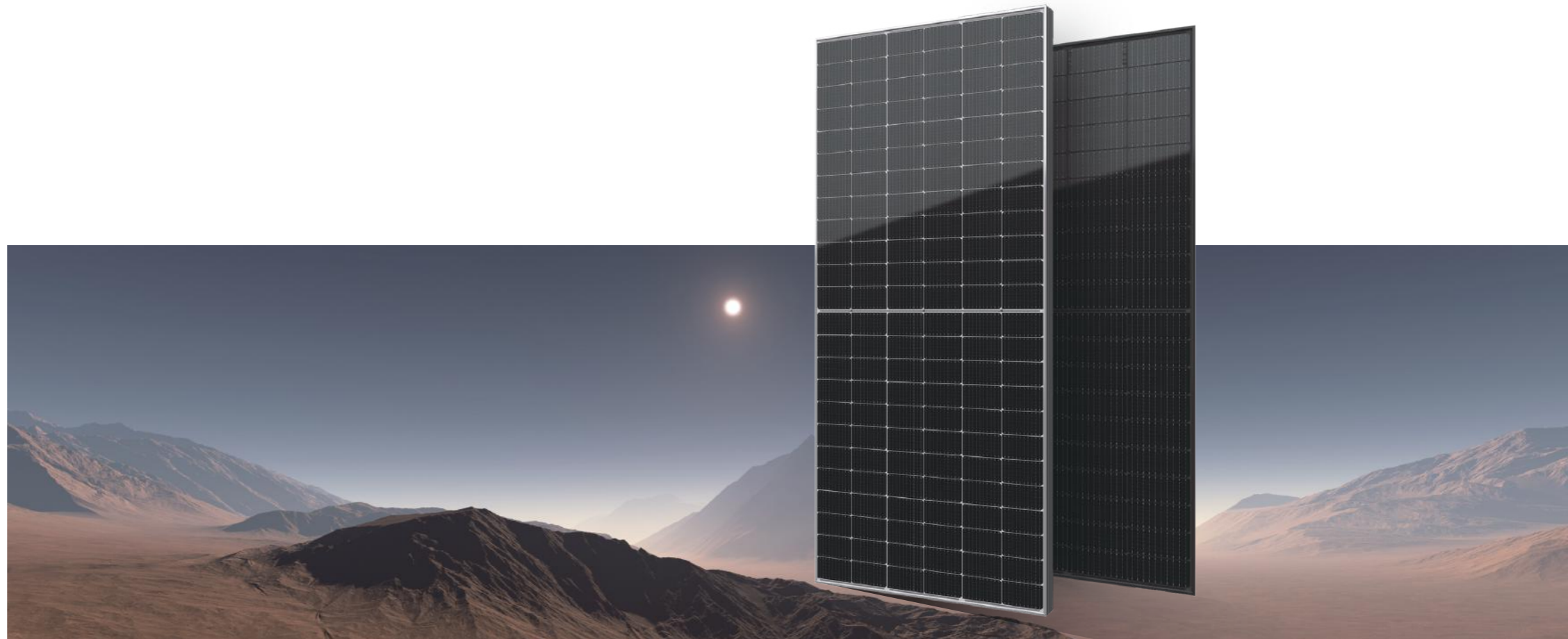




Grand Sunergy Co.,Ltd.

Web : www.grandsunergy.com

Email: sales@grandsunergy.com



TECHNOLOGY RE-BUILDS THE FUTURE



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1 Company Profile

2 R&D

3 Case Studies on HJT Advantages

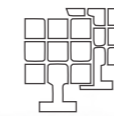
4 RoadMap

5 Product Profile

ABOUT OUR COMPANY

Founded in early 2022, Grand Sunergy is specializing in the Research & Development, manufacture, and trading of high efficiency HJT solar cells and modules. The company has established two production bases in China, with capacity 3.5GW of solar Module and 1.5GW of HJT solar cell by 2023.

