this webinar is powered by Huasun

pv magazine webinars

High performance at scale with HJT

11 August 2022

10:00 am – 11:00 am | CEST, Berlin
9:00 am – 10:00 am | BST, London
11:00 am – 12:00 pm | EEST, Athens

Mark Hutchins
Editor
pv magazine

Wang Wenjing
CTO
Huasun

Matthew Jin
GM of sales center
Huasun

Dr. Djarber Berrian
PV Innovation and Design Engineer
Belectric

Welcome!

pv magazine webinars

Do you have any questions? ? 

Send them in via the Q&A tab.  We aim to answer as many as we can today!

You can also let us know of any tech problems there.

We are recording this webinar today. 

We‘ll let you know by email where to find it and the slide deck, so you can re-watch it at your convenience.  

HJT Mass Production in Huasun

Wenjing Wang

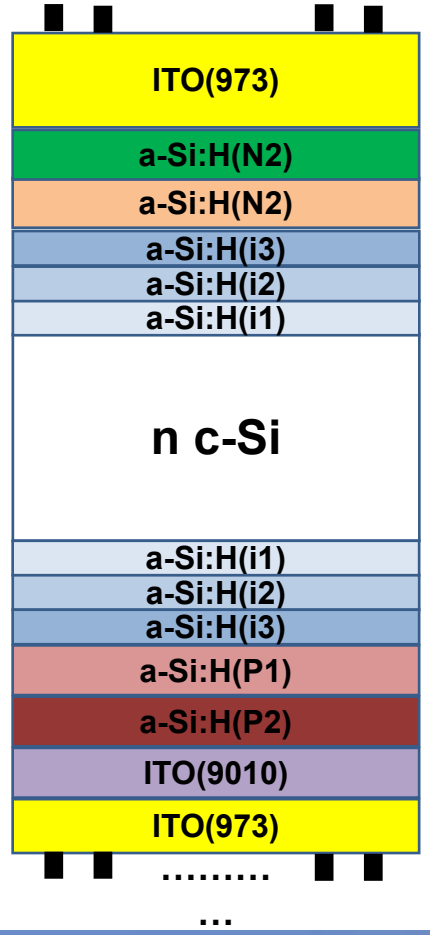
Huasun

Progress of HJT Technology in Mass Production

HJT 1.0

→2021

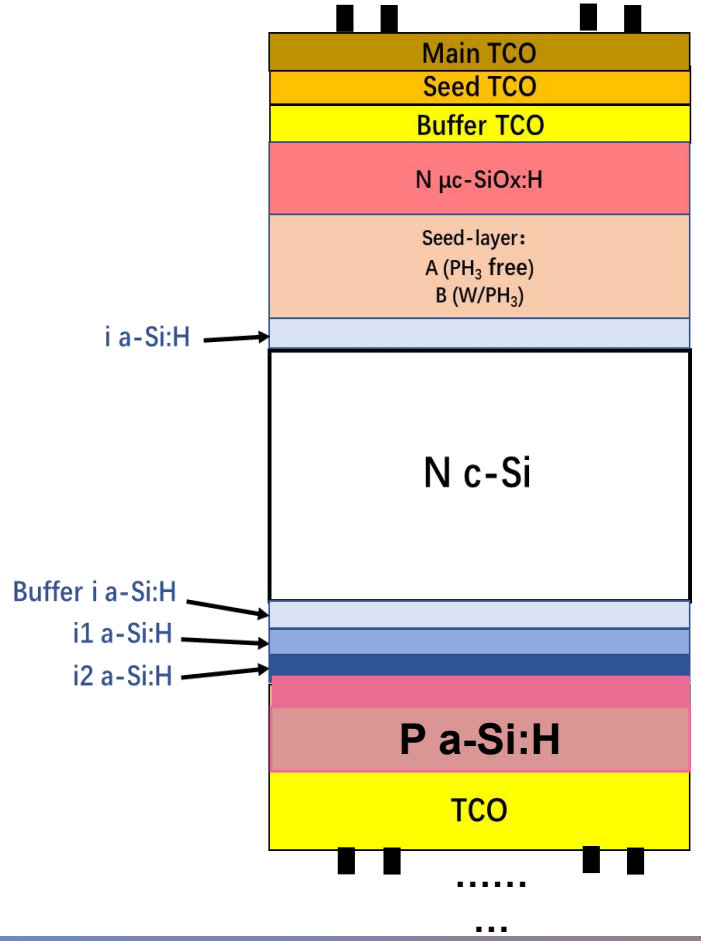
24.3%(ISFH)



HJT 2.0

2022~2023

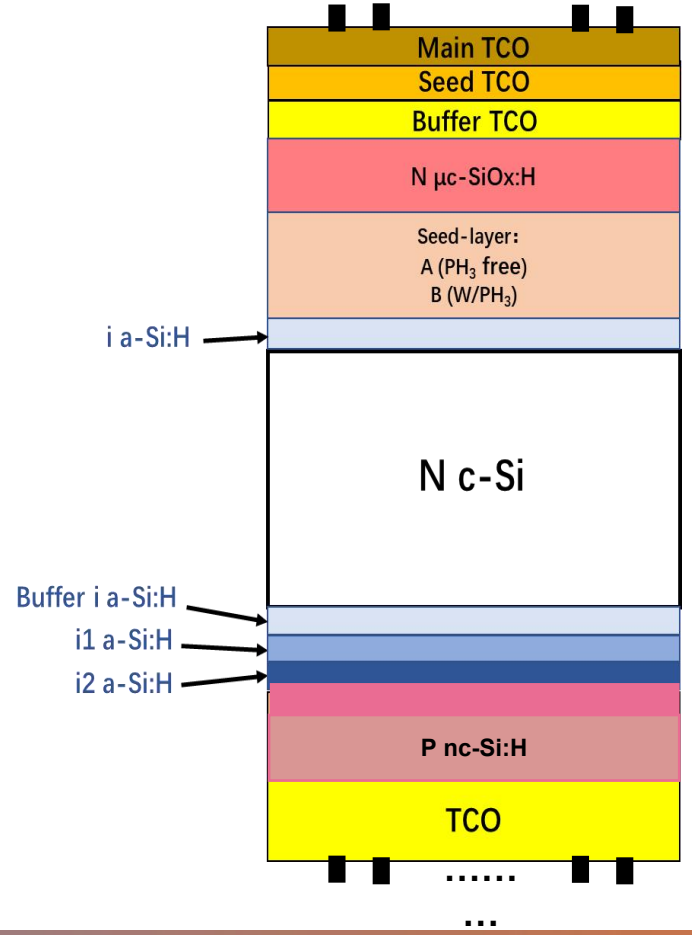
25%(ISFH)



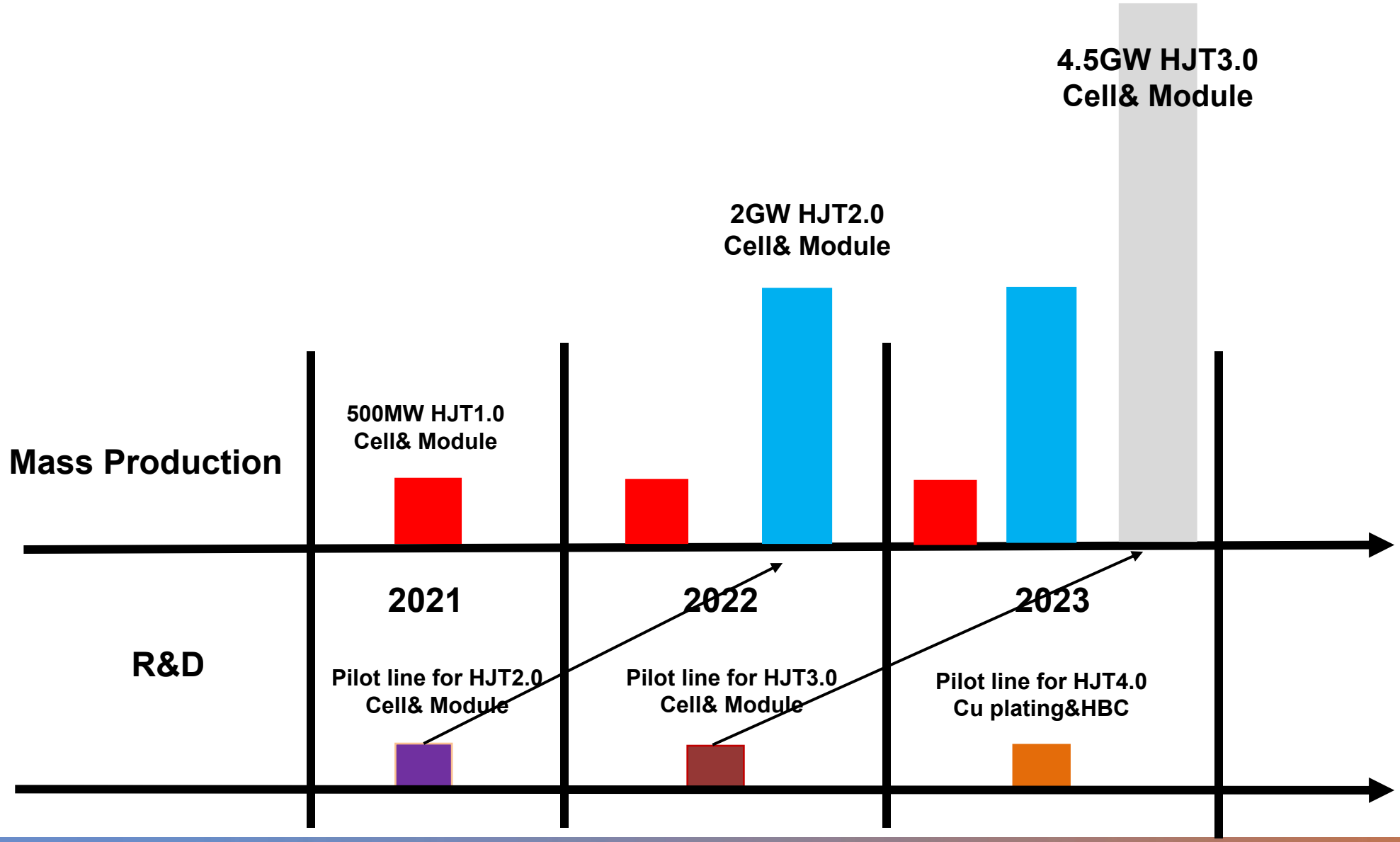
HJT 3.0

2024→

25.5%(ISFH)



The road map of HJT technology in Huasun

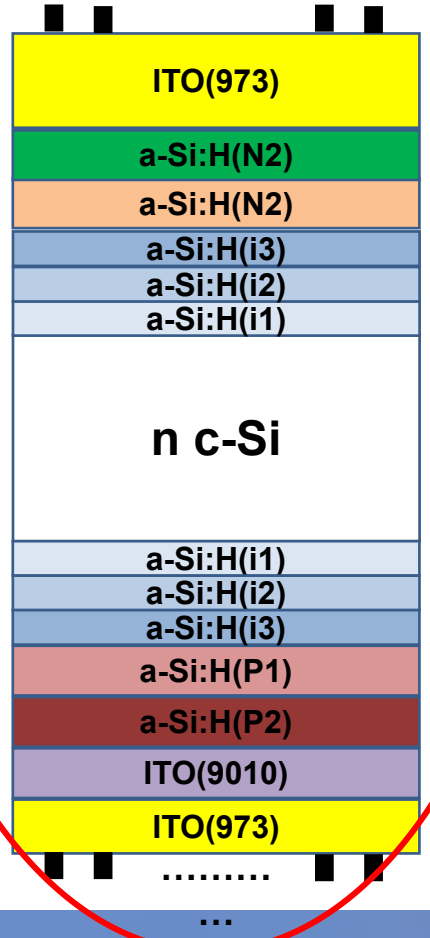


Progress of HJT Technology in Mass Production

HJT 1.0

→2021

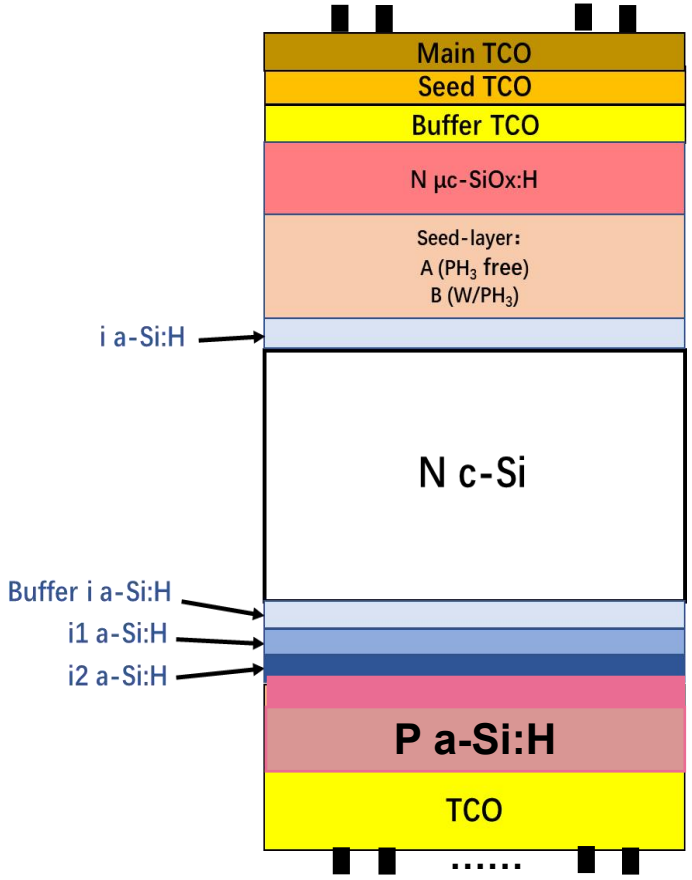
24.3%(ISFH)



HJT 2.0

2022~2023

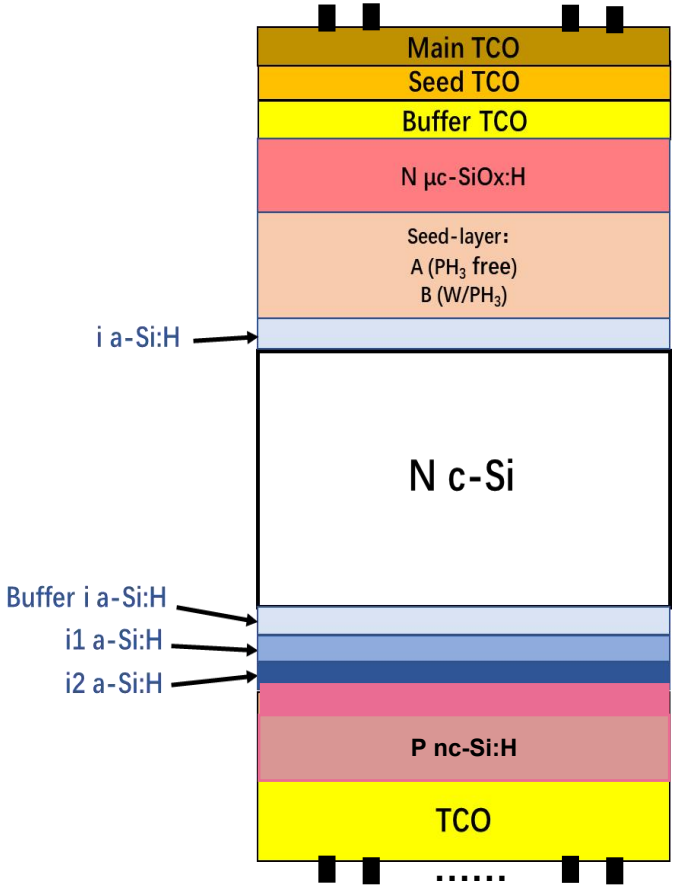
25%(ISFH)



