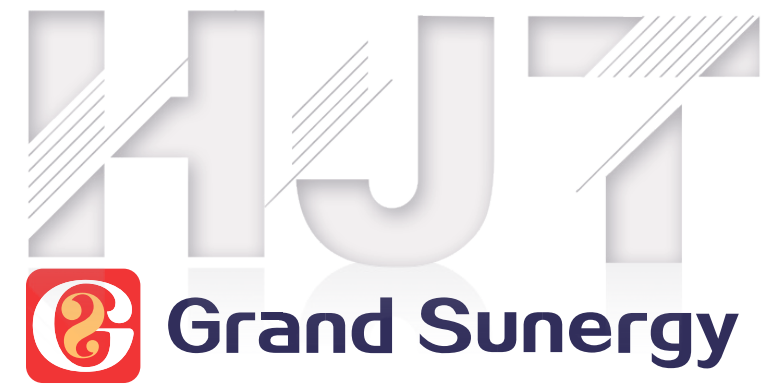
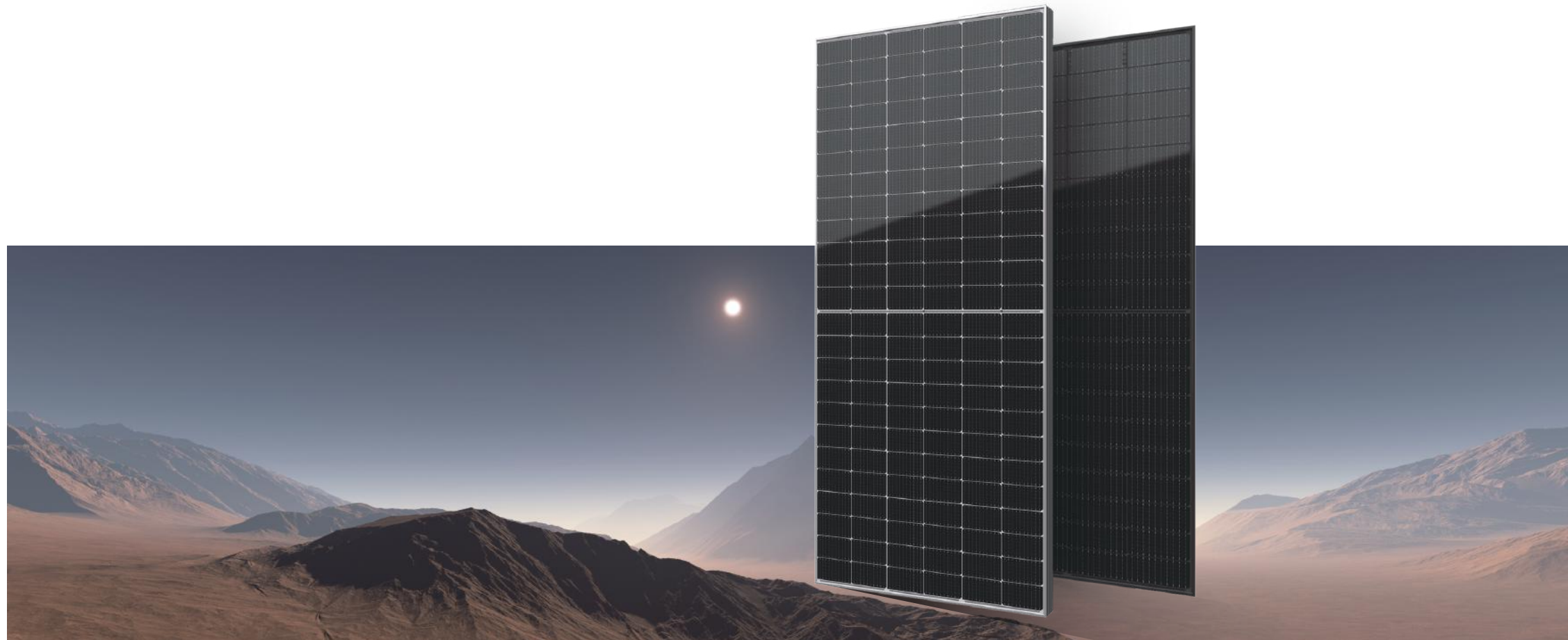




Grand Sunergy Co.,Ltd.

