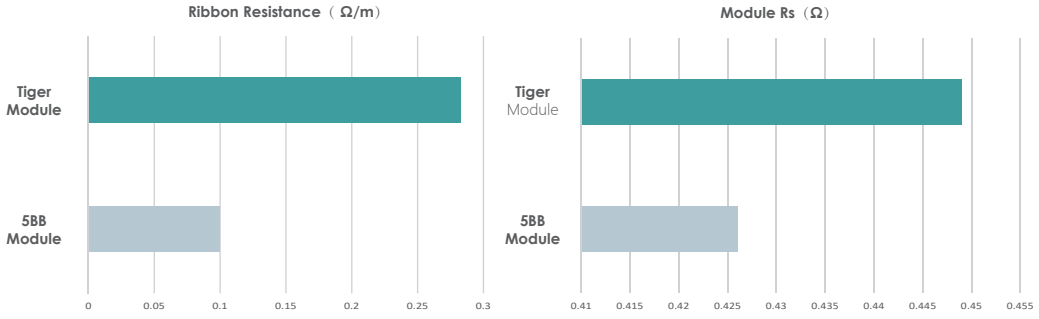

Figure 13 Tiger Rseries advantages

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According to the formula of $PR = \left(1 - \frac{0.0416}{V_{OC1000}}\right) * \frac{FF_{0(200)}}{FF_{0(1000)}} * \frac{(1-r_{s200})}{(1-r_{s1000})} * \frac{1-\frac{1}{r_{sh200}}}{1-\frac{1}{r_{sh1000}}}$, $r_s = \frac{R_s}{R_{ch}} = \frac{R_s * I_{sc}}{N * V_{oc}}$, the PR value of module is proportional to the string resistance (Rs). On the grounds of CPVT measured data as shown in Figure 13, Tiger module performs clear advantage in power generation with a higher PR value under the circumstance of lower irradiance, comparing to the performance of normal 5BB module.

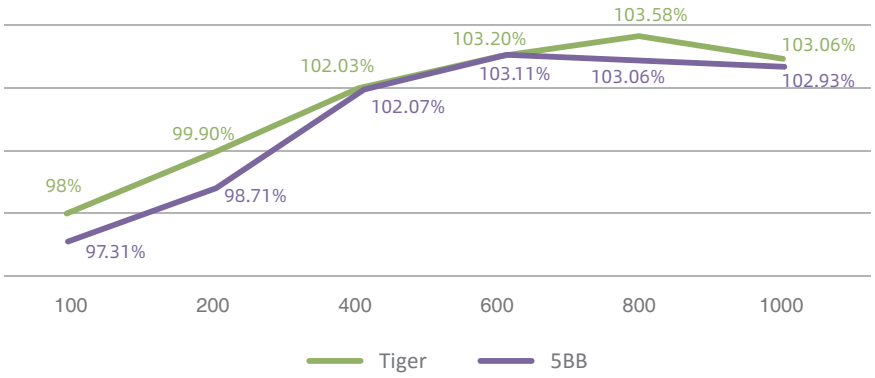

Figure 14 CPVT outdoor testing between Tiger & 5BB

In view of these two advantages, outdoor empirical analysis of normal 5BB module and Tiger 9BB module has been conducted in JinKO R&D Center located at Haining, relevant results are displayed in Figure 14.

According to the empirical results, Tiger module achieves an average gain of 1.57% in power generation compared to the normal 5BB module. Also the results reveal that the power generation gain can reach at 1.91% and 1.72% respectively under the low irradiance of 21st Sep and 22nd Sep.