HJT 3.0

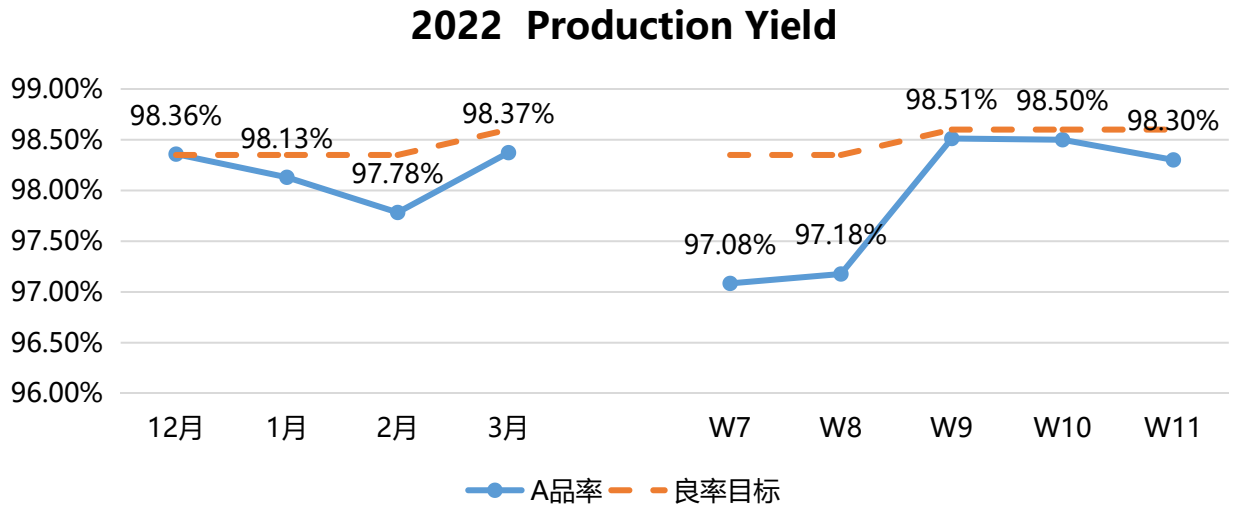
2024→

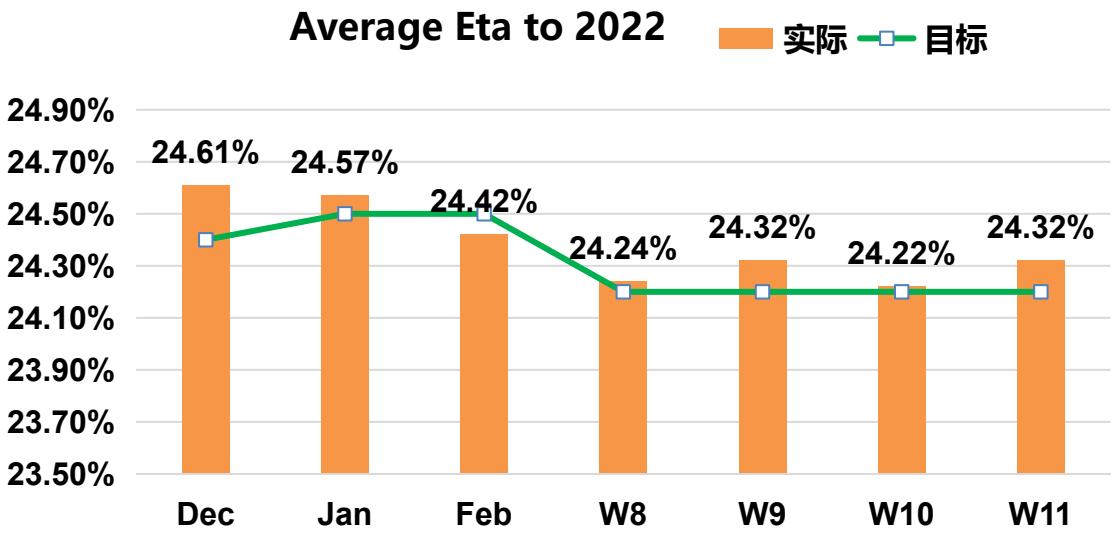
25.5%(ISFH)

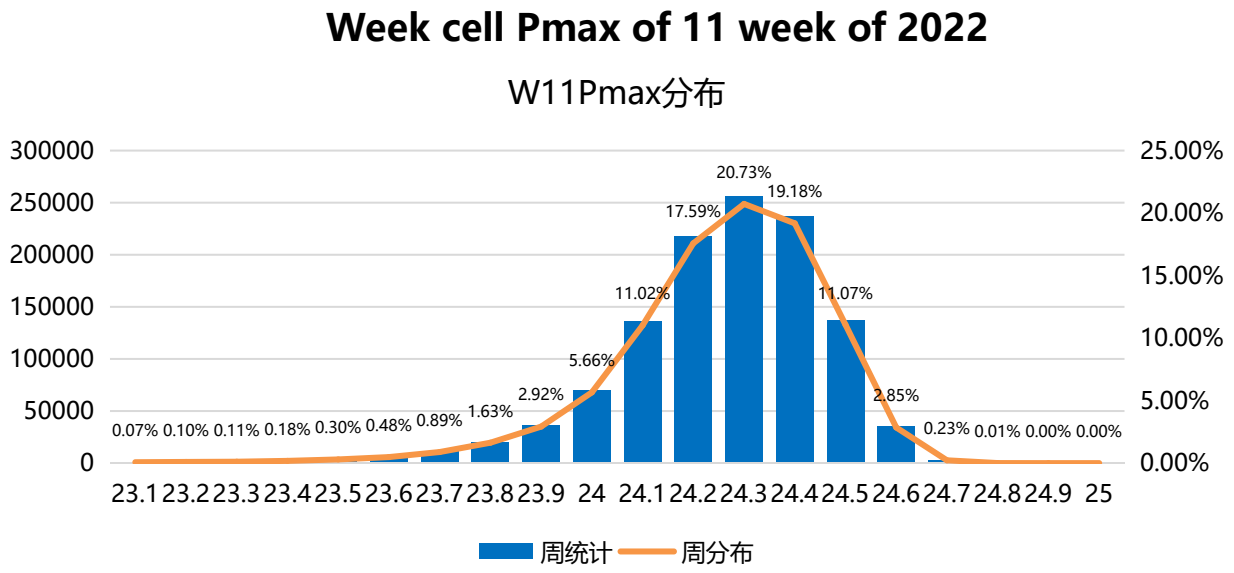


Mass production of HJT in Huasun

- Average efficiency: 24.3% for 12BB
- Yeld: ~98%





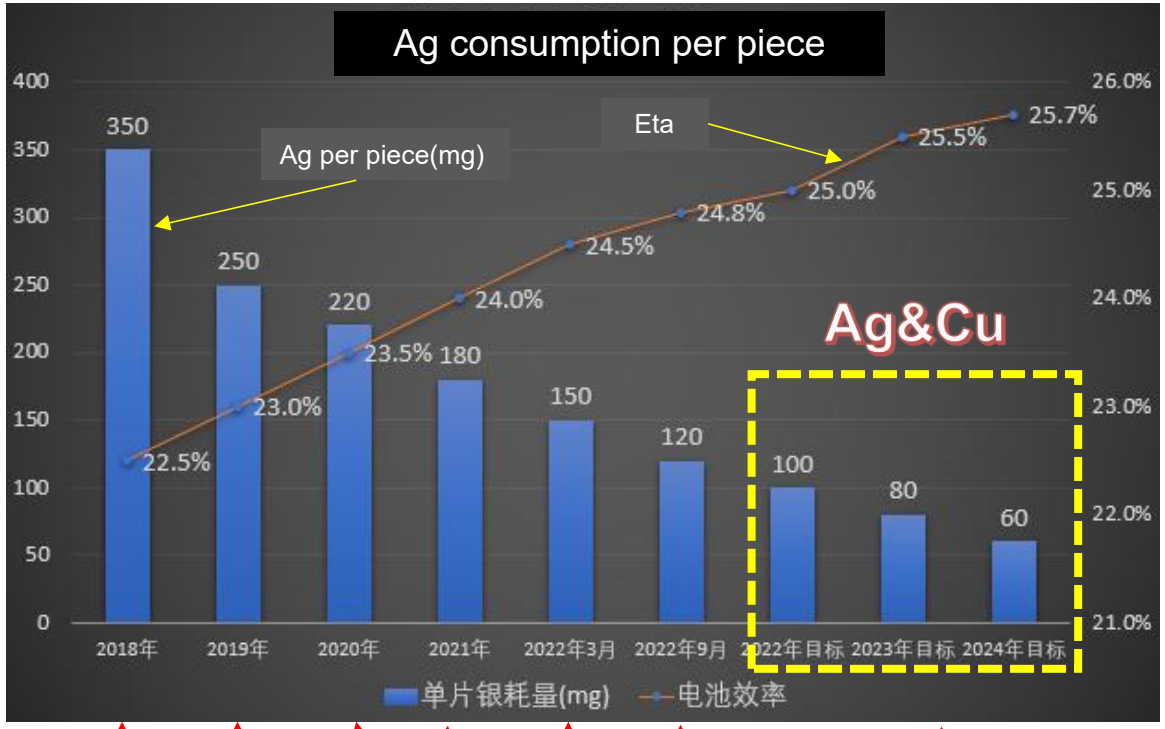


Efficiency and CTM in different Companies in China

No.	Company	Capacity (MW)	Cell Size	Eta(%)	Module type	Module Power (W)	CTM	Equivalent Eta(%) @CTM=100%	Record Eta (%)	Ag cost (mg/piece)	Ag cost (mg/W)
1	TW-ZW	100	M2-156	24.09%	60-half	345	99.40%	23.90%	25.45%	170	0.69
	TW-Hefei	180	G12-210half	24.04%	/	/	96.50%	23.20%	/	150	0.68
	TW-Jintang	1000	M60166	23.94%	72-half	475	100.30%	24.01%	/	185	0.67
2	Longji	/	M6-166	/	/	/	/	/	26.30%	/	/
3	GS	500	G-158	24.00%	60-half	358	99.50%	23.90%	25.20%	150	0.6
4	AK	220	G1-158	24.60%	72-half	435	97.50%	24.00%	/	180	0.71
5	Jinergy	200	M6-166	24.20%	72-half	466	97.50%	23.80%	24.70%	200	0.73
6	Huasun	500	M6-166	24.40%	72-half	472	98.00%	23.90%	25.26%	150	0.68
7	CSI	250	M10-182half	24.40%	/	/	97.00%	23.70%	/	150	/
8	JA	250	M10-182half	/	/	/	/	/	/	/	/

Source: Meng Fanying, CSPV17，2021，Suzhou, 2021.12.7-9

The road map of reducing the cost of electrode of HJT



M2@5BB

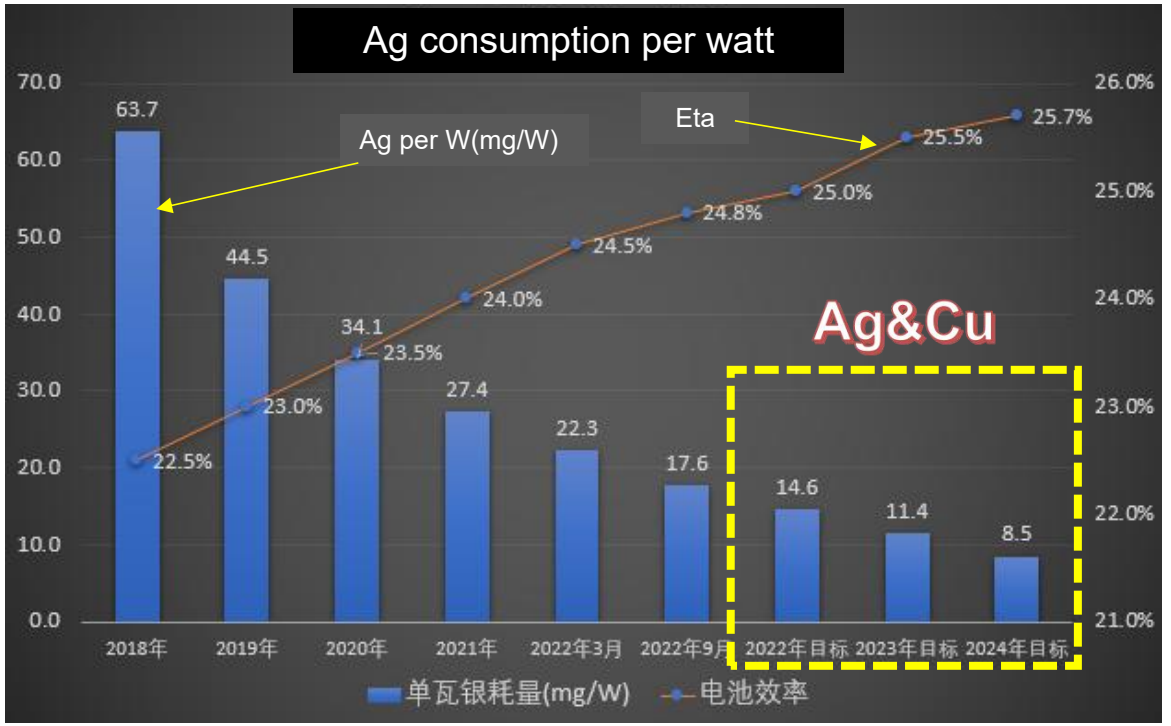
M2@9BB

M6@9BB

M6@12BB

SMBB+Metal Screen

Silver & Copper paste



M2@5BB

M2@9BB

M6@9BB

M6@12BB

SMBB+Metal Screen

Silver & Copper paste

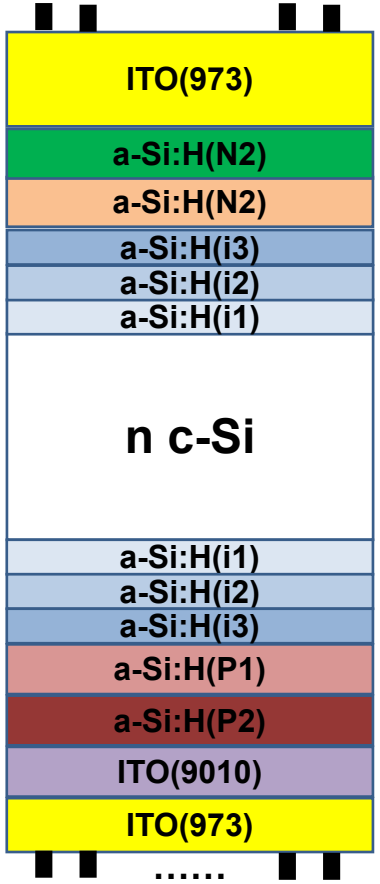
Progress of HJT Technology in Mass Production

HUASUN

HJT 1.0

→2021

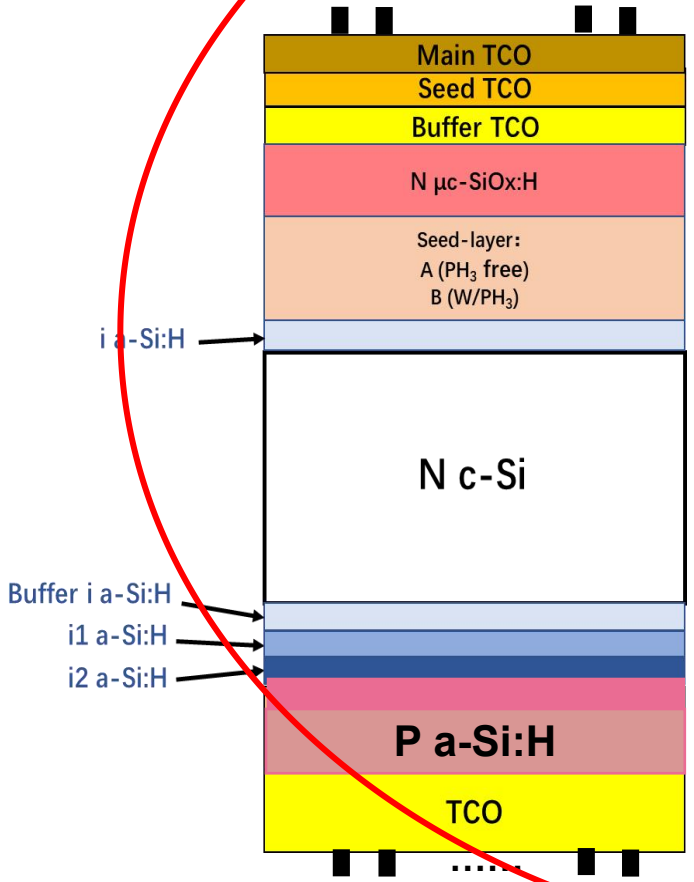
24.3%(ISFH)