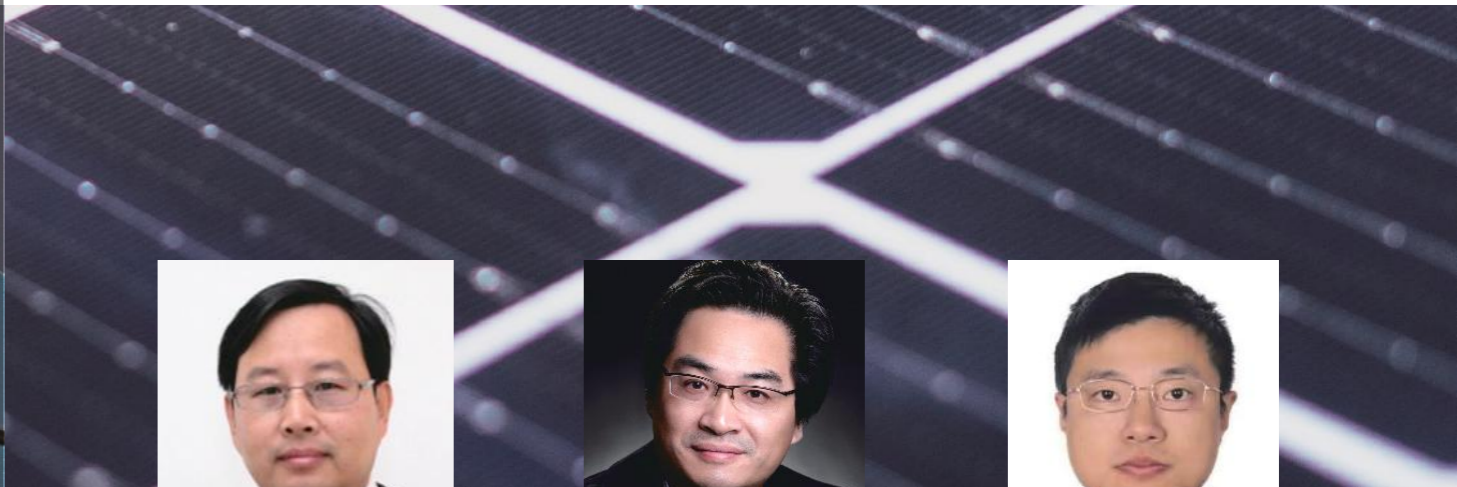
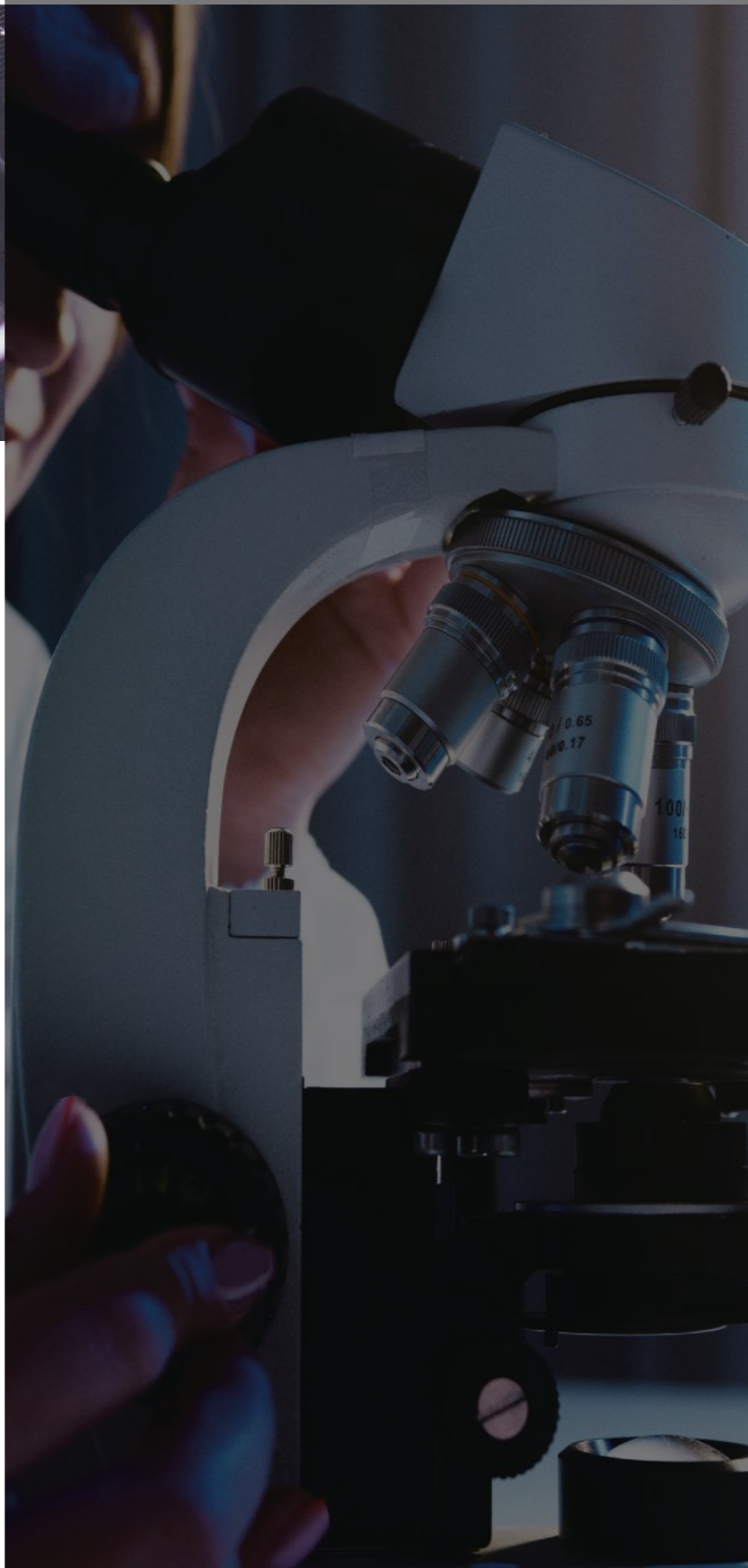
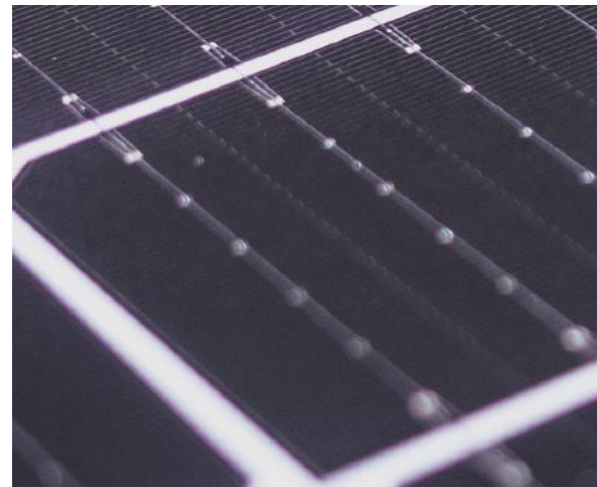
Grand Sunergy has established a strong R&D team, to develop the HJT technology's Cost Reduction, New Material Introduction, Technical Parameters Improvement much further.