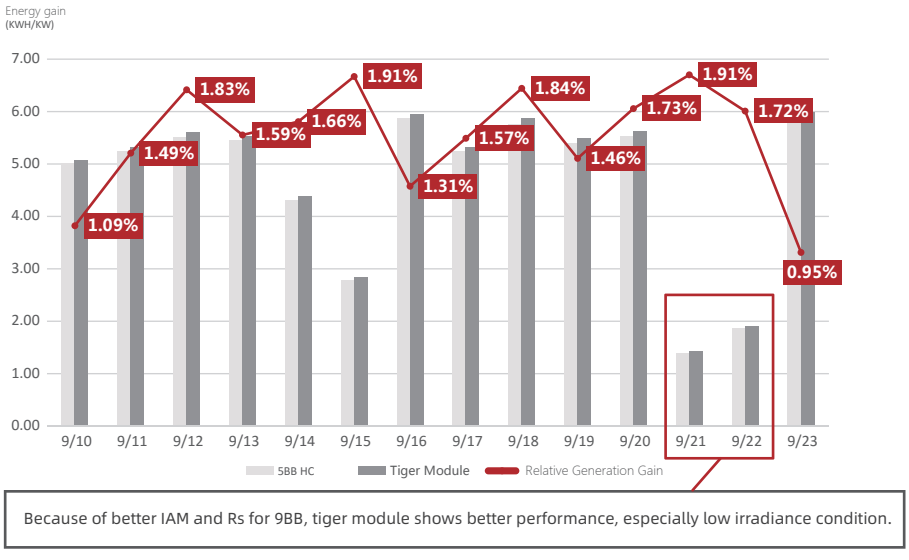

Figure 15 Tiger module energy gain

"Higher energy density" will become the future technology trend in module development, and the higher power generation per area undoubtedly will lead to a continuously decrease on LOCE cost.

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4 Application Scenarios of Tiger Module

Tiger modules can be widely applied due to its excellent characteristics of higher power, higher efficiency, and greater power generation, both suitable for utility and DG markets. In utility projects, Tiger monofacial module with an efficiency above 20.7% can bring substantial savings in land area, meanwhile a mainstream power of 465W in 2020 shows obvious advantages on BOS side, and also the improvement of the string power can effectively save the tracker cost. Tiger bifacial module is sealed with transparent backsheet on the back to achieve higher backside power generation gain, which is especially suitable for ground projects with higher reflection, such as desert and snow ground. Moreover, lightweight achievement by adopting the transparent backsheet, can effectively save BOS cost and further reduce LCOE cost.

Case 1: Low irradiance project

Weather condition of this project is subtropical monsoon climate which belongs to low irradiance area, ground type is sand and albedo is 30%-40%, DC capacity is 120MW, with 1.2 DC/AC ratio.

If we use normal 5BB module in this area, a lot of oblique light and scattered light will loss; From the inverter view, DC/AC ratio is lower and the DC voltage can not meet best output efficiency of inverter which will lead lower energy generation, IRR is influenced as well. If we choose Tiger module of 465w, 9BB design will lead better IAM and higher Rs which will bring better performance in low irradiance environment.

For project design, if we keep same land area and DC capacity, Tiger module will achieve higher distance between the trackers which will bring better rear side generation for bi-facial module to decrease LCOE significantly.

	G1 Module	M6 Module	Tiger Module
Power	405W	440W	465W
Length	2.031m	2.094m	2.205m
Width	1.008m	1.038m	1.032m
String number	10217	9404	9217
Module/string	29	29	28
Module area	606585m²	592767m²	587267m²
GCR	37.5%	36.7%	**36.4%**
Land area	1617560m²	1615171m²	**1613372ml**
Energy generation	152476MWh/year	153242MWh/year	**155922MWh/year**
PR	86.8%	87.2%	**88.7%**
String distance	5.33m	5.45m	**5.5m**
Front Energy generation	137629MWh/year	138522MWh/year	140399MWh/year
Rear side energy gain	10.59%	10.62%	**11.06%**

Table 1 Specific design for Case 1

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We do specific project design and energy generation simulation for the main stream 3 products (Tiger bi-facial 465w, M6 bi-facial half cell 440w and G1 bi-facial half cell 405w), results are showed in the table below. If we choose Tiger bi-facial module and keep same land area, tracker distance will increase effectively, combining with 9BB and tiling ribbon advantages, PR of Tiger is 2% higher than G1 module, rear side generation will increase 0.5% as well.