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Email: sales@grandsunergy.com



Grand Sunergy

TECHNOLOGY RE-BUILDS THE FUTURE



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1 Company Profile

2 R&D

3 Case Studies on HJT Advantages

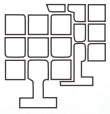
4 RoadMap

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 photovoltaic cells and modules. The company has established two production bases in China, with capacity 3.5GW of Module and 1.5GW of HJT 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.



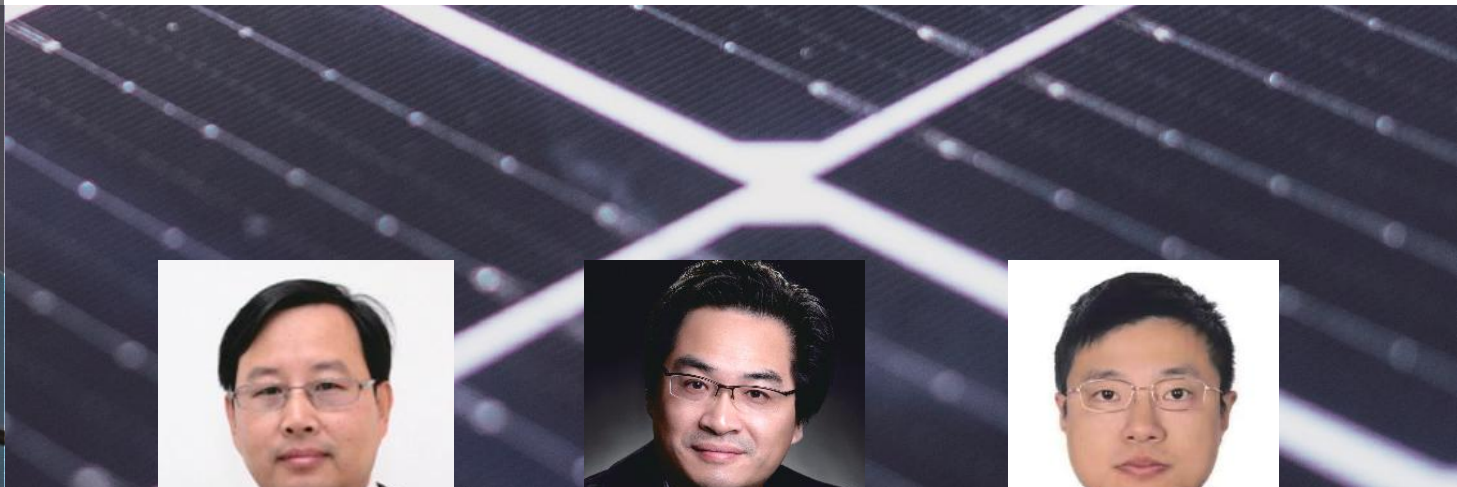
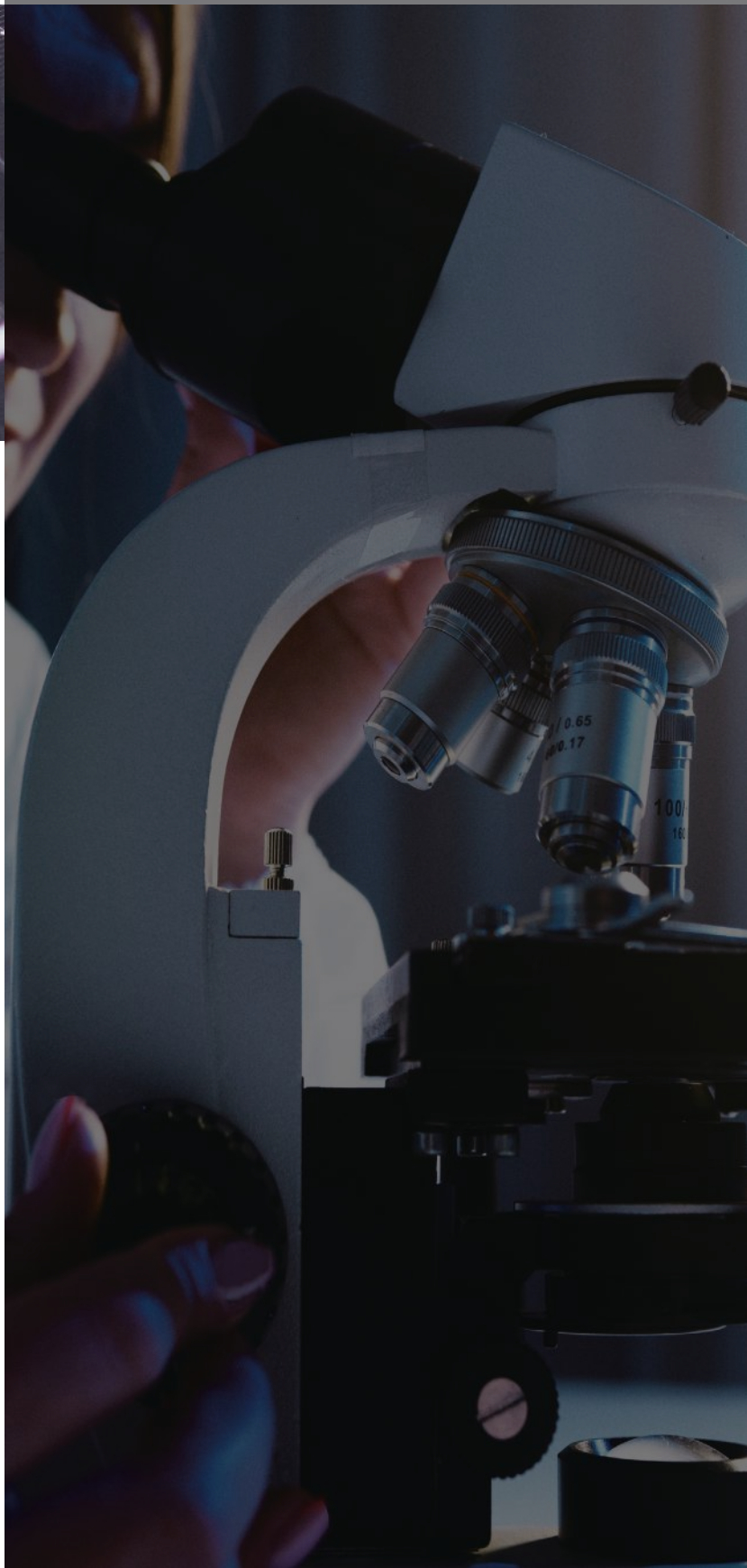
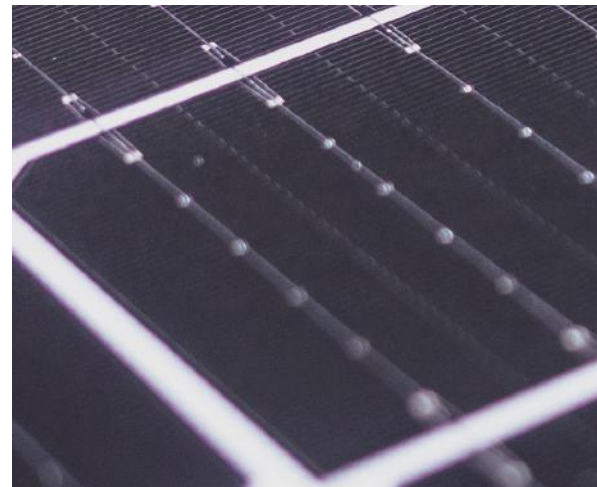
3.5GW