3.5GW
capacity of solar module



1.5GW
capacity of HJT solar cell



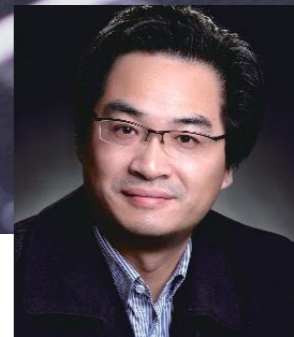
R&D

The Research Institute working together with Shanghai Jiao Tong University Solar Energy Research Institute conducts the various Research Subjects from different angles, including the new materials and technologies, manufacturing techniques, equipment improvements and so on. We strongly believe Science and technology is the first productive force in company's development.



Zhongwei Zhang
CEO

Doctor of Microelectronics and Solid State Electronics of East China Normal University



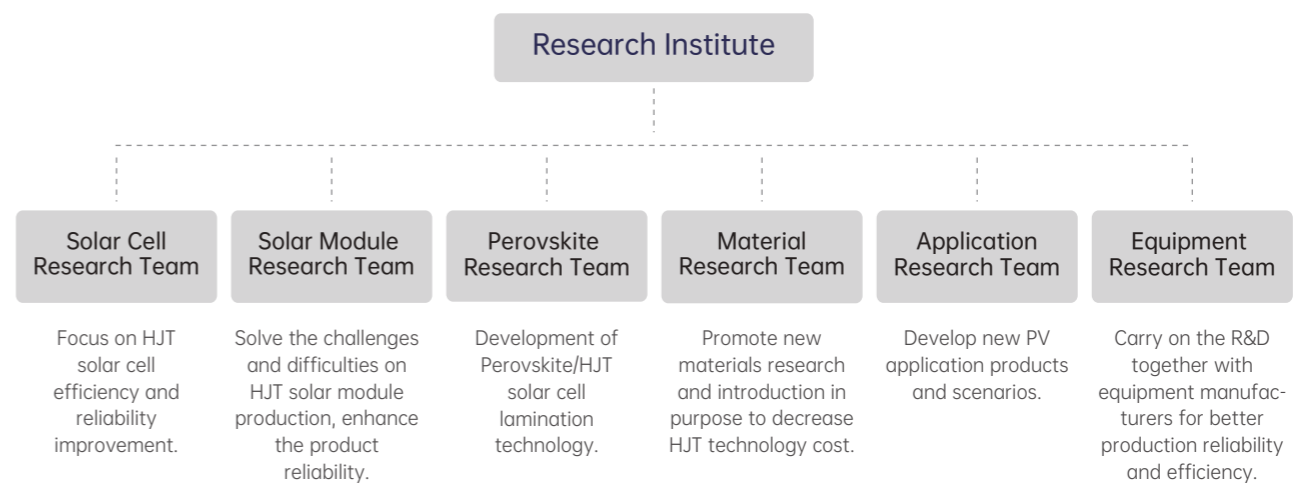
Wenzhong Shen
Director of Grand Sunergy Research Institute

Doctor of Shanghai Institute of Technical Physics Chinese Academy of Sciences Professor of Shanghai Jiao Tong University



Wenbin Zhang
CTO

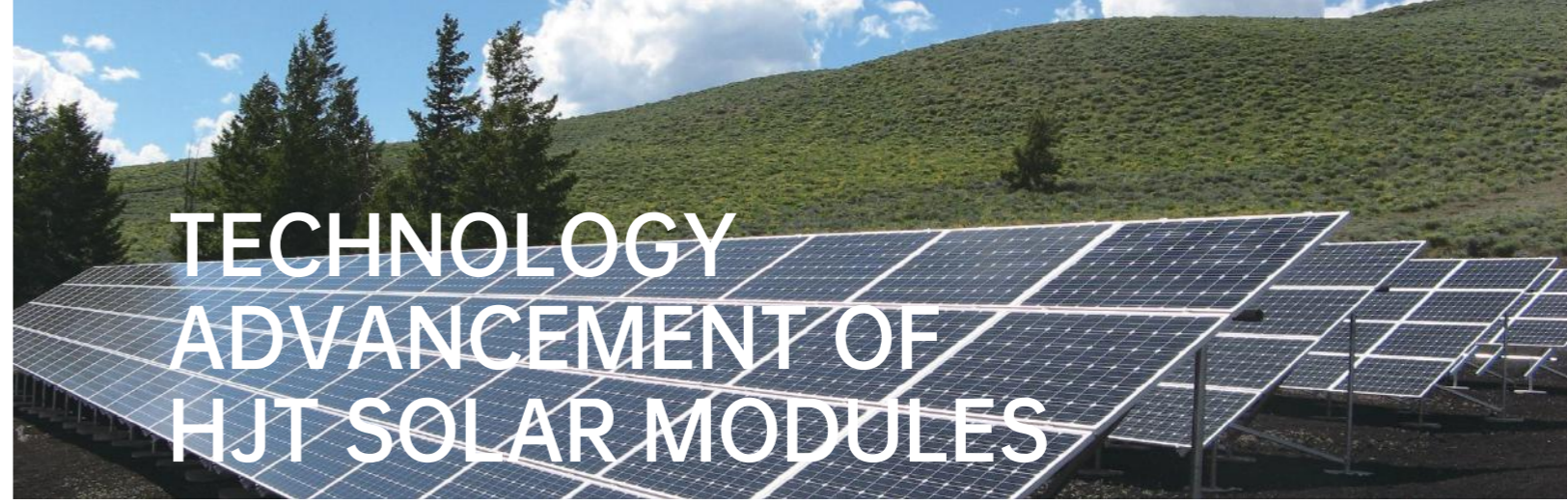
Doctor of Shanghai Institute of Ceramics Chinese Academy of Sciences





Lower Temperature Coefficient

-0.26%/°C heating coefficient of HJT solar cells, with 0.13%/°C advancement compare with Momoperc. Around 0.6~3.9% higher power generation per watt of HJT than bifacial PERC.