All of the technology update aims to decrease LCOE from energy generation and BOS, tracker cost will influence BOS significantly which has strong relationship with string number.

If we increase the power output per string, tracker cost will decrease significantly. For this 120MW project, if we use M6 module, there is 9404 strings needed, for tiger is 9217 only, there is 2% string saving. We choose 1P structure tracker which has 3 strings/tracker, Tiger needs 3072 trackers comparing with 3135 trackers for M6 module and tiger module could decrease 2.6% tracker cost directly.

LCOE Analysis			
Module	G1 Module	M6 Module	Tiger Module
Power	405W	440W	**465W** ↑
Efficiency	19.78%	20.24%	**20.43%** ↑
EPC Cost	100%	98.2%	**97.7%** ↓
Land Cost	100%	97.7%	**96.8%** ↓
O&M Cost	100%	94%	**88%** ↓
First year energy generation	152476(MWh/year)	153242(MWh/year)	**155922(MWh/year)** ↑
LCOE	0.4023	0.3930	**0.3845** ↓
IRR	8.64%	9.19%	**9.68%** ↑

Table 2 LCOE analysis for case 1

Not only the tracker, DC cable could be saved 2.5% and site formation cost could be saved 4% because of the module power output increase.

Combining with the energy generation benefit of Tiger module, we do some LCOE analysis for this 120MW project. EPC, land and energy generation advantages of Tiger module leading the development of industry.

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Under “the Belt and Road” strategic framework, “electricity establishment” is a significant part. Country of “the Belt and Road” has good irradiance resource which will bring more opportunities for PV industry.

Case 2: A 200MW project for “the Belt and Road” country

This project belongs to subtropical monsoon climate, there is fully irradiance for the whole year. We would like to choose mono-facial module for this project with the DC/AC ratio of 1:1.05. This project belongs to developed country which has lower land cost and higher labour cost.

This project belongs to high irradiance environment and the system will be fully operation during most of the time, module numbers of per string could not be too much which will beyond the highest MPPT voltage and lead lower efficiency of inverter. The core part of this project is to decrease labour cost to decrease LCOE. We design this project with 1P tracker with 6m distance. In addition, the height of string is 0.5m and rotation angle of tracker is ±45°. Higher power output will decrease labour cost significantly because of the decrease of module number.

	G1 Module	M6 Module	Tiger Module
Power	410W	445W	470W
Length	2.008m	2.094m	2.182m
Width	1.002m	1.038m	1.029m
String number	16821	15498	15198
Module number/string	29	29	28
Tracker number	5607	5166	5066
Module number	487809	449442	425544 ↓
Labour cost(¢/w)	8.37	7.71	7.53 ↓
EPC cost(¢/w)	67.68	65.97	65.45 ↓
Energy generation (MWh/year)	429371	430944	440264 ↑
LCOE(¢/kW·h)	2.79	2.64	2.57 ↓
IRR	10.73%	11.16%	11.51% ↑

Table 3 LCOE analysis for case 2

Tiger 470w mono-facial module has the highest power output of main stream product which will save module and tracker numbers to save labour cost. Lower labour cost with higher energy generation will lead the significant decrease of LCOE and increase IRR.

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Case 3: Third party LCOE analysis

In order to do more analysis on LCOE benefits for Tiger module, Jinko & ATA cooperate to analysis a hypothetical 100MWp power plant with Tiger & M6 module with central & string inverters to analysis LCOE.