capacity of Module



1.5GW

capacity of HJT cell



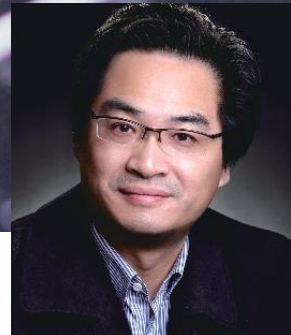
R&D

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



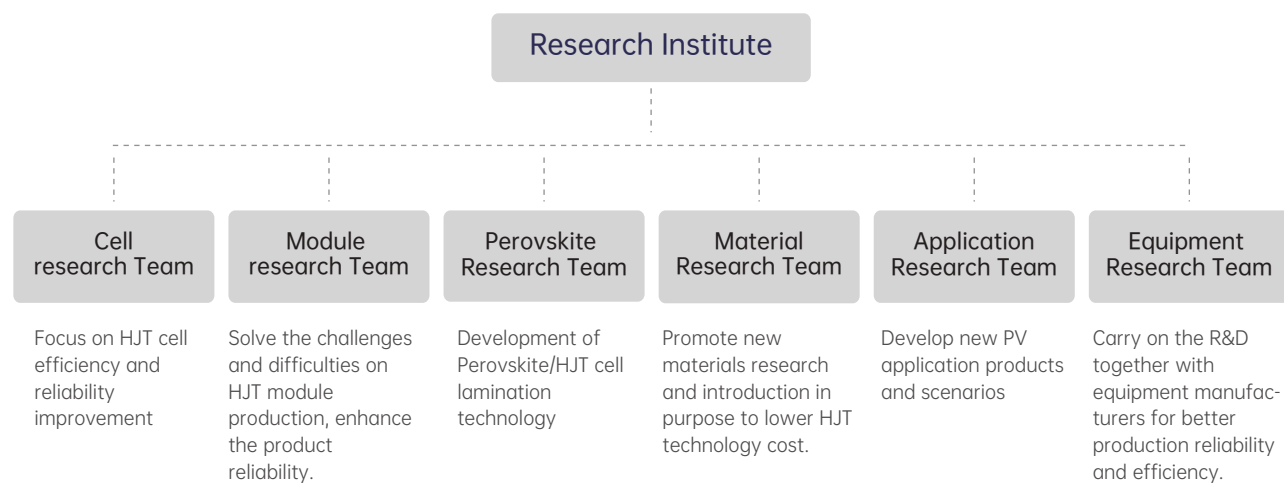
Wenzhong Shen
Director of Grand Sunergy Research Institute

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



Wenbin Zhang
CTO

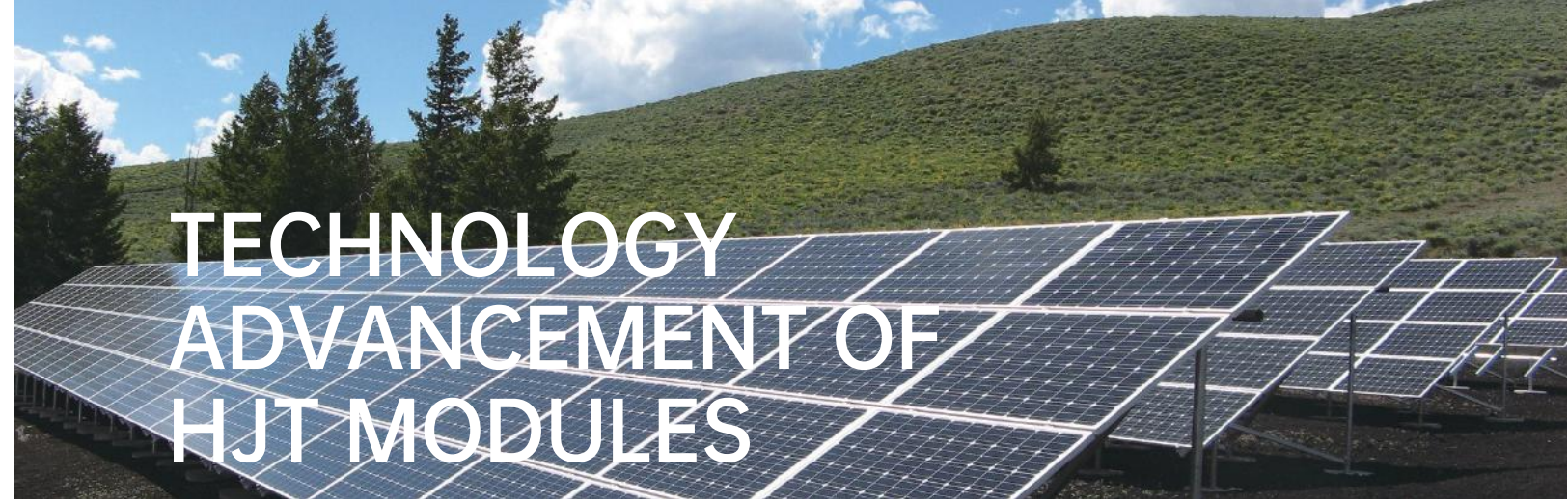
Doctor of Shanghai Institute of Ceramics Chinese Academy of Sciences