TECHNOLOGY ADVANCEMENT OF HJT SOLAR MODULES

85%+ bifaciality

10%-20% back irradiation and higher bifaciality contribute to 2%-4% higher power generation per watt of HJT solar cells than bifacial PERC solar cells.

High energy yield under weak light

Excellent N-type silicon wafer's yield performance under weak-light can increase power generation by 0.5-1%/Watt than bifacial PERC solar cells.



High reliability

No LID caused by B-O effect, outstanding PID resistance by TCO film, to best guarantee long-period durability and yield.

Low degradation rate

1% first year degradation of HJT solar cells, 0.3% for each successive year, around 1.9%-2.9% higher full life cycle power generation of HJT solar cells than bifacial PERC solar cells.



Best LCOE

Use the cutting-edge and most prominent technology to reduce LCOE to the greatest extent.

HIGHER YIELD PERFORMANCE LOWER DEGRADATION

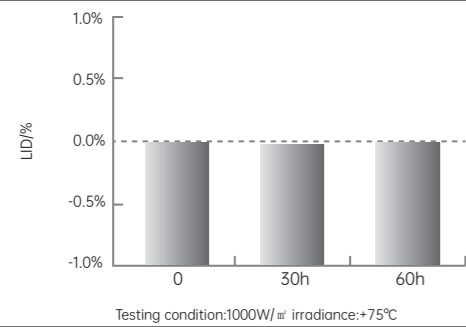
OUTSTANDING PID & LID

The antireflection layer that HJT solar cell applied is the Conductive ITO instead of the Insulate SixNy, to avoid the possibility of the electric conduction on cell surface, and the PID effect involved.

N-type wafer applied Boron Oxygen Composite-free center, to ensure the LID free. The 1st Year degradation of HJT is 1.5%, the yearly HJT solar module degradation is 0.36%, much lower than the 0.45%-0.55% from PERC.

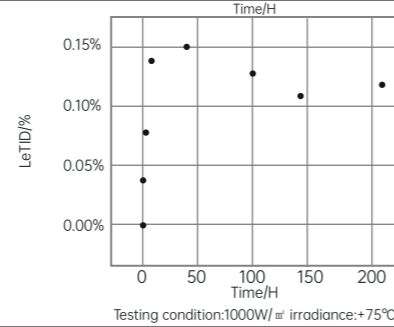


NO LID OF HJT SOLAR MODULE AFTER 30H&60H



Source: CFV SOLAR TESTLAB

NO DEGRADATION AFTER LETID TEST



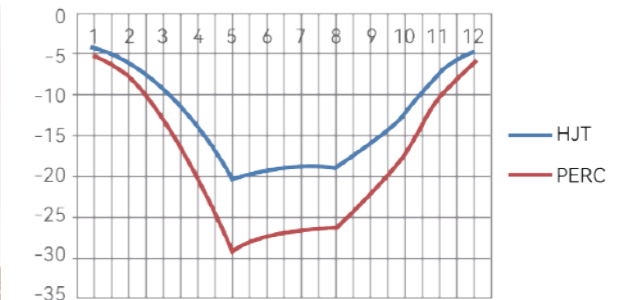
Source: CIE POWER, CHINA MERCHANTS SECURITIES

Power generation gain of HJT solar modules

Parameters	Power gain compared with PERC	Note
Impact of temperature coefficient	2-6%	Cold: 2%, hot: 4-6%
NO LID	1.2-3%	Compared with better PERC
Bifaciality	2%	HJT bifaciality 93%, PERC 82%
Weak light effect	0.3-1.0%	Voc of HJT: 740mv, Voc of PERC: 680mv
In total	5.5-10%	

Source: PV-Tech, China Merchants Securities

HJT SOLAR MODULE LOWER TEMPERATURE COEFFICIENT



100MW project in Abu Dhabi

(Abscissa represents the Month, Ordinate represents Power Loss by Hours)

Single Axle Track applied

Temperature Caused Lost Hours (h/Year)

Module	Ge'ermu (China)	Yin Chuan (China)	Abu Dhabi	Bortala (China)	Chongren (China)	Siziwang qi (China)
HJT	37	38	148	38	36	29
PERC	54	56	209	54	51	42
Decent Degree	16	17	61	17	15	14

Temperature Caused Power Loss by Hours in Different Locations

Temperature Caused Power Loss (%/Year)