HJT 2.0

2022~2023

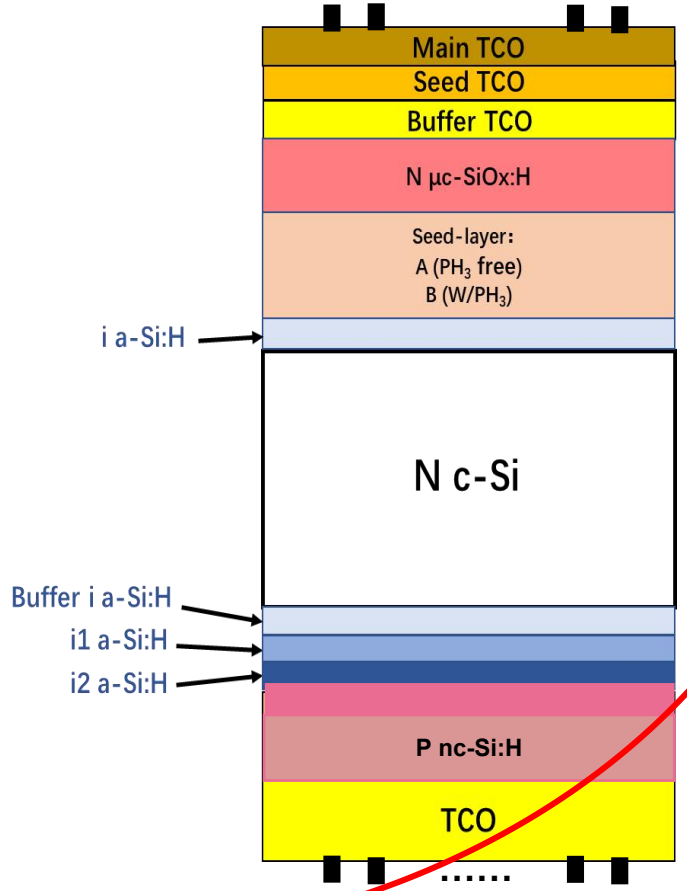
25%(ISFH)



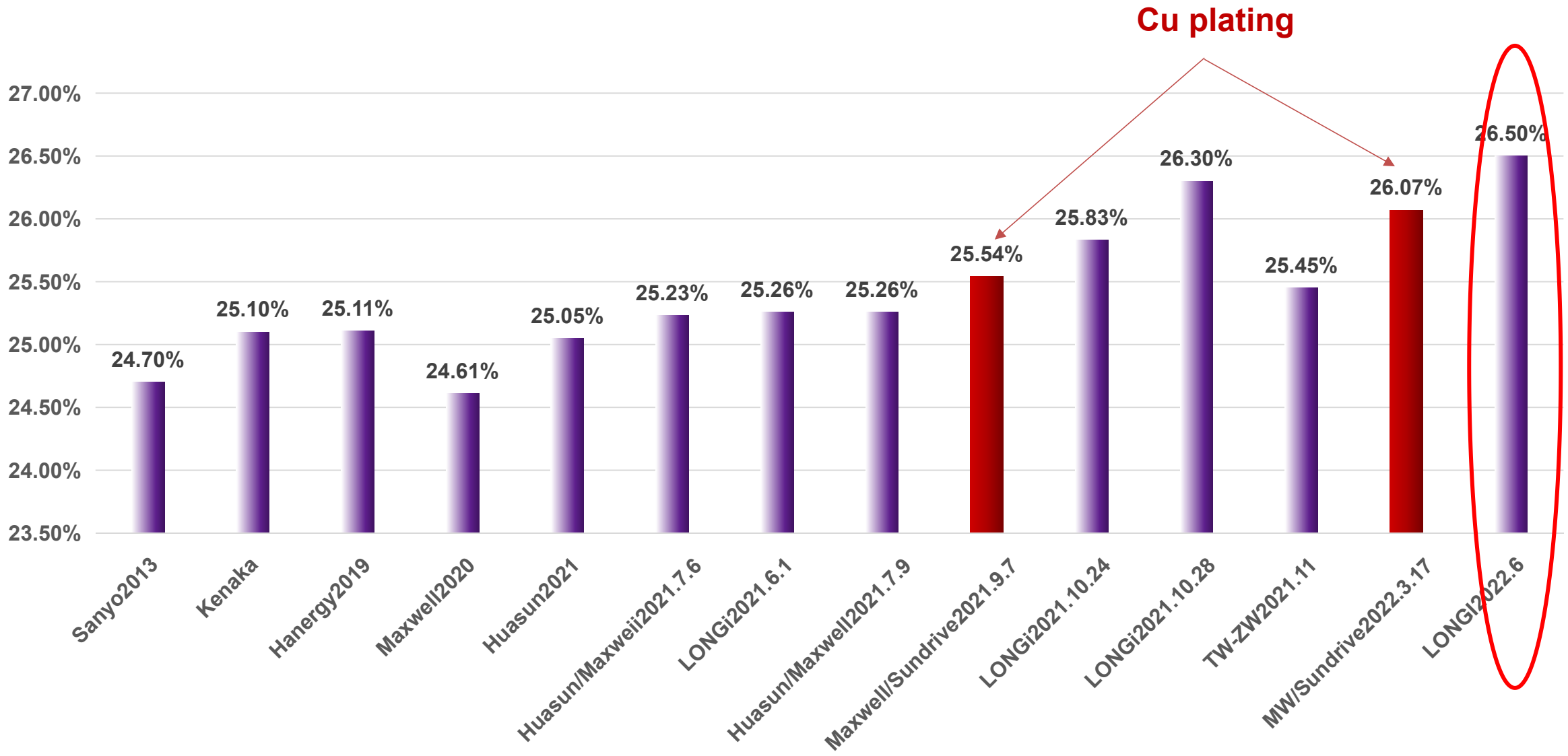
HJT 3.0

2024→

25.5%(ISFH)



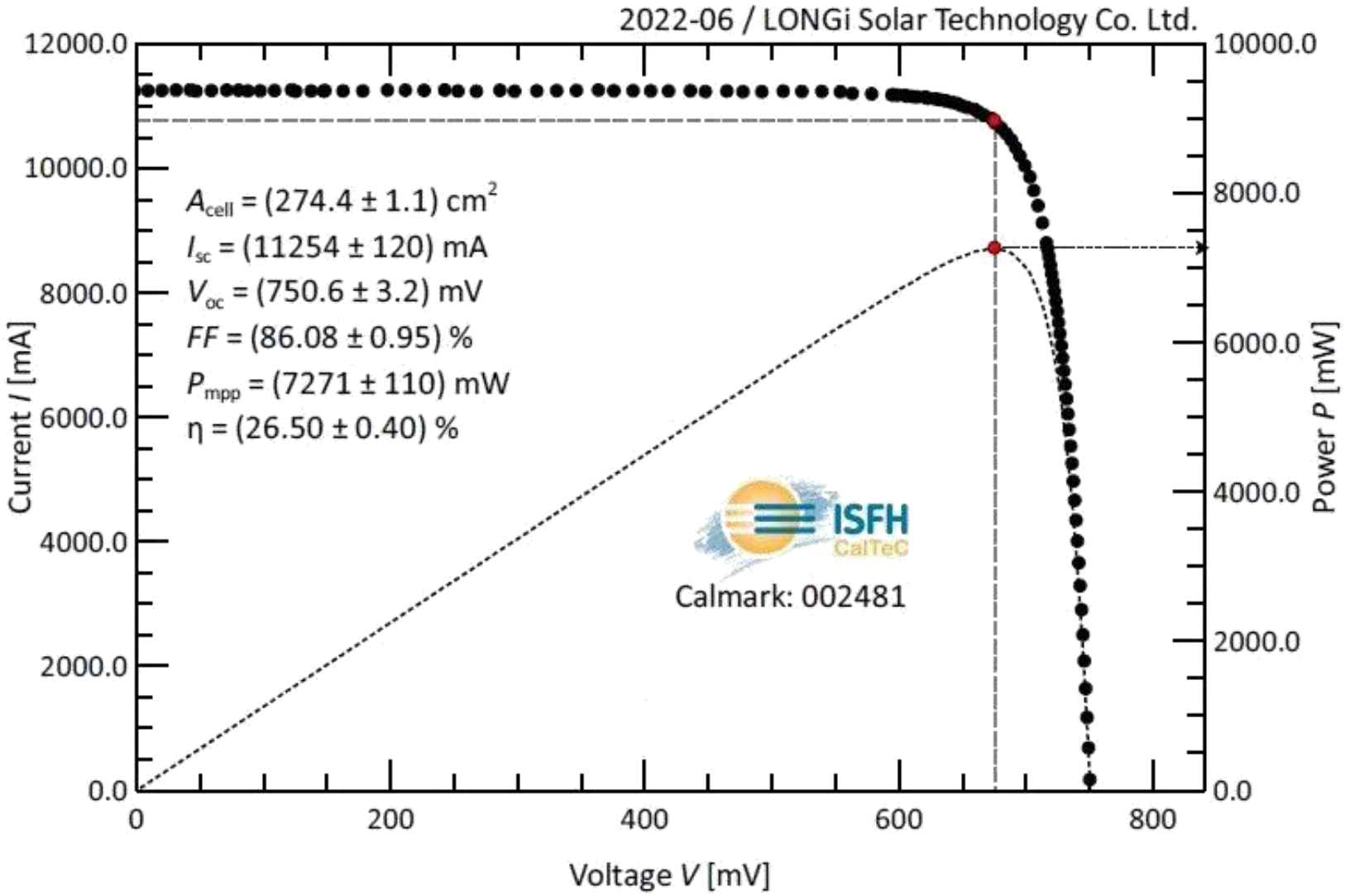
Efficiency record for HJT cell



New record of HJT solar cell

By Longi

2022.6



Data for best HJT cell

Unit	Eff(%)	Voc(mV)	Jsc (mA/cm²)	FF(%)	Bifacial(%)	Size(cm²)	Time
Longi	26.5*	750.6	41.01	86.08	——	274.4	2022.6
Maxwell/Sun Drive	26.07*	746.7*	40.71	85.74	——	274.3	2022.3.17
Longi	26.3*	750.2	40.49	86.59	——	274.3	2021.10.28
Longi	25.82*	750.4	40.20	85.57	——	274.5	2021.10.24
Maxwell/Sun Drive	25.54*	746.0	40.23	85.08	——	274.5	2021.9.7
Huasun/Maxwell	25.26*	746.2	40.00	84.64		274.50	2021.7.9
Longi	25.26*	748.5	39.48	85.46	——	244.55	2021.6.1
Huasun/Maxwell	25.23*	745.6	39.80	85.03	——	274.3	2021.7.2
Hanergy	25.11*	747.0	39.55	84.98	——	244.45/Cz	2019.12
Huasun/Maxwell	25.05*	745.5	39.61	84.82	——	274.3/Cz	2021.5
Maxwell	24.61*	746.0	39.12	84.33	——	244.39/Cz	2021
Zhongwei	24.05*	744.6	38.60	83.67		244.43	2020
Kaneka	25.10	738.0	40.8	83.5	——	151.9/Cz	2019

* ISFH

Pilot Line of HJT2.0 in Huasun

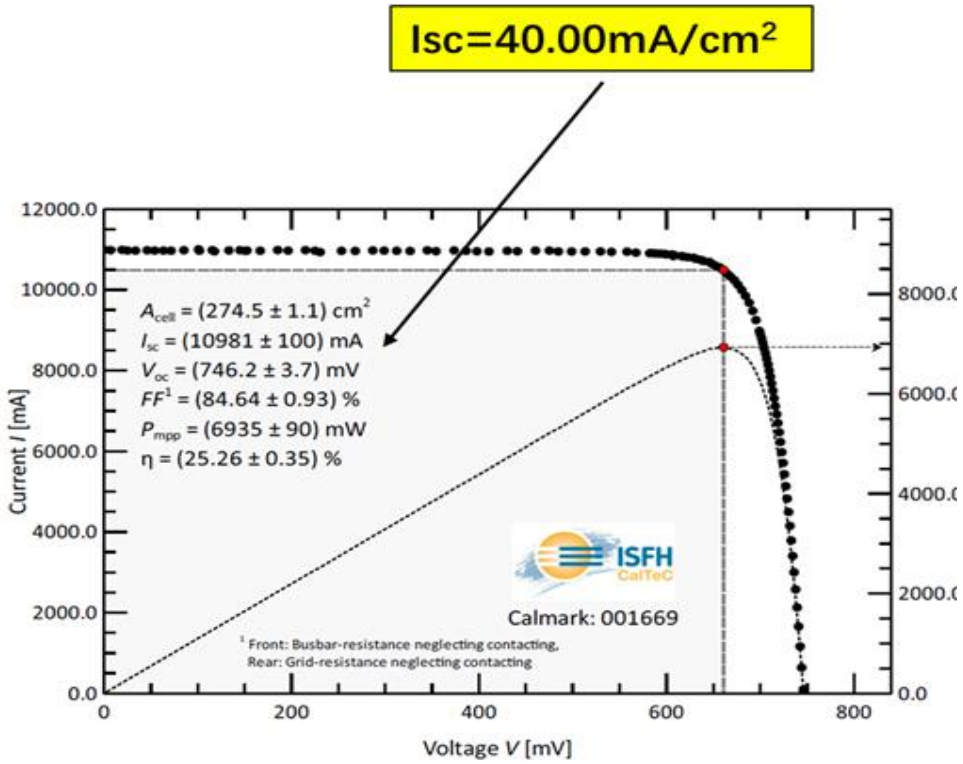
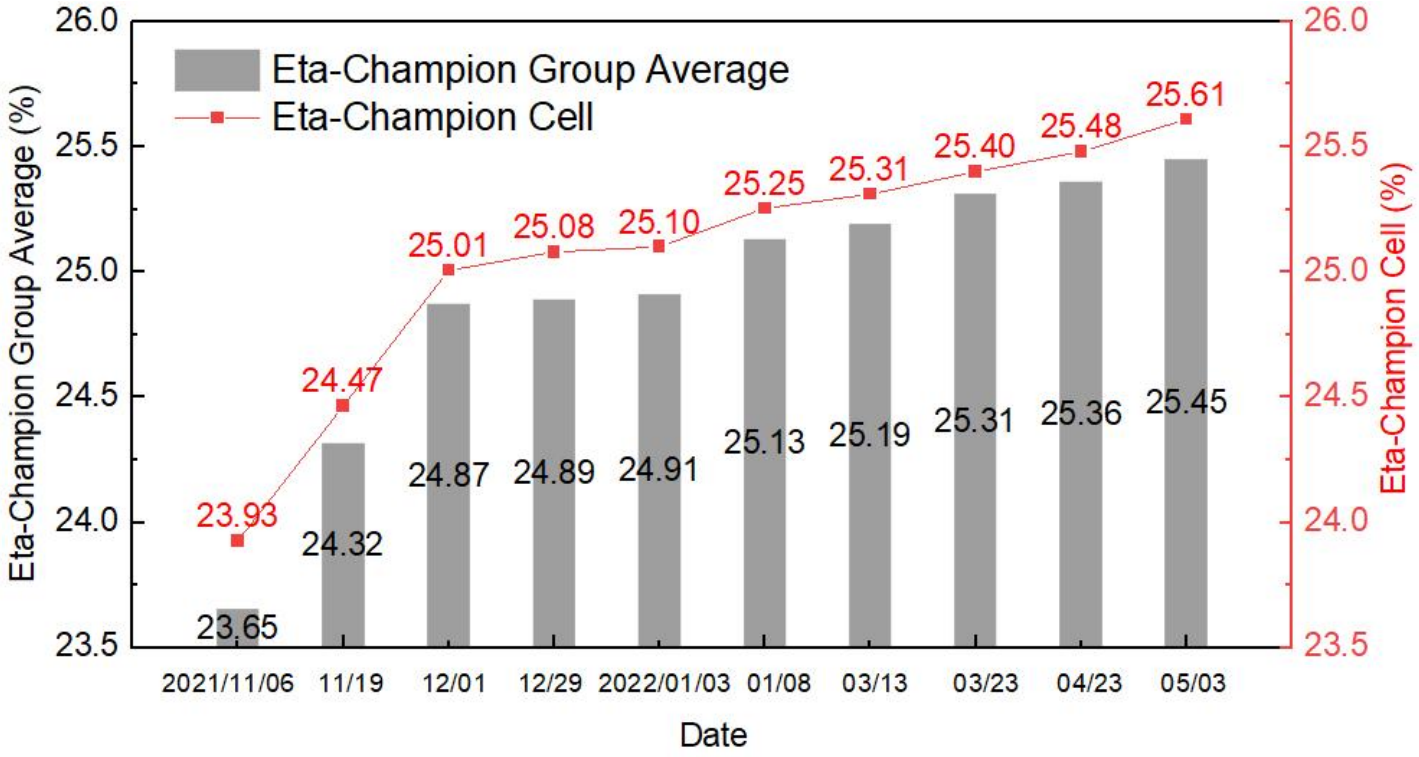