Below are the results:

Description	Units	Quantity (#)	Unitary CAPEX (EUR/unit)	CAPEX (EUR)	Quantity (#)	Unitary CAPEX (EUR)	CAPEX (EUR)
		Case 1: Jinko Central inverter			Case 3: M6 Central inverter		
Fencing	m	4 869	43	210 001	4 868	43	210 001
Internal Roads	m²	20 635	18	370 001	20 633	18	370 001
Modules	unit	217 392	138	30 000 096	227 244	132	30 000 096
Trackers	unit	3 882	2 540	9 860 032	3 918	2 540	9 951 485
Power Stations: 2 Inverters of 2,5MWac + 1 Transformer of 5MW	unit	16	200 000	3 200 000	16	200 000	3 200 000
MV Station foundations	unit	16	10 400	166 400	16	10 400	166 400
Combiner Box	unit	324	1 358	440 001	327	1 346	440 001
Labor related to components	modules	217 392	0	100 000	227 244	0	104 532
Labor related to cables	m	902 604	1	541 563	921 048	1	552 629
Total cables				1 557 795			1 571 305
Others, assuming 0.6MEUR/MWp for case 1	Wp	100 000 320	1	13 554 303			13 554 303
Total				**60 000 192**			**60 120 754**
		Case 2: Jinko String inverter			Case 4: M6 String inverter		
Fencing	m	4 869	43	210 001	4 868	43	210 001
Internal Roads	m2	20 635	18	370 001	20 633	18	370 001
Modules	unit	217 392	138	30 000 096	227 244	132	30 000 096
Trackers	unit	3 882	2 540	9 860 032	3 918	2 540	9 951 485
MV Stations - 6MW transformer	unit	14	107 374	1 503 235	14	107 374	1 503 235
SmartACU2000DB-D 2PID	unit	14	4 696	65 739	14	4 696	65 739
Inverters	unit	793	3 470	2 751 365	793	3 470	2 751 365
MV Station foundations	unit	14	5 775	80 850	14	5 775	80 850
ACbox 2in1	unit	432	480	207 360	432	480	207 360
Labor related to components	modules	217 392	1	200 001	227 244	1	209 064
Labor related to cables	m	1 167 167	1	700 300	1 216 177	1	729 706
Total cables	-	-	-	1 810 458	-	-	1 792 850
Others, assuming the same as in case 1				13 554 303			13 554 303
Total				**61 313 741**			**61 426 056**

This project is located in Albacete (Spain) and there are 4 cases. All these cases have 100MWp and same available area have been considered.

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Because of the feature of “high energy density” for Tiger module, cost of tracker/labout/O&M are saved and energy generation is increased significantly.

Location	Albacete (Spain)			
Module	Jinko	M6	Jinko	M6
Inverter	Central inverter	Central inverter	String inverter	String inverter
Case	1	2	3	4
MWp	100.0	100.0	100.0	100.0
MWac	83.20	83.20	83.27	83.27
Energy production (MWh/y) (new & clean)	207031	204607	206959	204646
Capex (MEUR)	60.00	60.12	61.31	61.43
Unitary Capex (MEUR/MWp)	0.6000	0.6013	0.6131	0.6143
Unitary Capex (MEUR/MWac)	0.7212	0.7226	0.7364	0.7377
Total Investment (MEUR)	65.41	65.52	66.8	66.89
Equity Investment (MEUR)	19.62	19.66	20.04	20.07
Leverage	70%	70%	70%	70%
Net Present Value (MEUR) (for assumed tariff)	33.14	32.33	32.38	31.6
Discount rate Ke	7.70%	7.70%	7.70%	7.70%
Assumed tariff (EUR/MWh)	40	40	40	40
Internal Rate of Return (IRR)	**12.26%** ↑	12.01%	**11.84%** ↑	11.60%
LCOE assuming IRR=Ke (EUR/MWh)*	**31.85** ↓	32.30	**32.6** ↓	33.02

“Tiger module case studies have more IRR and lower LCOE than M6 module ones for a given DC capacity, land availability and module cost per MWdc, regardless the inverter technology. This improvement comes from three factors: more production, lower Capex and lower Opex” .

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Statement

This report was written by Jinko Solar Co., Ltd. (hereinafter referred to as “we, us, our, and ours”). This report is based on legally obtained information, but we do not guarantee the accuracy and completeness of such information. Part of the analysis included in this report is based on various assumptions, which may lead to significant differences in the analysis results. The contents and opinions in the report are for reference only.

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