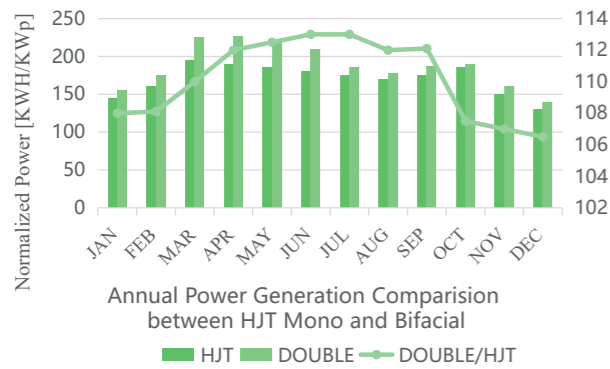
Module	Ge'ermu	Yin Chuan	Abu Dhabi	Bortala	Chongren	Siziwang qi
HJT	1.6%	1.92%	6.40%	2.02%	2.45%	1.43%
PERC	2.35%	2.88%	9.36%	3.00%	3.60%	2.20%
Decent Degree	0.8%	1.0%	3.0%	1.0%	1.20%	0.80%

Temperature Caused Power Loss Ratio in Different Locations

Currently the Temperature Coefficient of PERC solar module is $-0.45\% \sim -0.3\%/^{\circ}\text{C}$, TOPCon $-0.29\% \sim -0.28\%/^{\circ}\text{C}$, HJT can be lowered to 0.26% . Under High Temperature environment, the HJT solar module can generate more energy than other technology solar modules.

HIGHER BIFACIALITY

HJT solar cell has nature bilateral structure, best choice for bifacial solar modules up to 30%+ additional power generation from HJT Bifacial solar module rear side. Nature symmetrical structure of HJT solar cell presents excellent color consistency.



Installed Surface	Power Generation Benefit VS Perc A	Power Generation Benefit VS Perc B
Asphalt Pavement	13.3%	14.0%
Cement Pavement	12.9%	14.4%
Grass	15.4%	16.7%
White Stone Pavement	20.9%	24.5%
White Paint	33.3%	35.7%

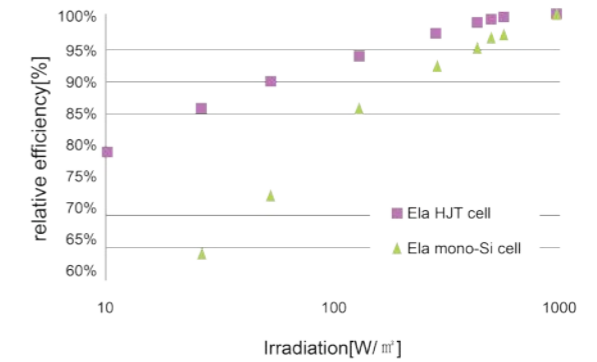
The installation angle is 30°, location in California USA.

The Bifacial HJT solar module has 10.9% more power generation than Mono-facial HJT solar module in a single year.

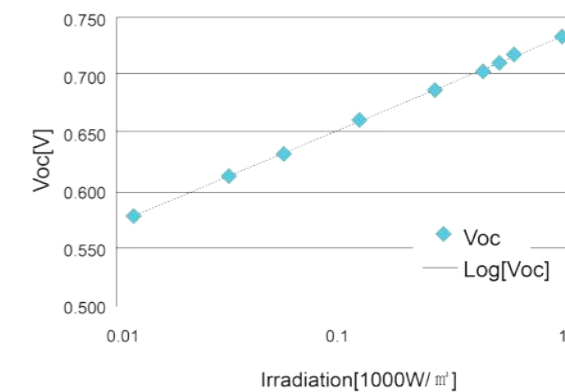
EXCELLENT WEAK-LIGHT PERFORMANCE



HJT solar cell applies the N-type wafer while PERC using P-Type wafer. Under the 600W/m² radiation, N-type solar-module has 1-2% more power generation than P-type PERC solar module.



(a) Relative irradiance behaviour of the efficiency for a 5 inch HJT solar cell (red squares) compared to a mono-Si reference cell (green triangles).



(b) The VOC of a 5 inch HJT solar cell shows nearly perfect logarithmic dependence on irradiance.