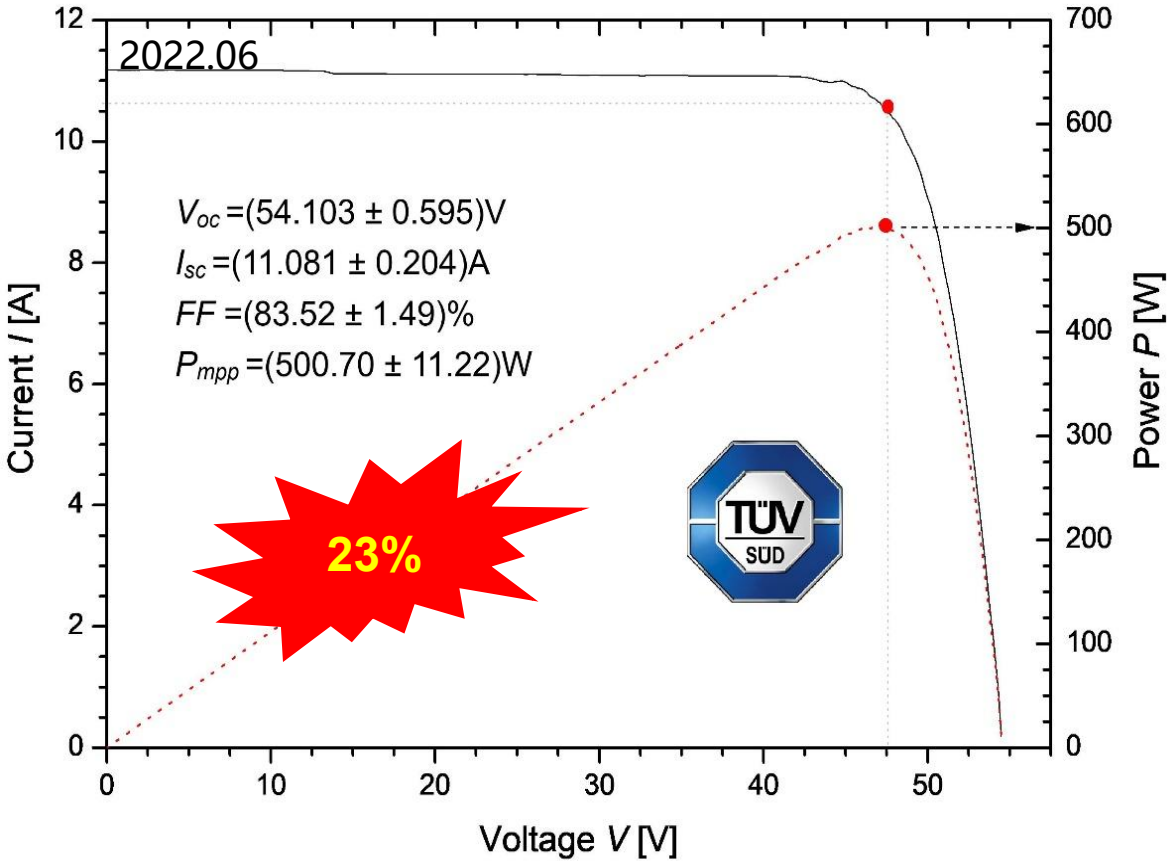
Fig. 2: Plot of the measured current-voltage characteristics under standard test conditions.

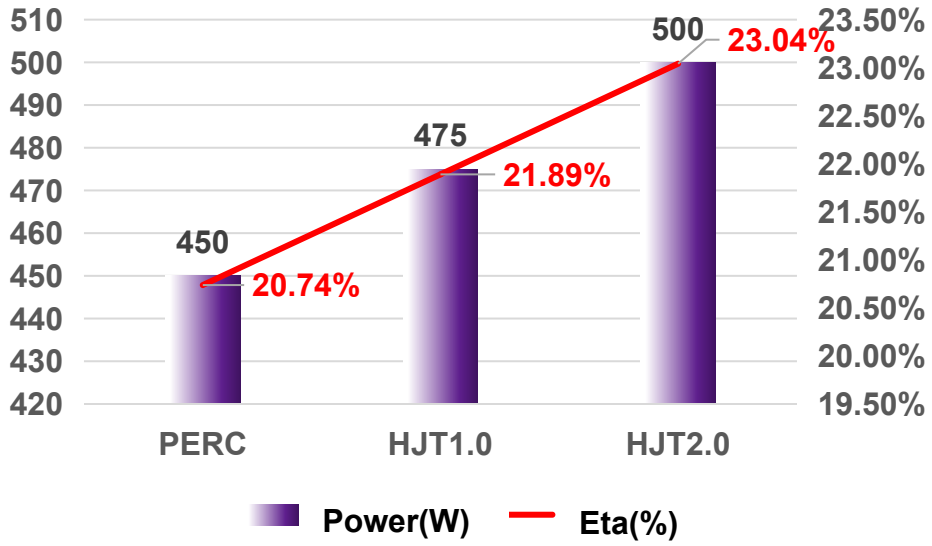
2021.7.9



The average efficiency of best batch is 25.45%，that of the best cell arrived to 25.61%.

The module for HJT2.0 in pilot line

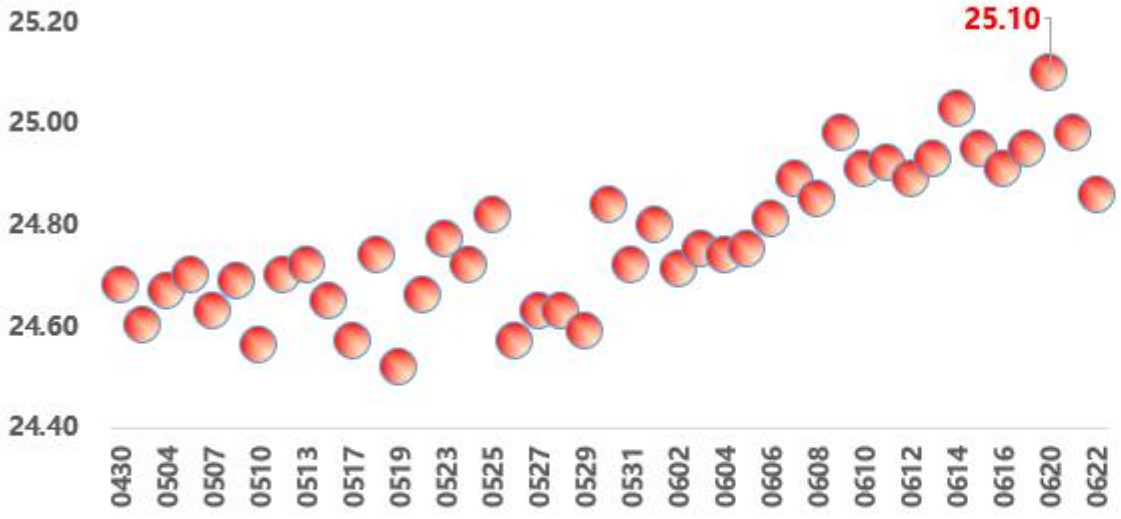




Mass production for HJT2.0-very beginning data

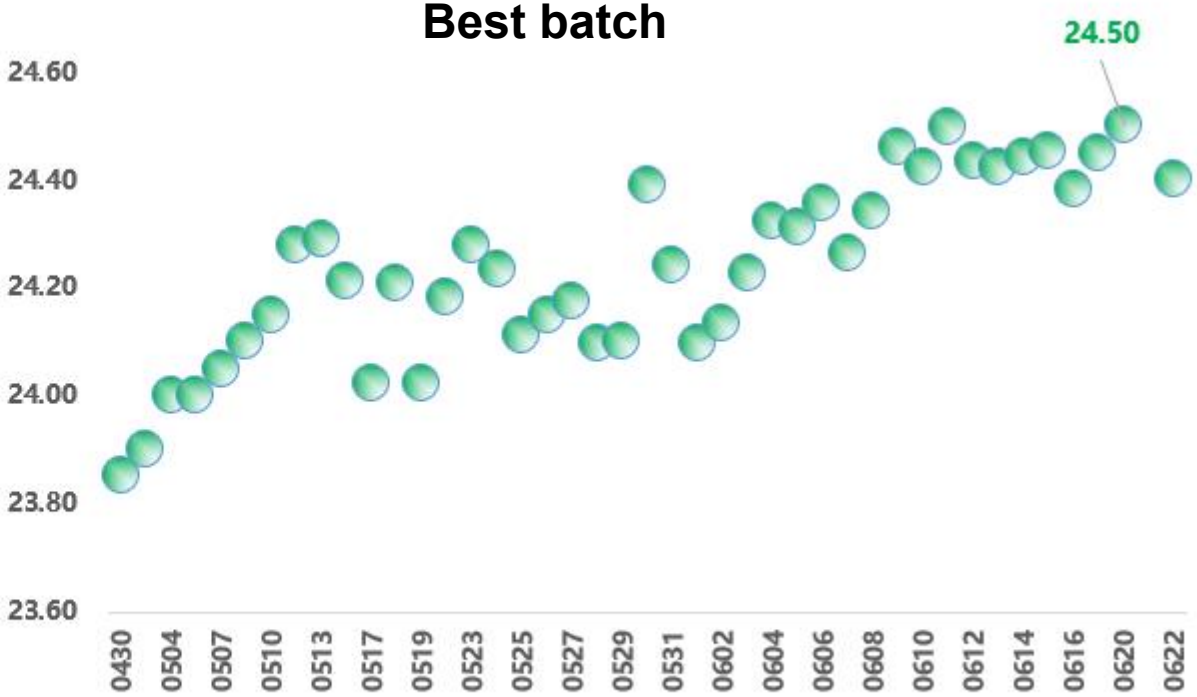
2GW mass production line for HJT2.0

Best cell



Eta	Uoc	FF	Isc
25.10	0.746	85.10	8.71

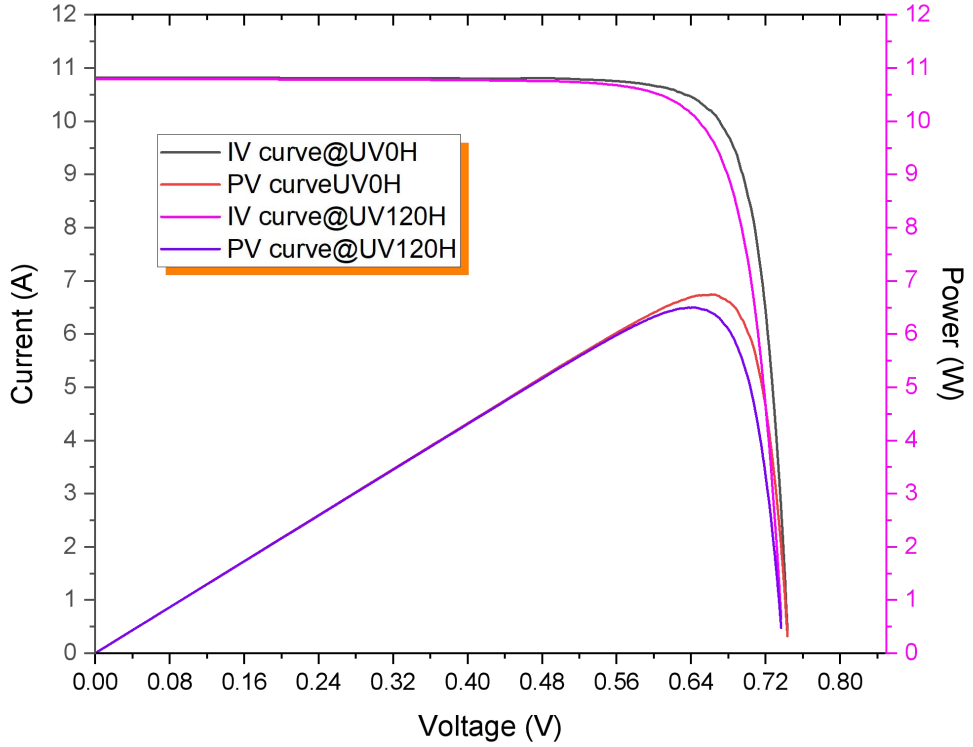
Best batch



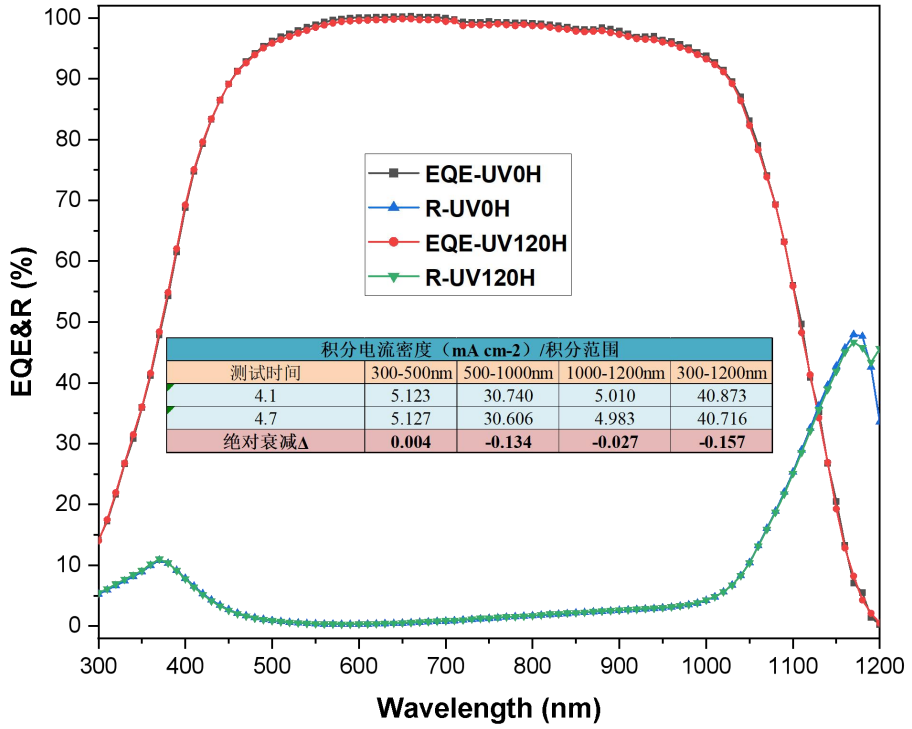
A challenge of HJT solar cell

—— UVID

The character of UVID for HJT



IV

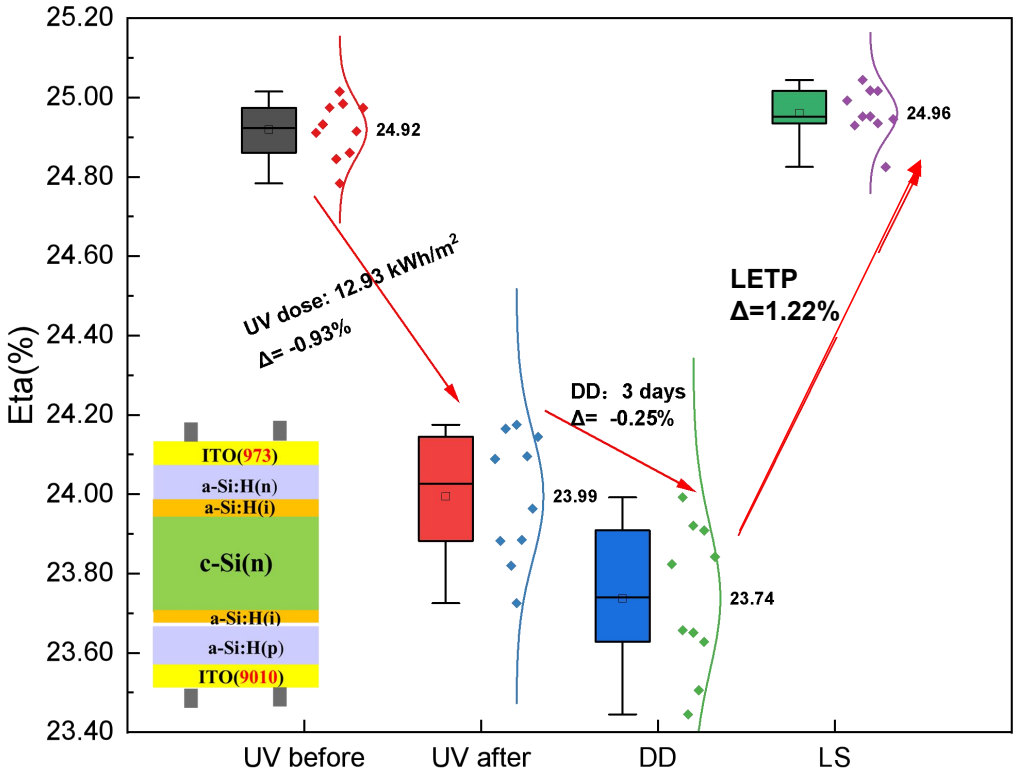


积分电流密度（mA cm-2）/积分范围				
测试时间	300-500nm	500-1000nm	1000-1200nm	300-1200nm
4.1	5.123	30.740	5.010	40.873
4.7	5.127	30.606	4.983	40.716
绝对衰减Δ	**0.004**	**-0.134**	**-0.027**	**-0.157**