-0.26%/°C

-0.26%/°C heating coefficient of HJT 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 MODULES

85%+ bifaciality

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

1.5% first year degradation of HJT cells, 0.36% for each successive year,
 Around 1.9%-2.9% higher full life cycle power generation of HJT cells than bifacial PERC cells

Best LCOE

A cutting-edge and most prominent technology to best reduce LCOE



HIGHER YIELD PERFORMANCE. LOWER DEGRADATION

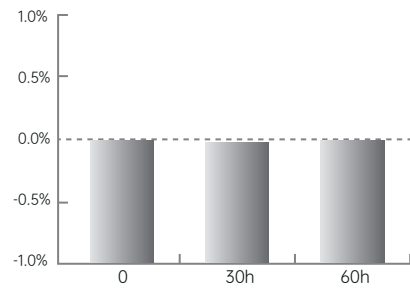
OUTSTANDING PID & LID

The antireflection layer that HJT 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 module degradation is 0.36%, much lower than the 0.45%-0.55% from Perc.



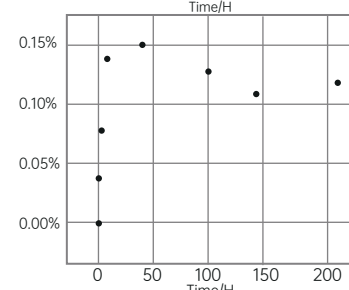
NO LID OF HJT MODULE AFTER 30H&60H



Testing condition:1000W/m² irradiance:+75°C

Source:CFV SOLAR TESTLAB

NO DEGRADATION AFTER LETID TEST



Testing condition:1000W/m² irradiance:+75°C

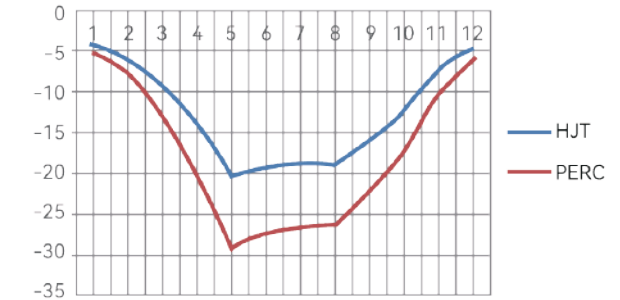
Source:CIE POWER, CHINA MERCHANTS SECURITIES

Power generation gain of HJT 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 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)

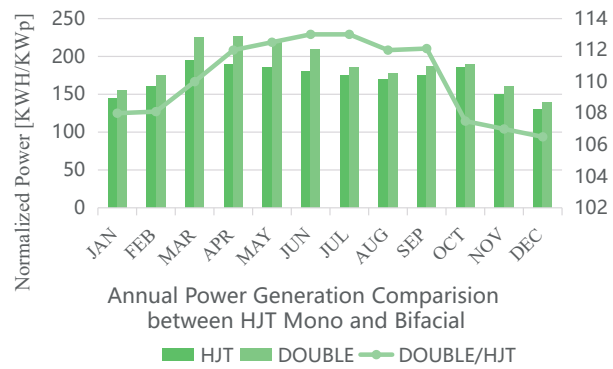
Module	Ge'ermu	Yin Chuan	Abu Dhabi	Bortala	Chongren	Siziwang qi
HJT	1.6%	1.92%	6.40%	2.02%	2.45%	1.43%
PERC	2.35%	2.88%	9.36%	3.00%	3.60%	2.20%
Decent Degree	0.8%	1.0%	3.0%	1.0%	1.20%	0.80%

Temperature Caused Power Loss Ratio in Different Locations

Currently the Temperature Coefficient of Perc 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 module can generate more energy than other technology modules.