HJT TECHNOLOGY PRICE PREMIUM ANALYZATION UNDER DIFFERENT CONDITION



HJT module can bring lower LCOE cost compared with other solar cell technologies, because of:

Lower BOS cost

Higher Efficiency of HJT solar module, the Higher Unit Area generation, the lower BOS involved.

Longer Power Warranty

By the advantages of HJT lower power degradation, high bifaciality and lower temperature coefficient, HJT solar module can generate more power.

Condition 1

Not Considerate the Additional Generation of HJT technology

Condition 2

Only take the lower Degradation benefit of HJT under Consideration

Condition 3

Comprehensive consideration of all HJT benefit

LCOE of HJT projects is 1.3% lower than PERC

If, set LCOE at the same level:

HJT solar modules have 3.2% price premium compared with PERC and price of HJT solar module could be around 0.008\$ higher than PERC

LCOE of HJT projects is 3.4% lower than PERC

If, set LCOE at the same level:

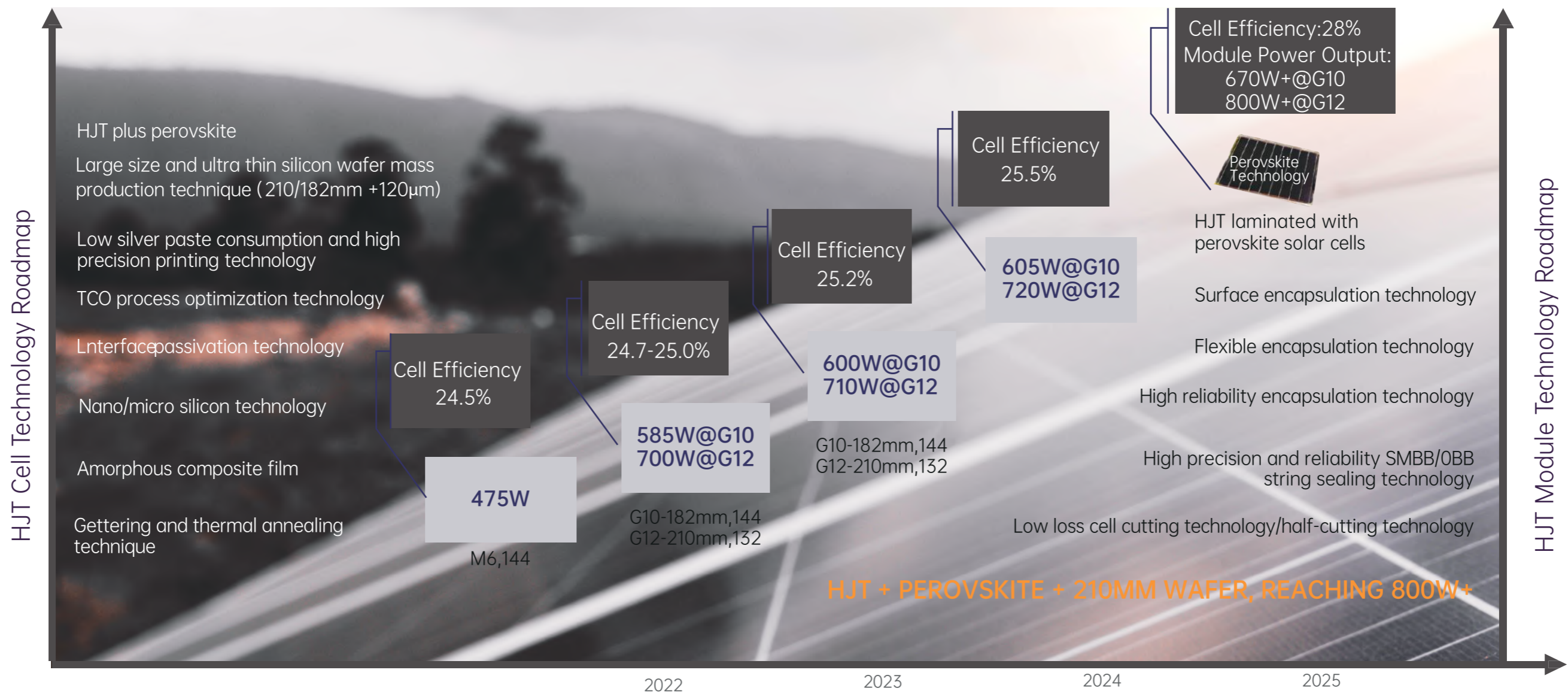
HJT solar modules have 8% price premium compared with PERC and price of HJT solar module could be 0.018\$ higher than PERC