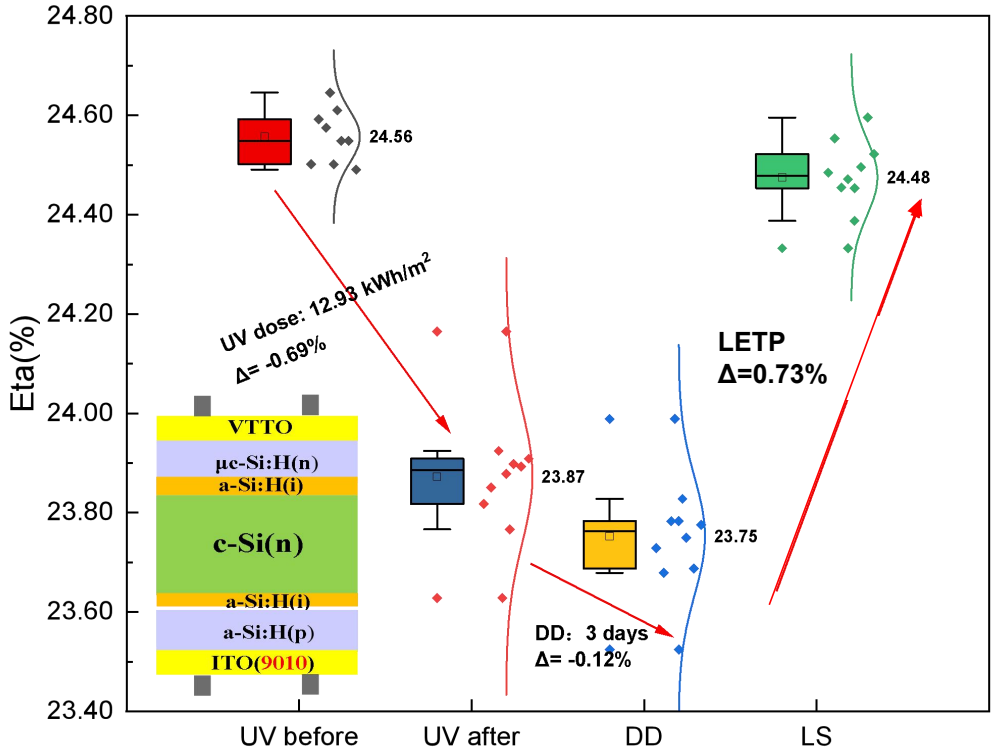
QE

- **UV exposion 120h，Eta decreased about 2.9%.**
- **FF and Voc decreased, But Isc not decreased so much. QE almost same.**

UV Induced degradation and recover



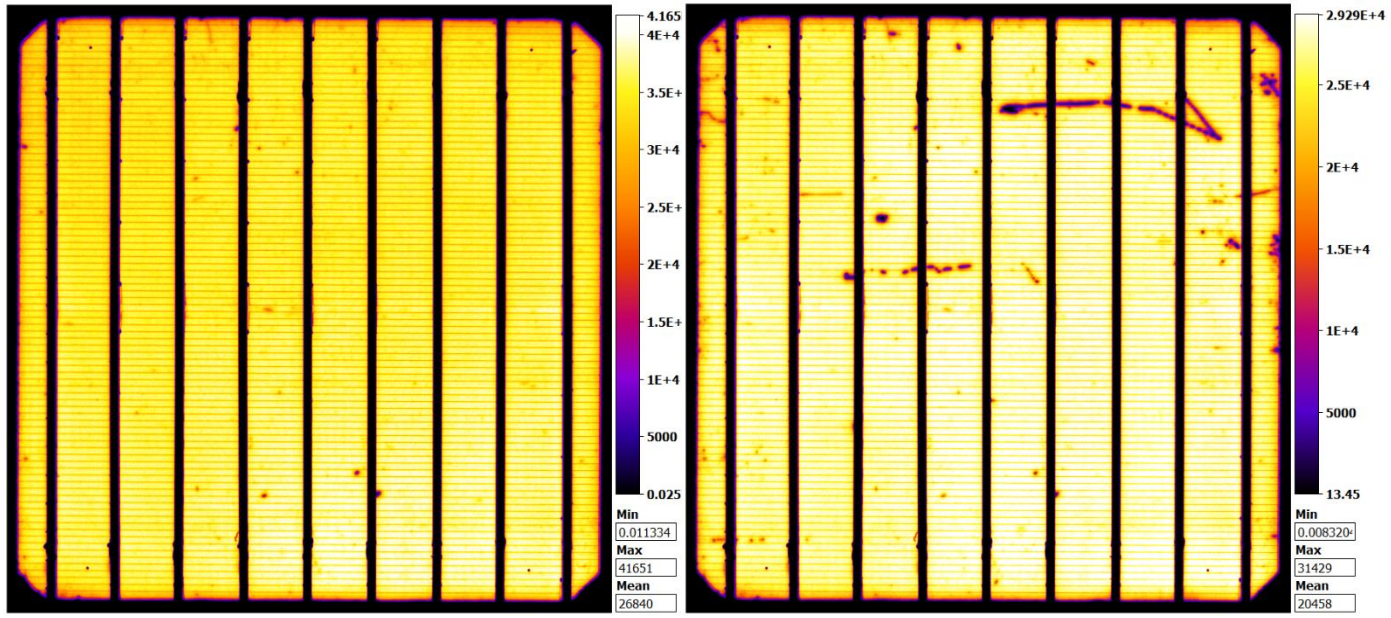
HJT 1.0 (a-Si:H)



HJT 2.0 (μc-SiOx)

- UV cause efficiency decrease（UVID）.
- The LETP UVID

UV Induced degradation and recover

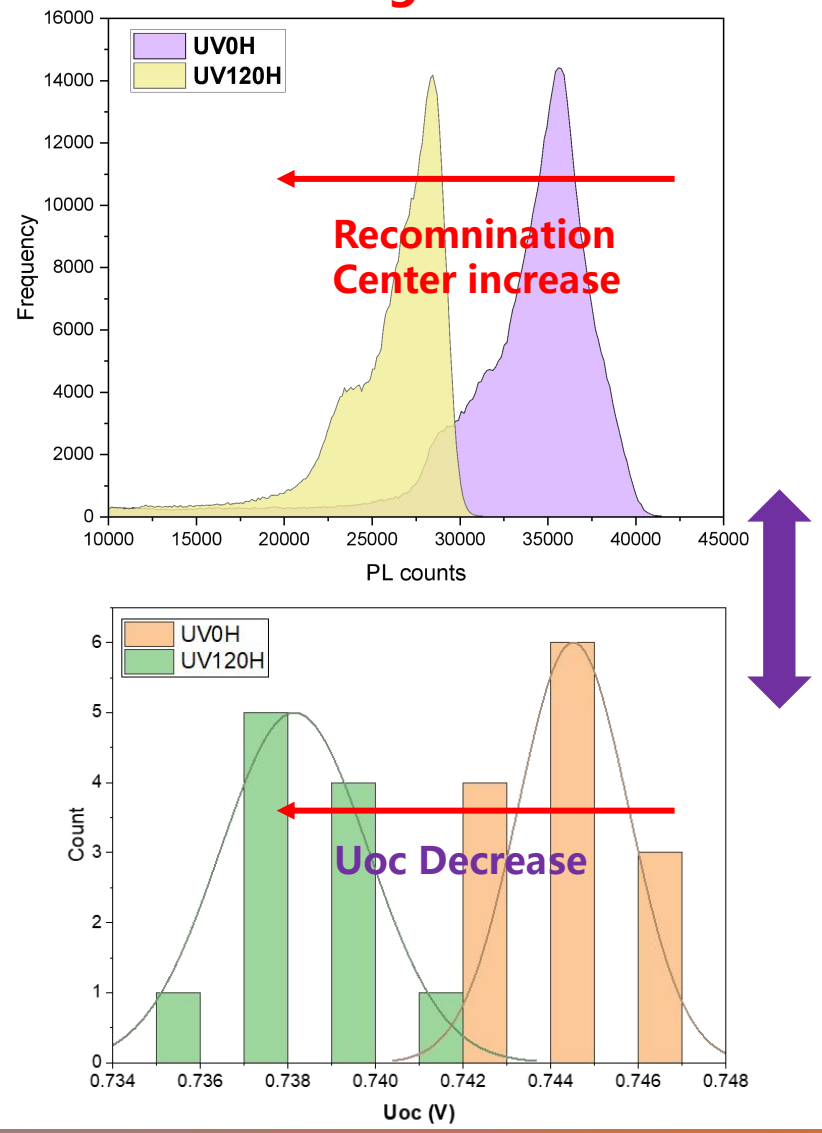


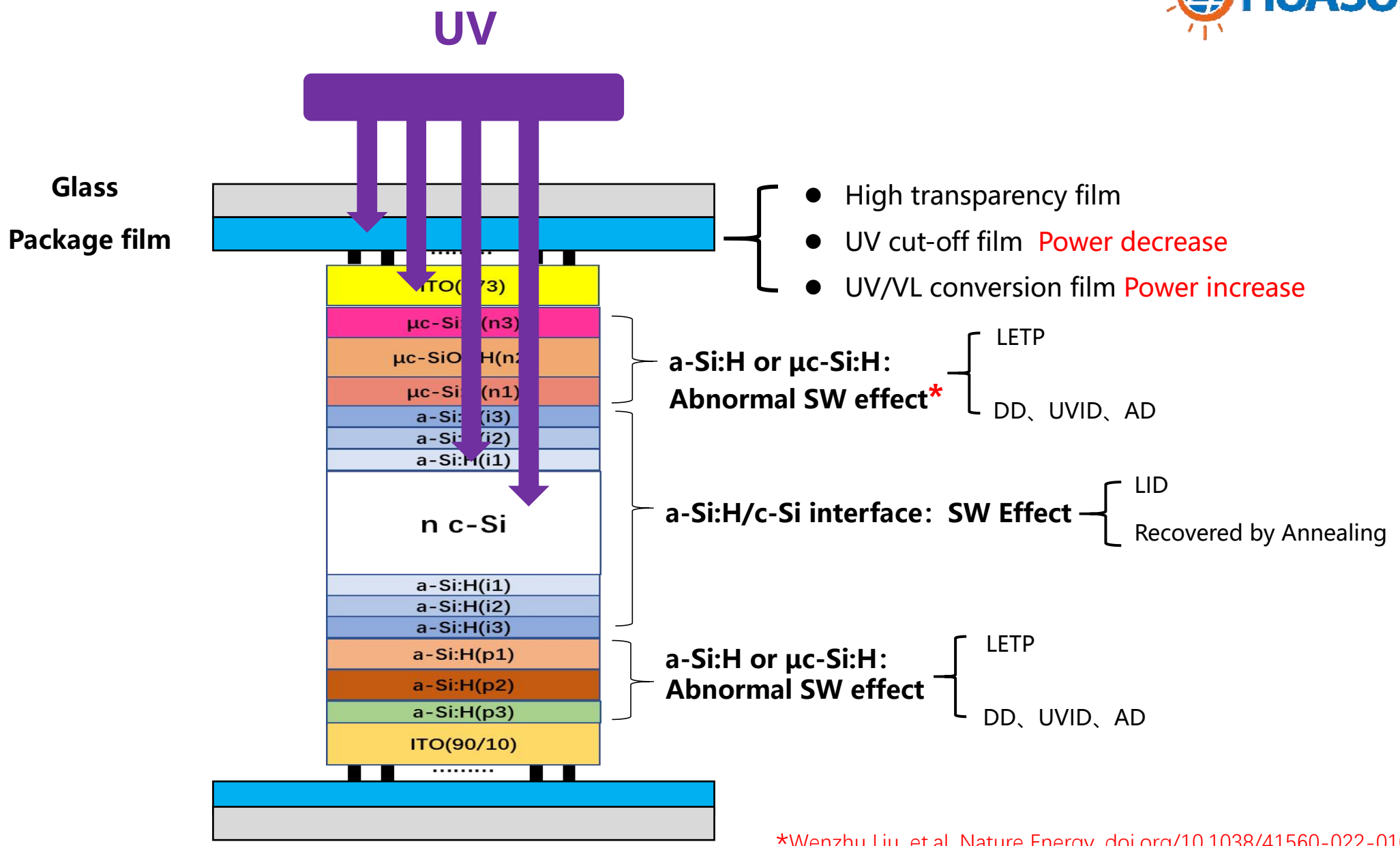
UV0H **UV120H**

Open circuit PL image

- After UV120H，PL become dark. There are more black dote. This mean there more recombination center.
- Uoc decrease.