HIGHER BIFACIALITY

HJT Cell has nature bilateral structure, best choice for bifacial modules
 Up to 30%+ additional power generation from HJT Bifacial module rear side
 NATURE symmetrical structure OF HJT cell PRESENTS excellent color consistency



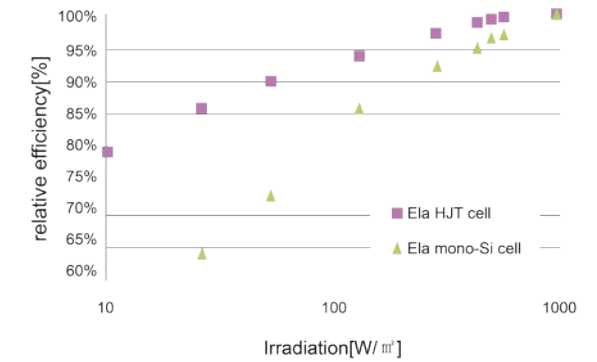
The installation angle is 30°, location in California USA.
 The Bifacial HJT module has 10.9% more power generation than HJT mono-facial module in a single year.

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%

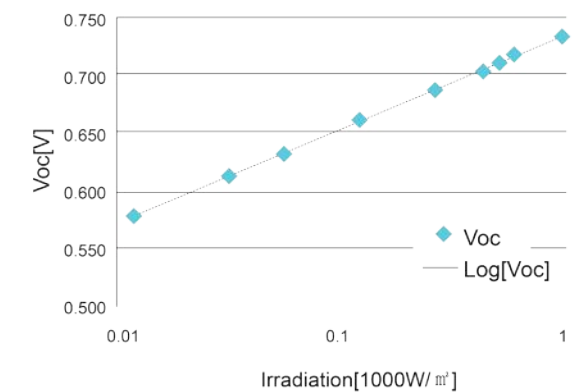
EXCELLENT WEAK-LIGHT PERFORMANCE



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



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



(b) The VOC of a 5 inch HJT 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 cell technologies.

Lower BOS cost

Higher Efficiency of HJT 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 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

Set LCOE at the same level

HJT modules have 3.2% price premium compared with PERC

Price of HJT module could be around 0.008\$ higher than PERC

LCOE of HJT projects is 3.4% lower than PERC

Set LCOE at the same level

HJT modules have 8% price premium compared with PERC

Price of HJT module could be 0.018\$ higher than PERC

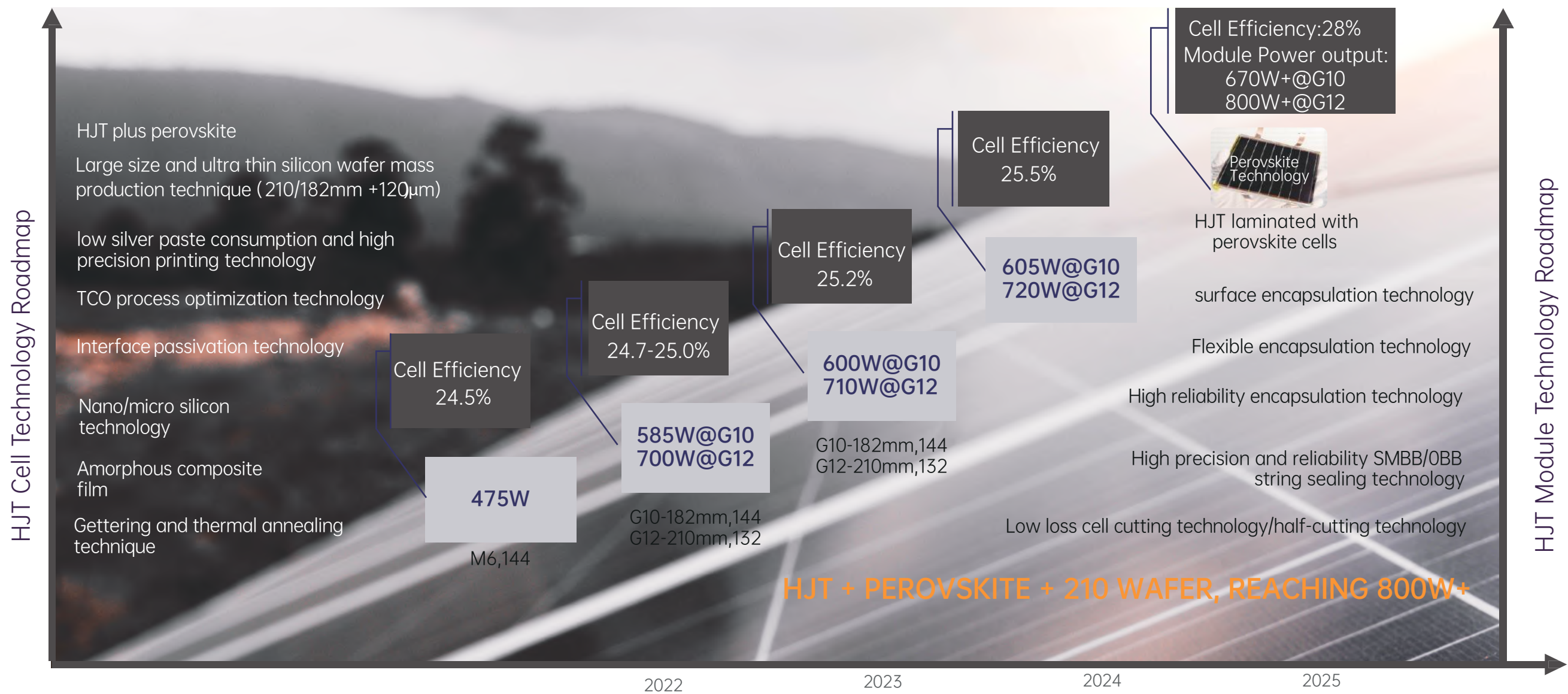
LCOE of HJT projects is 4.3-8% lower than PERC