LCOE of HJT projects is 4.3-8% lower than PERC

If, set LCOE at the same level:

HJT solar modules have 13.2% price premium compared with PERC and price of HJT solar module could be 0.053\$ higher than PERC

GRAND SUNERGY HJT PRODUCT AND TECHNOLOGY ROADMAP



Chasing (SERIES)

(210 HJT)



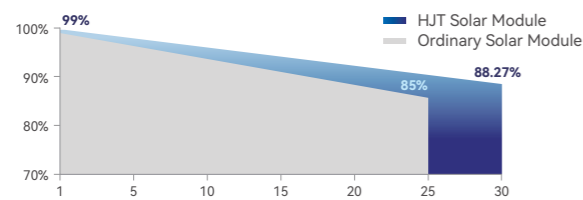
Eutropic (SERIES)

(182 HJT)

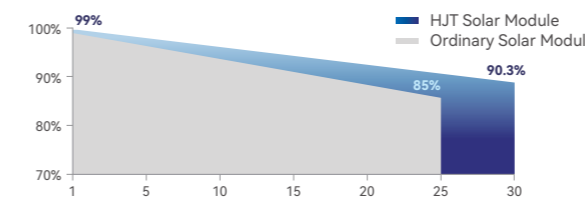


HJT, 720W
Good choice for large-scale projects

HJT, 585W
Good choice for large-scale projects



- 720W**
Maximum Power Output
- 23.18%**
Maximum Solar Module Efficiency
- 0.26%/°C**
Industry Leading Negative Temperature Coefficient
- 85%**
Bifaciality
- 30Years**
Linear Power Warranty



- 585W**
Maximum Power Output
- 22.65%**
Maximum Solar Module Efficiency
- 0.26%/°C**
Industry Leading Negative Temperature Coefficient
- 85%**
Bifaciality
- 30Years**
Linear Power Warranty



Eutropic SERIES

(182 HJT)



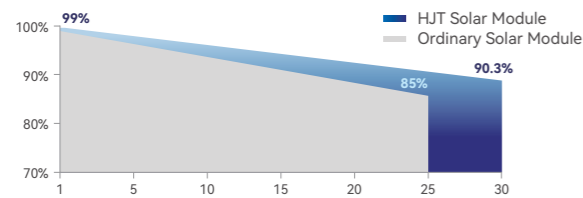
Eutropic SERIES

(182 HJT)

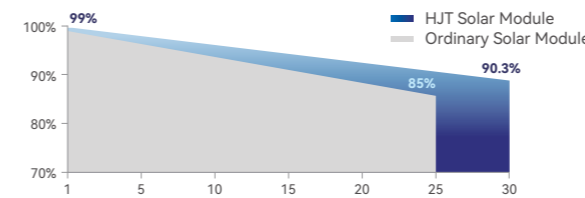


HJT, 435W
Suitable for roof-top projects

HJT, 485W
Applicable to multiple scenarios



- 435W**
Maximum Power Output
- 22.25%**
Maximum Solar Module Efficiency
- 0.26%/°C**
Industry Leading Negative Temperature Coefficient
- 85%**
Bifaciality
- 30Years**
Linear Power Warranty



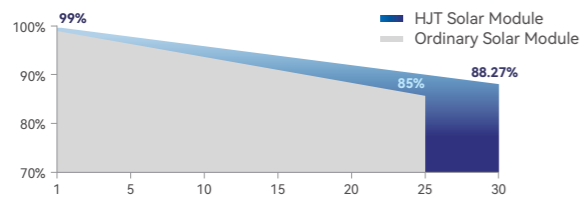
- 485W**
Maximum Power Output
- 22.35%**
Maximum Solar Module Efficiency
- 0.26%/°C**
Industry Leading Negative Temperature Coefficient
- 85%**
Bifaciality
- 30Years**
Linear Power Warranty

Eutropic SERIES

(182 HJT FULL BLACK)



HJT, up to 425W
Excellent aesthetic appearance



- 425W**
Maximum Power Output
- 21.74%**
Maximum Solar Module Efficiency
- 0.26%/°C**
Industry Leading Negative Temperature Coefficient
- 85%**
Bifaciality
- 30Years**
Linear Power Warranty