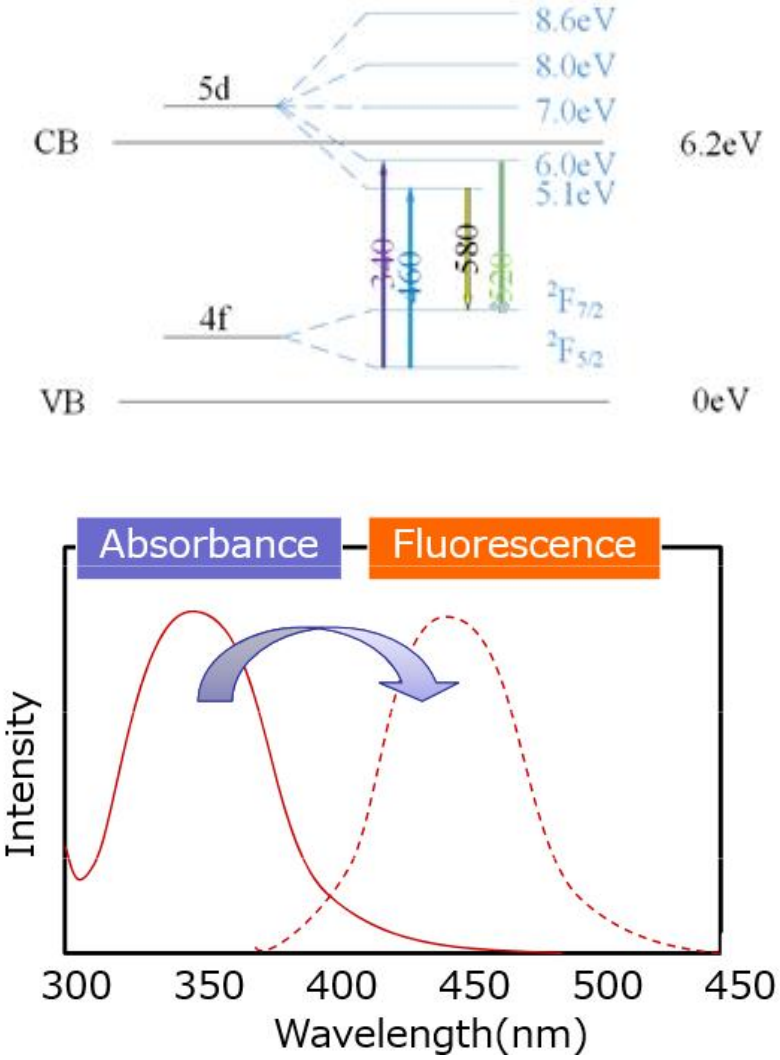
Uoc Degradation



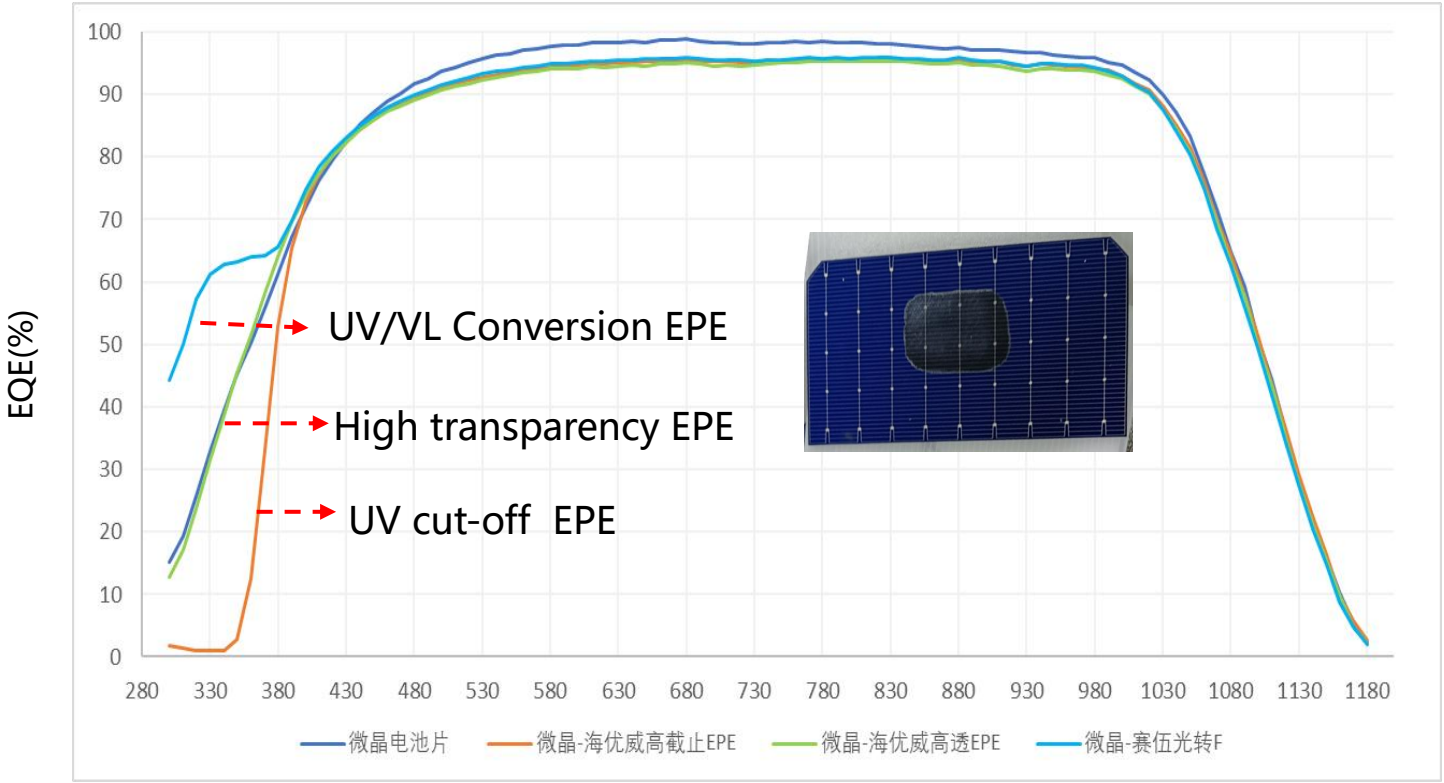


*Wenzhu Liu, et.al. Nature Energy, doi.org/10.1038/41560-022-01018-5

Solution of UVID

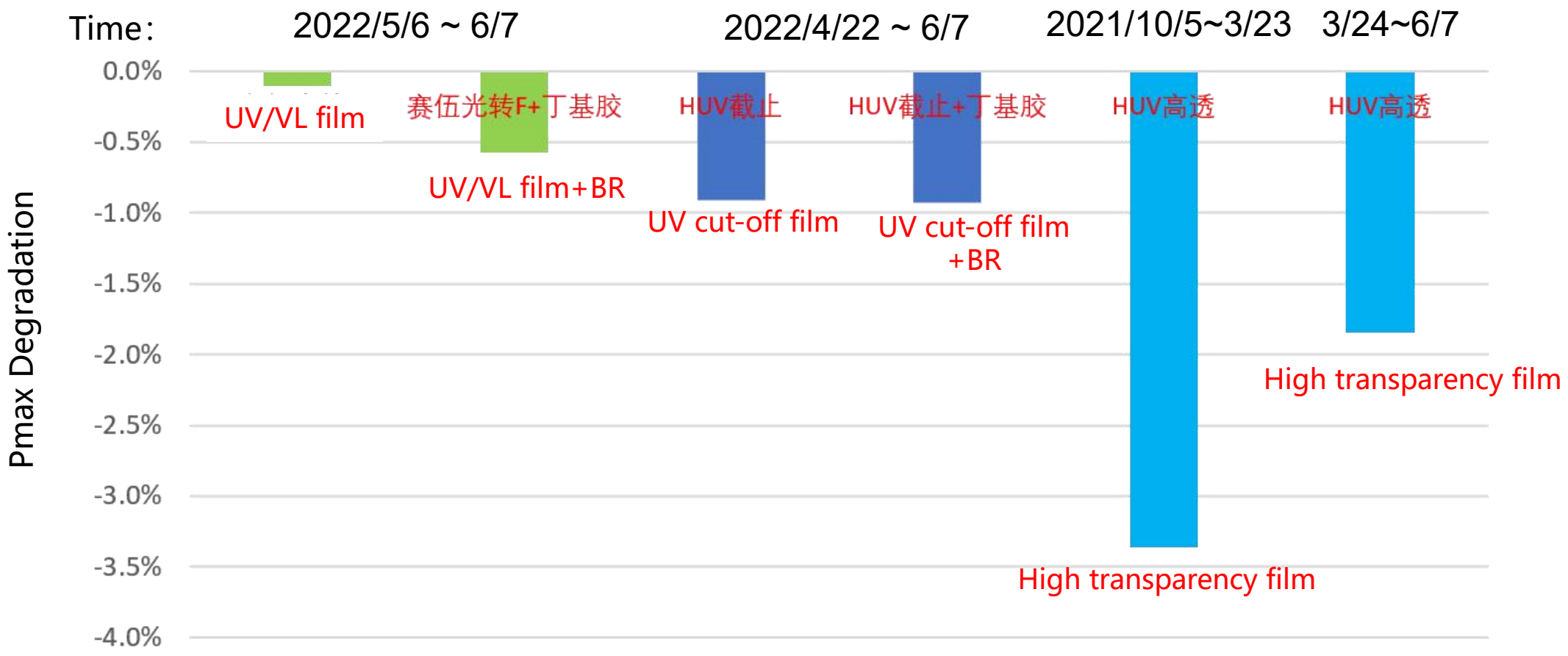


UV to Visible Light Conversion Encapsulation（UV/VL Film）



Condition：Wavelength：300-1100nm；Frequency：1000HZ；Step length：10nm

Outdoor UV experiment for different package film



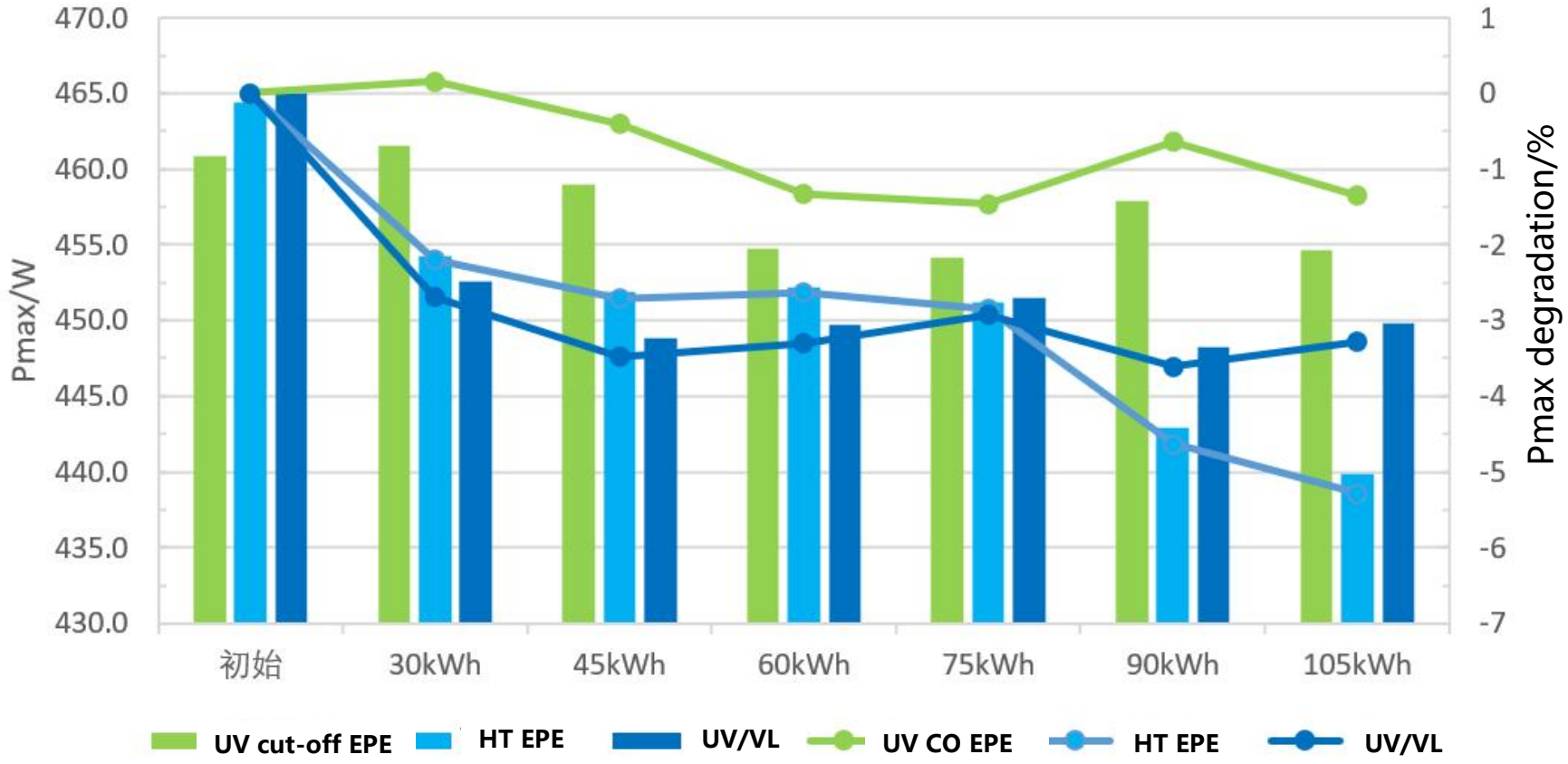
BR—Butyl Rubber

Indoor UV experiment for different package film

- UV cut-off film is quite stable.
- UV/VL Film decrease at beginning, and stable later.
- High transparent film keep decreasing.

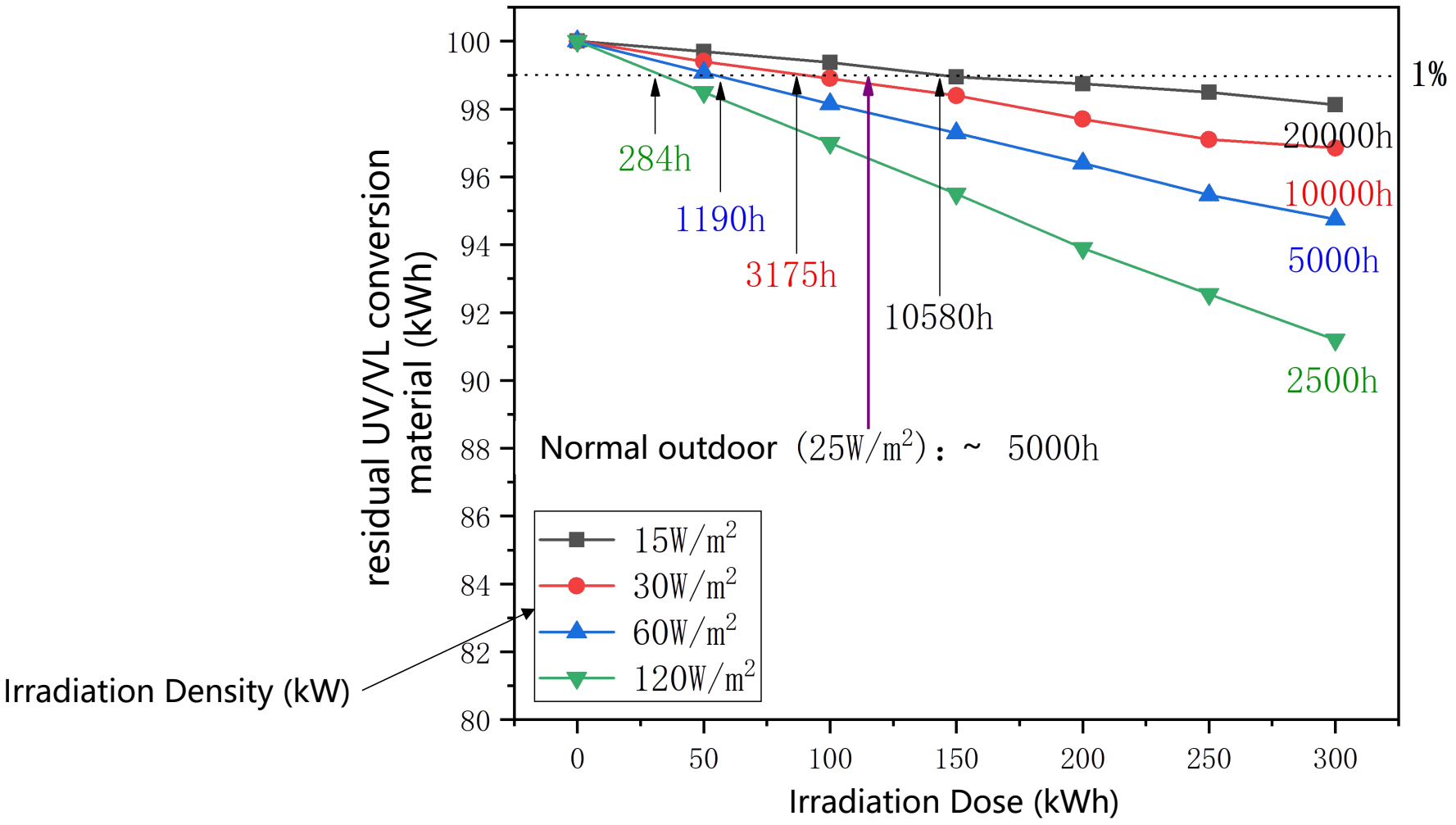
Density of UV light:

180W/m²



UVID for different package film

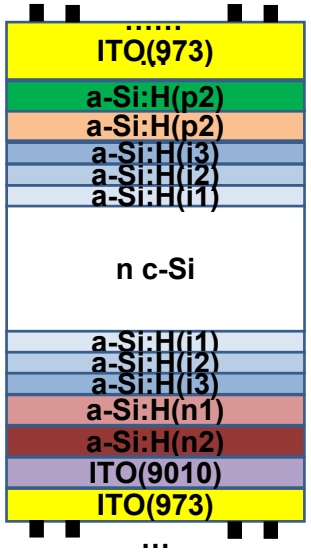
Degradation of UV/VL conversion film for different UV intensity



From SYBRID Technical Report

Summary

a-Si:H HJT



Up to 2021

Average eff. 24.3%

Yield: 98%

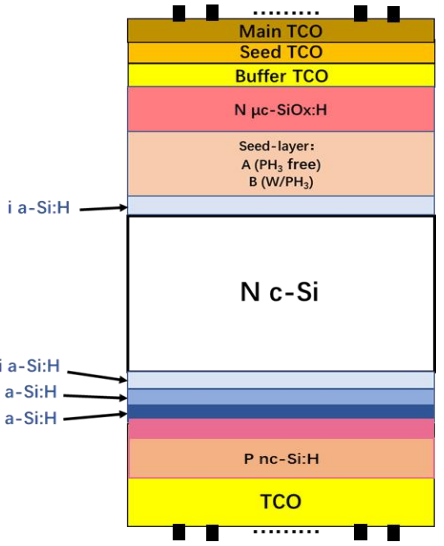
Eff.	24.3%
CTM	99%
Power(M6@72)	475W
Ag paste	23mg/W
CTM=100% Equivalent Eff.	24%

Average 25.3%

Best 25.26%

Eff.	25.3%
CTM	98.14%
Power(M6@72)	490W
Ag paste	——
CTM=100% Equivalent Eff.	24.83%