Set LCOE at the same level

HJT modules have 13.2% price premium compared with PERC

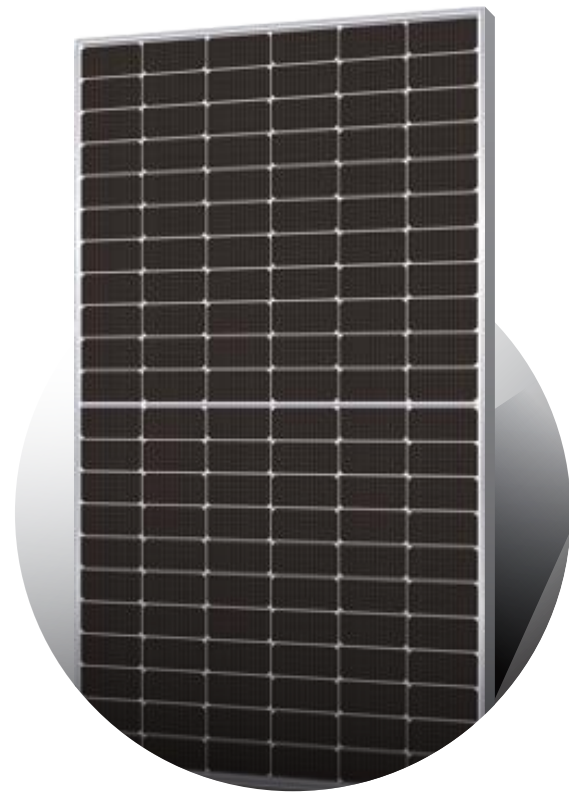
Price of HJT module could be 0.053\$ higher than PERC

GRAND SUNERGY HJT PRODUCT AND TECHNOLOGY ROADMAP



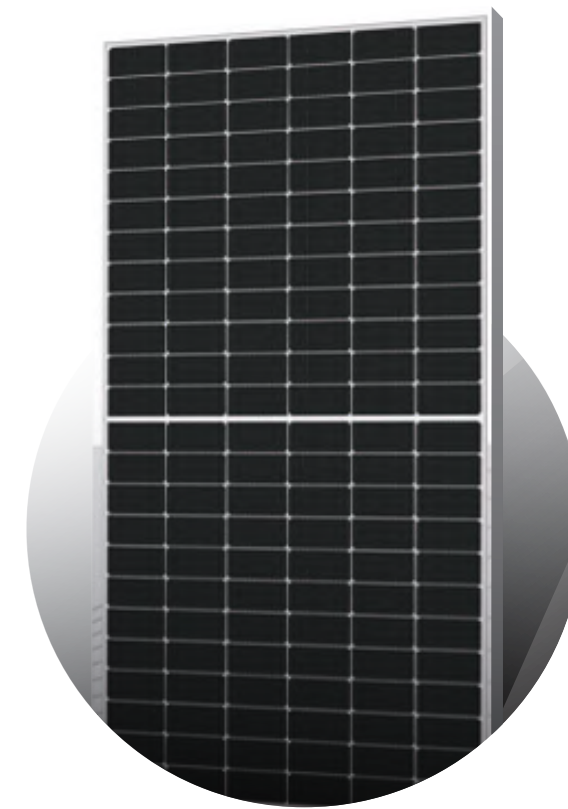
Chasing SERIES

(210 HJT)