µc-Si(O):H HJT



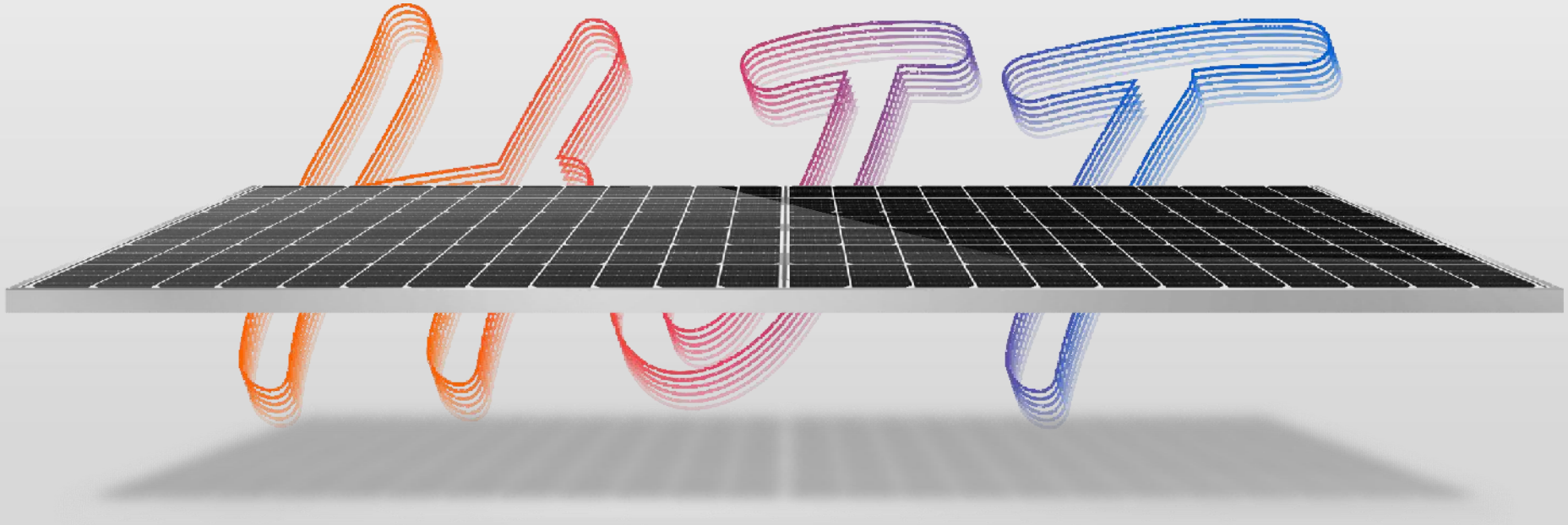
From 2022

Acknowledge:

Thank You

Build a ZERO Carbon World

HJT Portfolio and Supply in Europe



Anhui Huasun Energy Co., Ltd

CONTENT

About Huasun

Headquarters
Xuancheng•Anhui

Sales Center
Nanjing•Jiangsu

Founded in
2020.07

Intelligent factories
176,000㎡

Headcounts
1,500

Core Tech/Product
HJT Solar Cell/Module
HJT Specialized Wafer

Front runner in New Photovoltaic Era
Pioneer of HJT mass production

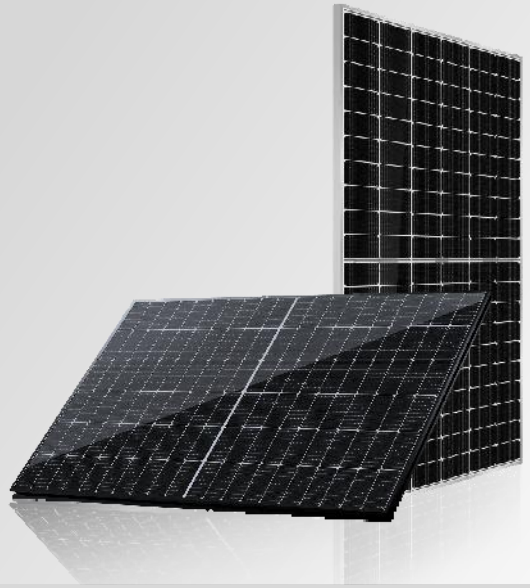
Specializing in the development and application of ultra-high-efficient N-type silicon based heterojunction (HJT) solar cells and module technology，with leading industrial R&D and innovation ability, Huasun strives to provide customers with PV products in higher performance and better quality.

2022 Q2
HJT Solar Cell Capacity

2.7GW

2022 Q2
HJT Solar Module Capacity

2.7GW



Huasun Team

Huasun actively responds to climate change solutions, gathers the most experienced talents in HJT field , and forms a super R&D team led by authorities in the industry, to explore effective approaches to improve solar cell efficiency, and challenge the low-cost but productive mass production of HJT cells and modules.

15Y+
Team members' average experience in solar tech development and management in leading companies

100+
Talents in HJT field

1 Chief Scientist
Of National High-tech R&D program as well as National Key Basic research Project

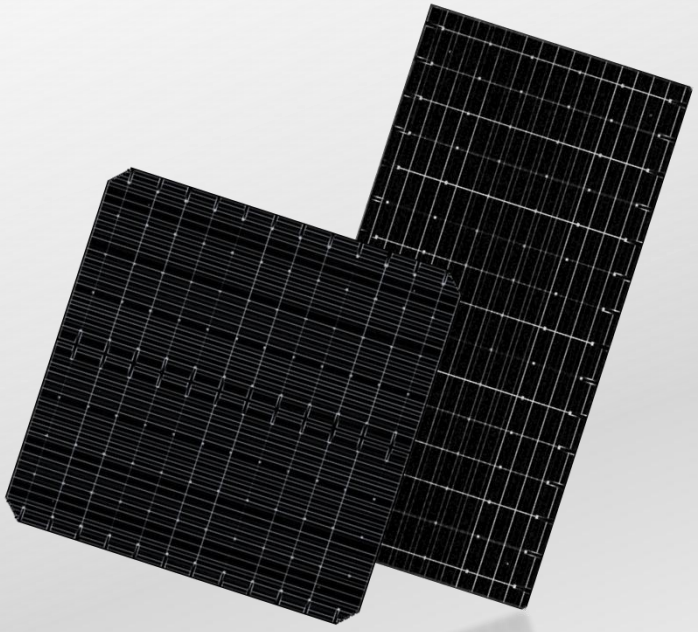
2 Leading Talents in HJT Field

4 Ph.D

33 Masters

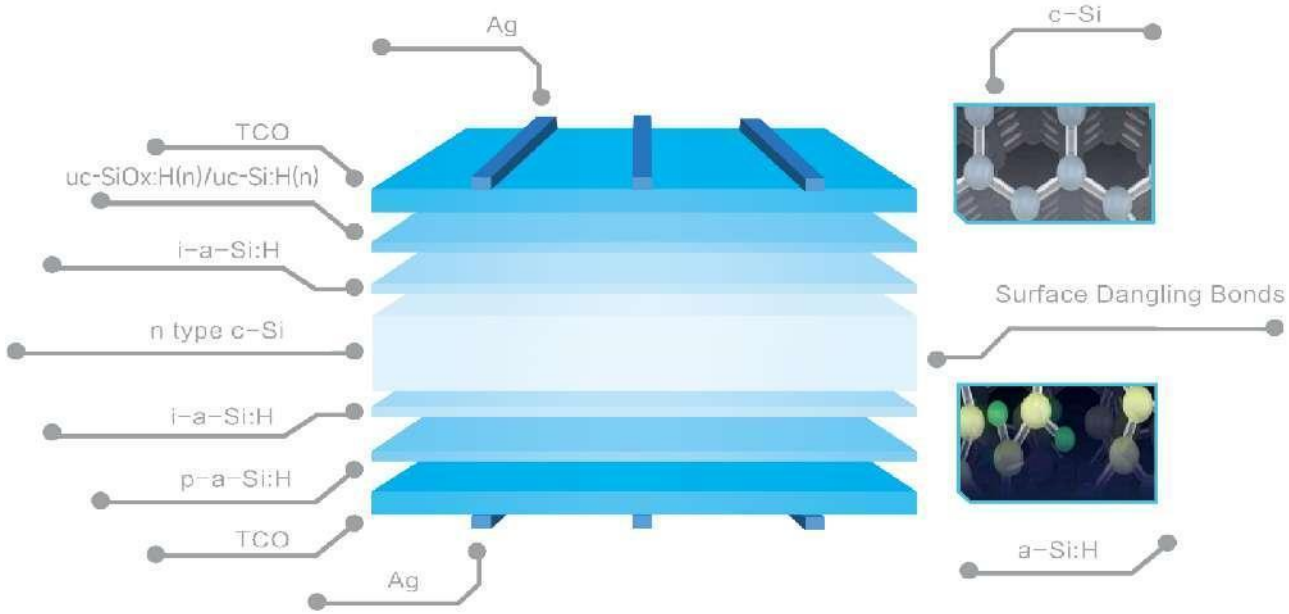
New Generation
Mainstream platform Cell Tech

HJT



HJT cells combine the advantages of crystalline silicon and thin film technologies, with excellent light absorption and passivation effects, and are superior to PERC in efficiency and performance. It is one of the solar cell technologies that increase conversion efficiency and power output to the highest level and also represents the development direction of the new generation of cell platform technology.

The natural bifacial symmetrical structure of HJT cells can effectively improve the power generation capacity on module’ s backside. The extremely low temperature coefficient enables modules to maintain stable power generation performance in high temperature environments. Excellent low-light performance increases modules’ power generation period and further improves power output.



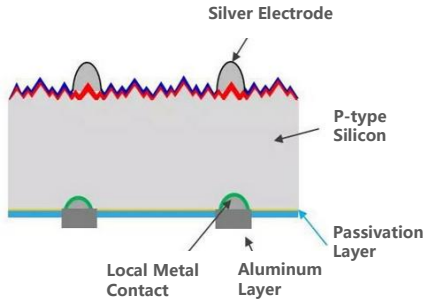
Massive Production effi. Advantage

PERC

A mature cell technology, has already reached its efficiency limit of 24.5%

Efficiency Range

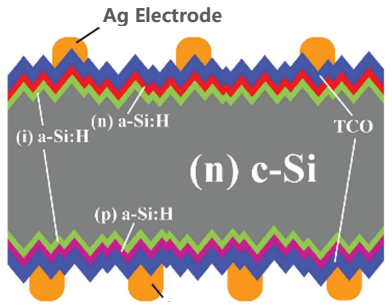
22.5~23.5%



Close to its efficiency limits and has no clear direction to improve

Efficiency begins from

24%



Explicit path to improve cell efficiency with huge potential.

HJT

The initial efficiency at start of massive industrialization has exceeded PERC, and is going to reach 25.5~26% during 2022-2023.

* Huasun average efficiency in mass production is 24.75% at present; Maximum efficiency of single production batch is 24.9%; Maximum efficiency of single piece is 25.3%

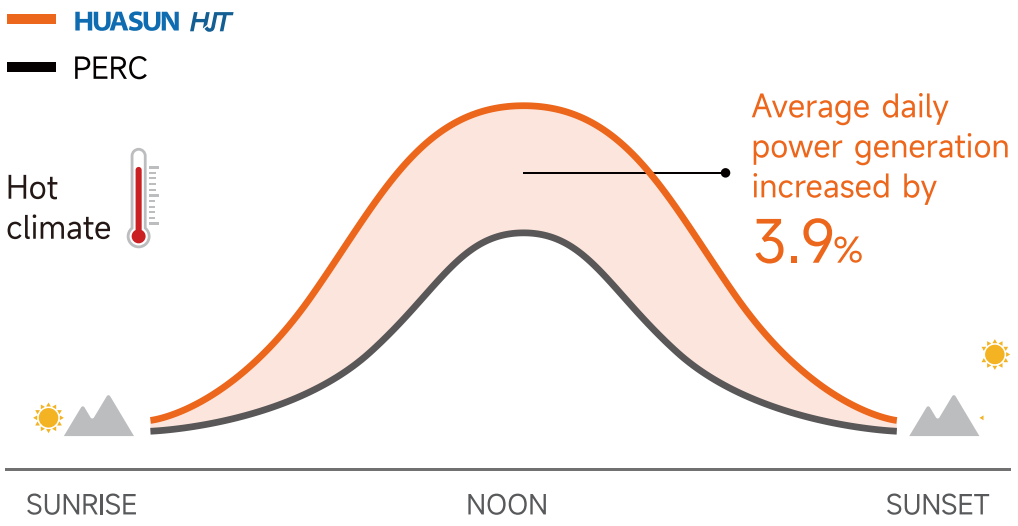
Superior Temp. Co-efficient

Industry Leading

-0.26%/℃

Temp. Co-efficient

-0.26%/℃ Temperature coefficient means HJT solar panels generate about 3.9% MORE electricity than PERC panels in a hot climate.



Product	Temp Coefficient %/℃	Maximum power 500W, the efficiency loss under 65℃	Efficiency loss in a hot climate
Mono	-0.45	90W	18.0%
Mono PERC	-0.38	76W	15.2%
HJT	**-0.26**	**52W**	**10.4%**

Extremely Low Attenuation

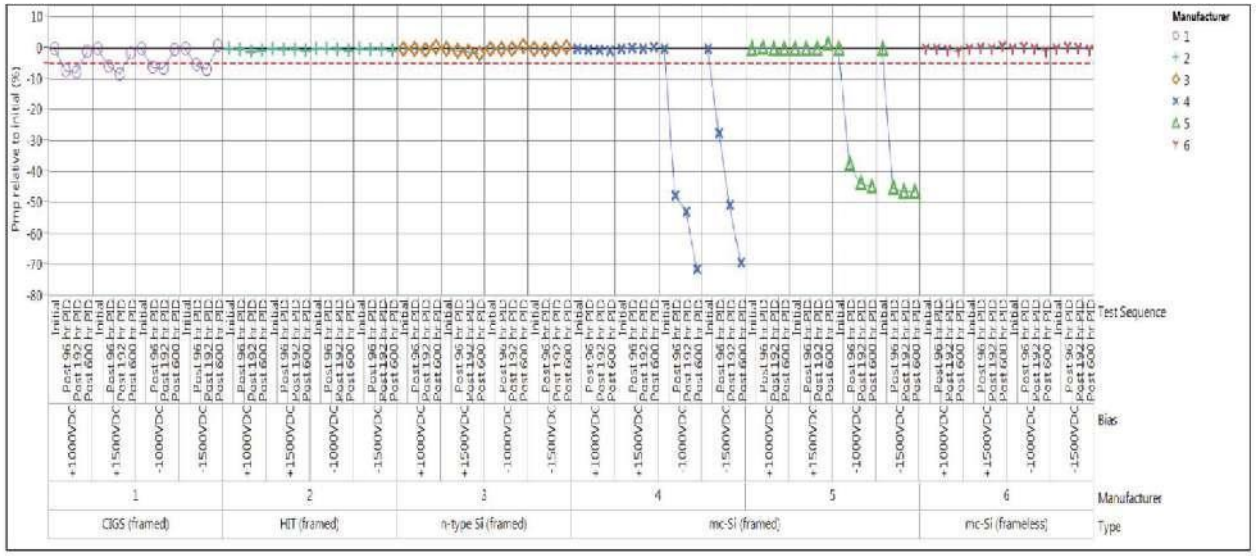
NO

PID

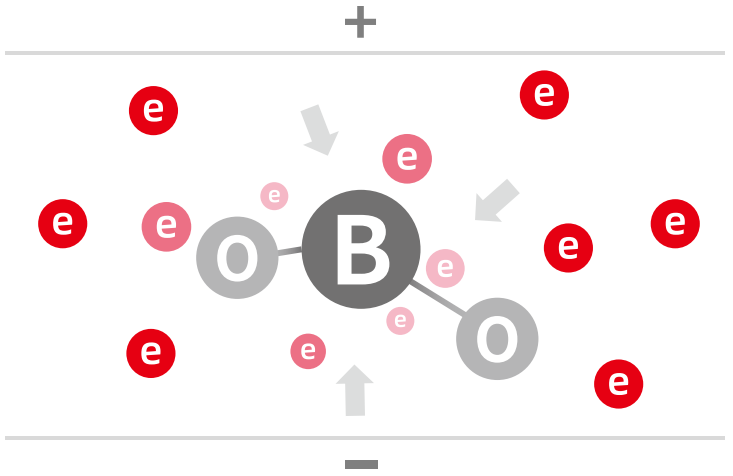
LID

N-type wafer does not have B-O bond，resulting in no LID effect, which fundamentally guarantee the products' durability and yield.

TCO film on HJT cell is conductive，so the charge will not polarize on the surface，which can prevent the potential-induced attenuation, avoiding PID from the structure. Huasun HJT modules adopt EPE as encapsulation, which has stronger waterproof performance. With double-glass design , material inside modules will not be corroded, so PID attenuation can be prevented.