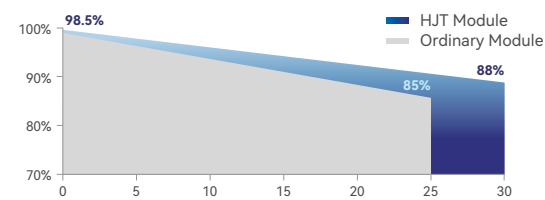


Eutropic SERIES

(182 HJT)

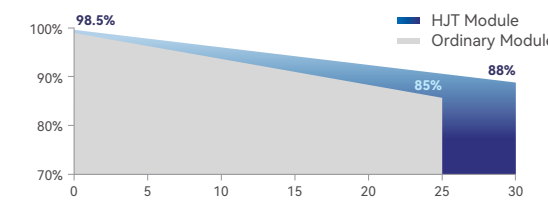


HJT, 700W
Good choice for large-scale projects



- 700W**
Maximum Power Output
- 22.53%**
Maximum Module Efficiency
- 0.26%/°C**
industry leading negative temperature coefficient
- 85%**
Bifaciality
- 30Years**
Linear Power Warranty

HJT, 590W
Good choice for large-scale projects



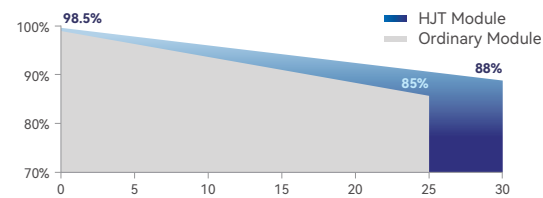
- 590W**
Maximum Power Output
- 22.84%**
Maximum Module Efficiency
- 0.26%/°C**
industry leading negative temperature coefficient
- 85%**
Bifaciality
- 30Years**
Linear Power Warranty

Eutropic SERIES

(182 HJT)



HJT, 435W
Suitable for roof-top projects



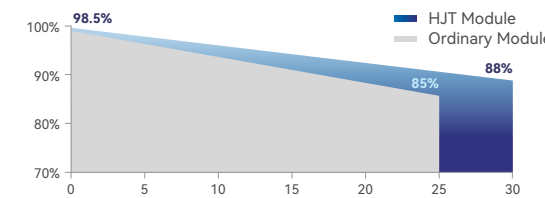
- 435W**
Maximum Power Output
- 22.25%**
Maximum Module Efficiency
- 0.26%/°C**
industry leading negative temperature coefficient
- 85%**
Bifaciality
- 30Years**
Linear Power Warranty

Eutropic SERIES

(182 HJT)



HJT, 485W
Applicable to multiple scenarios



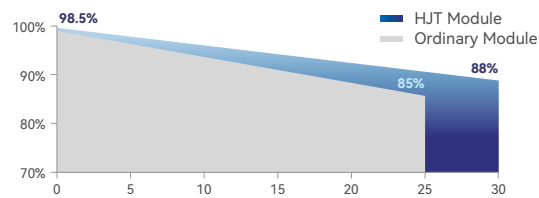
- 485W**
Maximum Power Output
- 22.35%**
Maximum Module Efficiency
- 0.26%/°C**
industry leading negative temperature coefficient
- 85%**
Bifaciality
- 30Years**
Linear Power Warranty

Eutropic SERIES

(182 HJT FULL BLACK)



HJT, up to 430W
Excellent aesthetic appearance



- 430W**
Maximum Power Output
- 21.99%**
Maximum Module Efficiency
- 0.26%/°C**
industry leading negative temperature coefficient
- 85%**
Bifaciality
- 30Years**
Linear Power Warranty