来源：CFV solar test lab



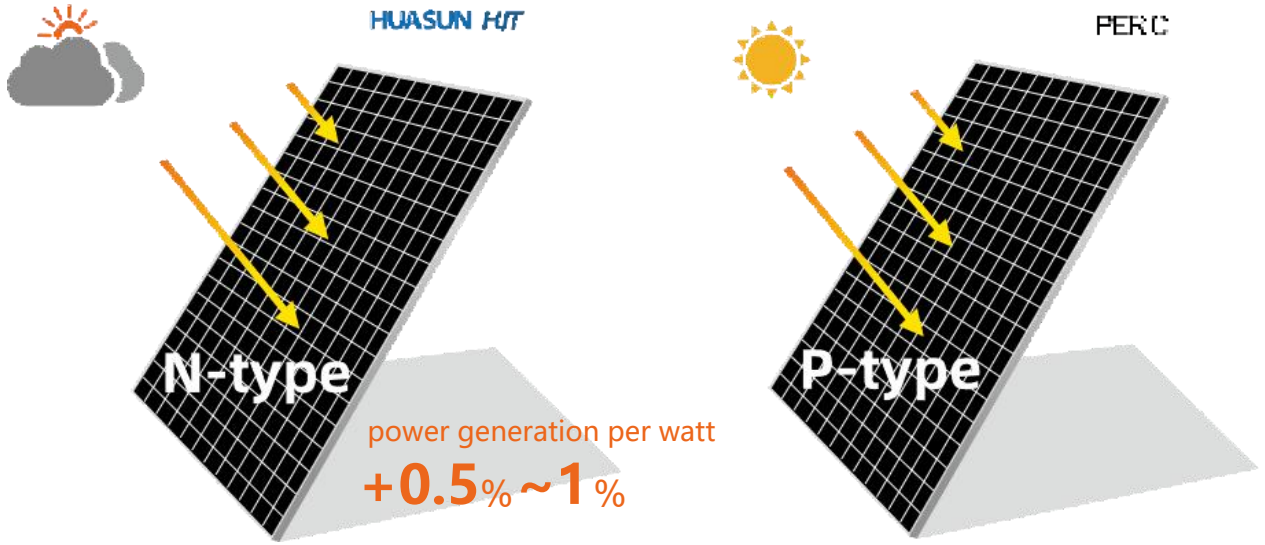
Normal solar cells have B-O band which leads to LID

Great Weak-light Performance

Energy yield in weak light environment

+0.5~1%

Compared with the P-type monocrystalline silicon wafer, the N-type wafer has a better low-light effect, which contributes about 0.5%~1% energy yield to the power generation per watt.

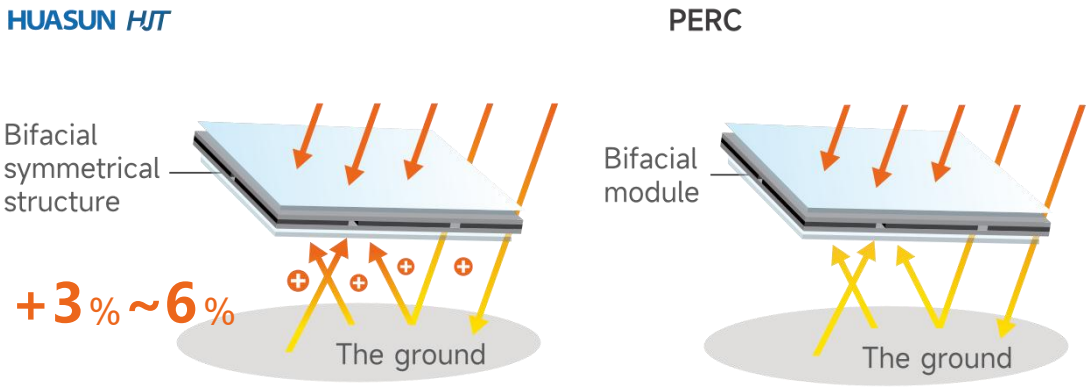


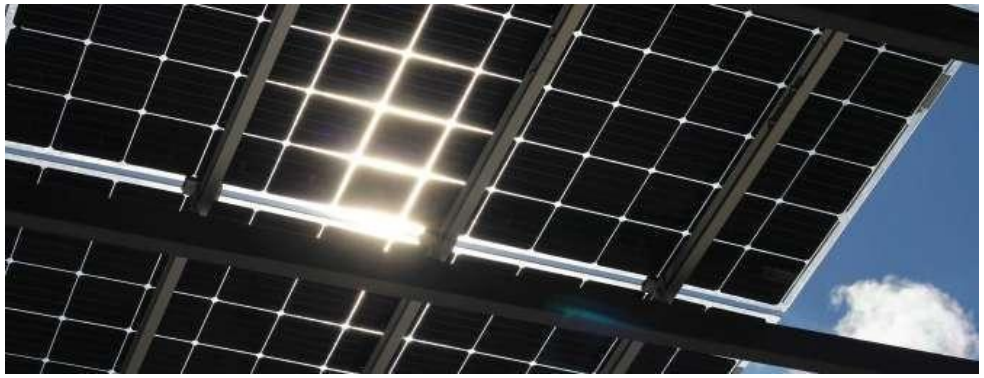
Bifaciality Benefits

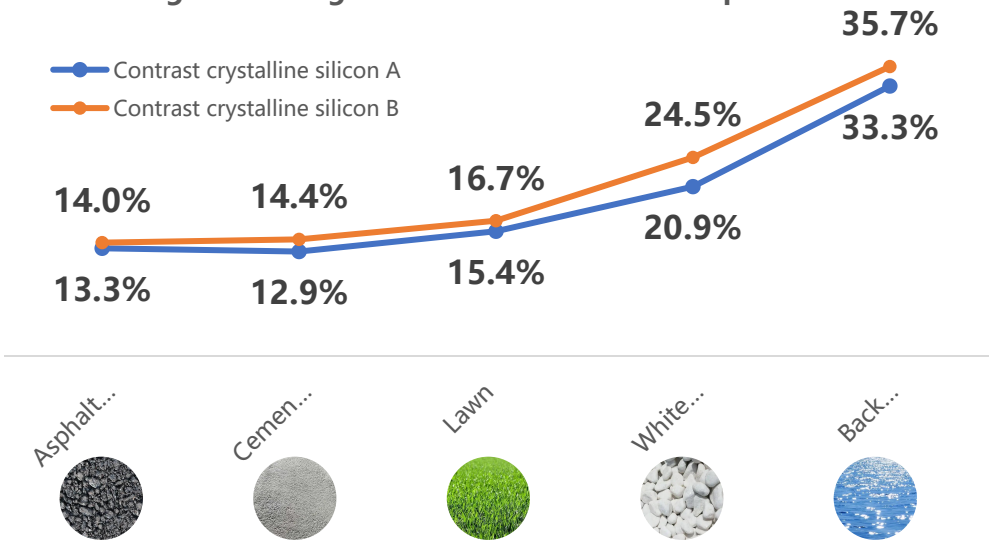
Higher bifacial energy yield

+3~6%

HJT’ s natural bifacial symmetrycal structure makes the bifacility up to 95%. The power generation per watt of HJT cells is about 3%~6% higher than that of bifacial PERC cells. In practical applications, the output gain of Huasun HJT bifacial modules can reach more than 30%。

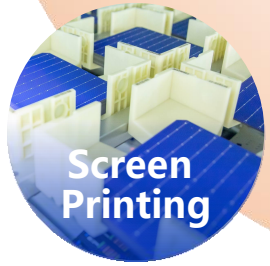






* According to Huasun data： the output gain of Huasun HJT bifacial modules can reach more than 30%

HUASUN



HJT Production Process

Fewer manufacturing process compare with other solar cell technologies

4 Steps HJT **VS** **>10 Steps** OTHER

Ultra-low Carbon Footprint

Till the end of 2022, Huasun can get an estimated CO^2 carbon footprint of HJT module manufacturing as low as 397g/W, by applying and improving various methods to reduce the carbon emission during HJT solar cell processing.

Higher efficiency

Higher efficiency leads to a much lower CFT per watt.

Lower process temp.

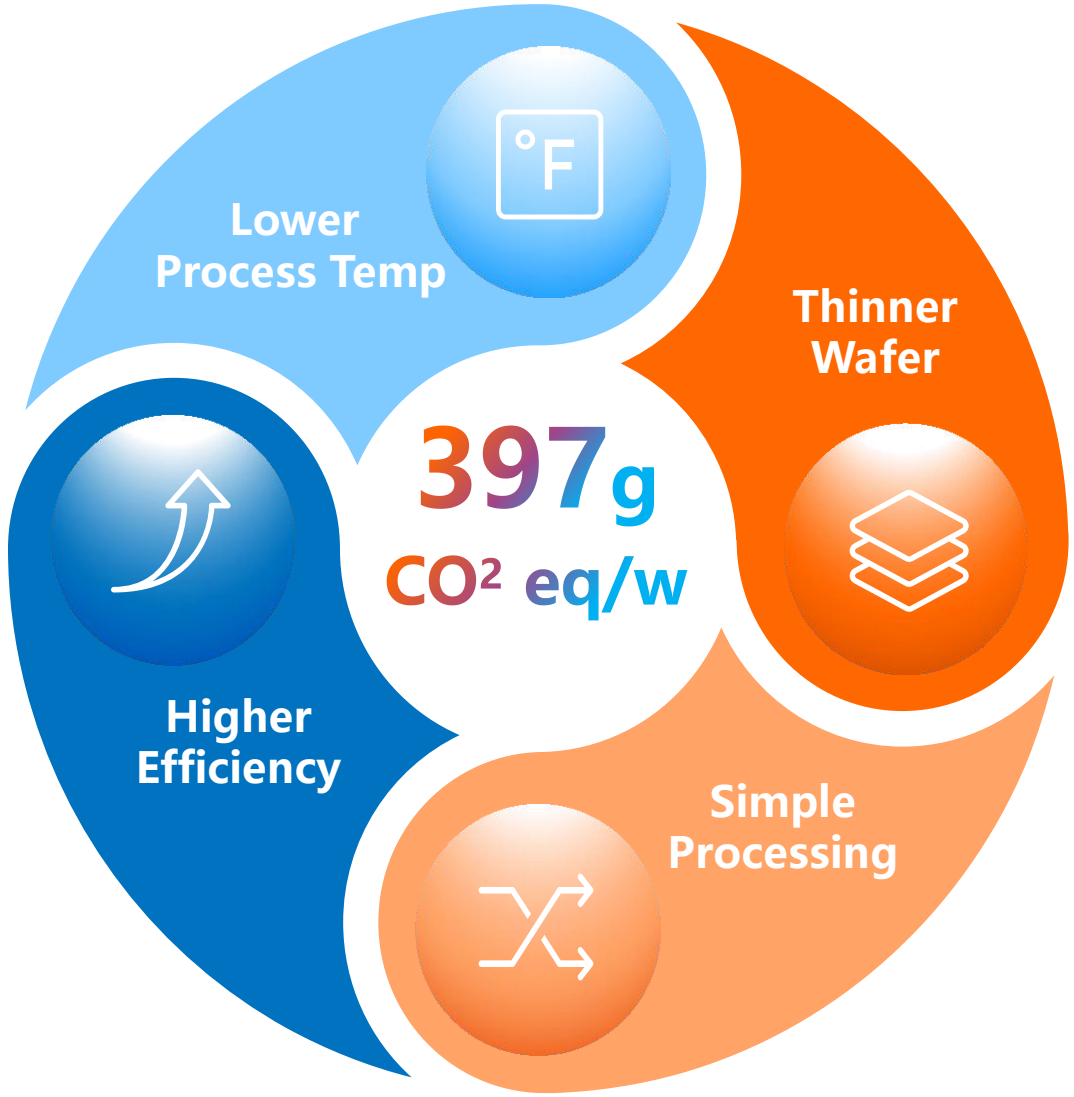
Low temp. processing consume less energy.

Thinner wafer

Being able to adopt Thinner wafer helps to reduce wafer CFT per piece.

Simpler processing

Simpler cell processing takes less energy consumption from manufacturing



High Quality Result From Advanced Materials

Non-destructive Cutting Technology
Non-destructive smooth cutting surface, no heat affected area, little impact on cell efficiency

Encapsulate With EPE
High barrier from water vapor, anti-PID, high cross-linking degree, high light transmittance

Sealing With PIB Based Sealant
The edge of the module is sealed with PIB based sealant to improve water resistance.

Double Glass Design With Frame
Front/back mechanical loading up to 5400/2400Pa

Racking System Adaption
A whole set of racking solutions can be designed

High Reliability

High Power Generation

Huasun cooperated with first-class material suppliers around the world, providing products that exceeded industry quality standards.

Lower Temperature Coefficient
Compared to PERC, HJT has lower temperature coefficient, to raise power output. HJT's advantages are more obvious in high temperature, high irradiation area

Higher Bifacial Energy Yield
HJT cell's bifaciality can reach 95%, which would bring more energy yield.

Better Weaklight Performance
The minority carrier lifetime of N-type cell is high, resulting in a better power generation ability in weak light condition than PERC.

NO LID, NO PID in cell
N-type wafer has no B-O bond, and TCO conducts electricity on HJT cell surface without insulating layers, so LID and PID can be eliminated in principle.

Lower Lifetime Degradation Rate
1% attenuation in the 1st year, the annual attenuation from the 2nd year is 0.375%, and the power is not less than 88% until the 30th year.

Real Installation Contrast

Third party demonstration base:

- CTC state inspection group Hainan outdoor demonstration base (Ding'an, Hainan)

Module project:

- Huasun HJT Bifacial double-glass module 460W 166mm 144cell
- Other PERC Bifacial double-glass module 445W 156mm 156cell

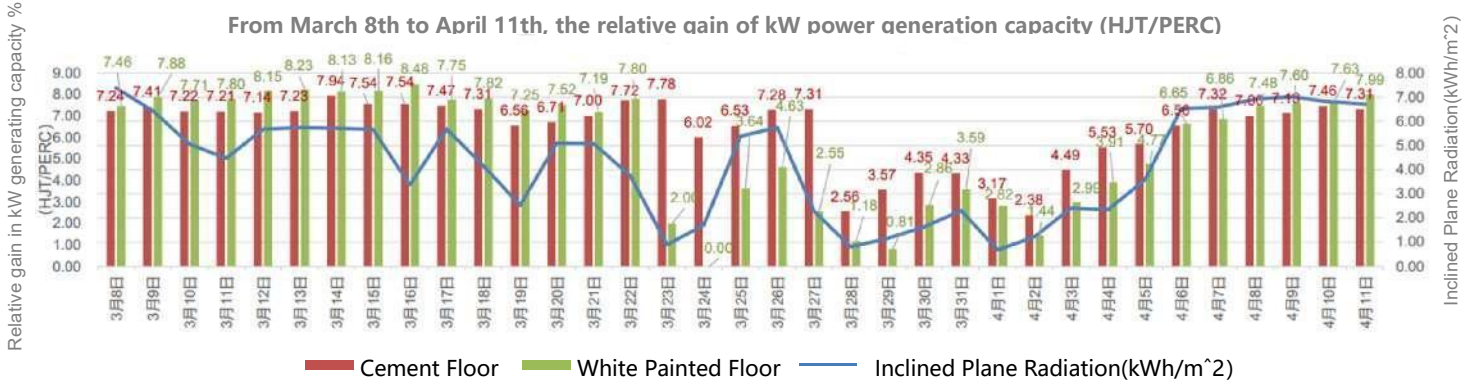
Empirical scheme:

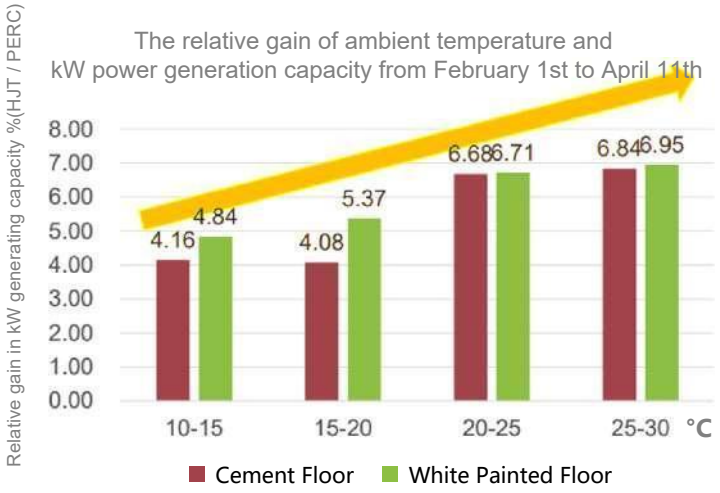
- Modules are connected in series to HUAWEI inverter, to monitor the power data HJT modules and PERC modules on white ground and cement pavement

More power generation:

Same installation capacity HJT module VS PERC Bifacial double-glass module: average power gain

+6.44% (White Ground) **+6.51% (Cement Pavement)**





Stronger power generation:

- Higher Temperature, more obvious advantages of HJT. HJT increase power generation **+4~7%** per watt than PERC Bifacial double-glass module

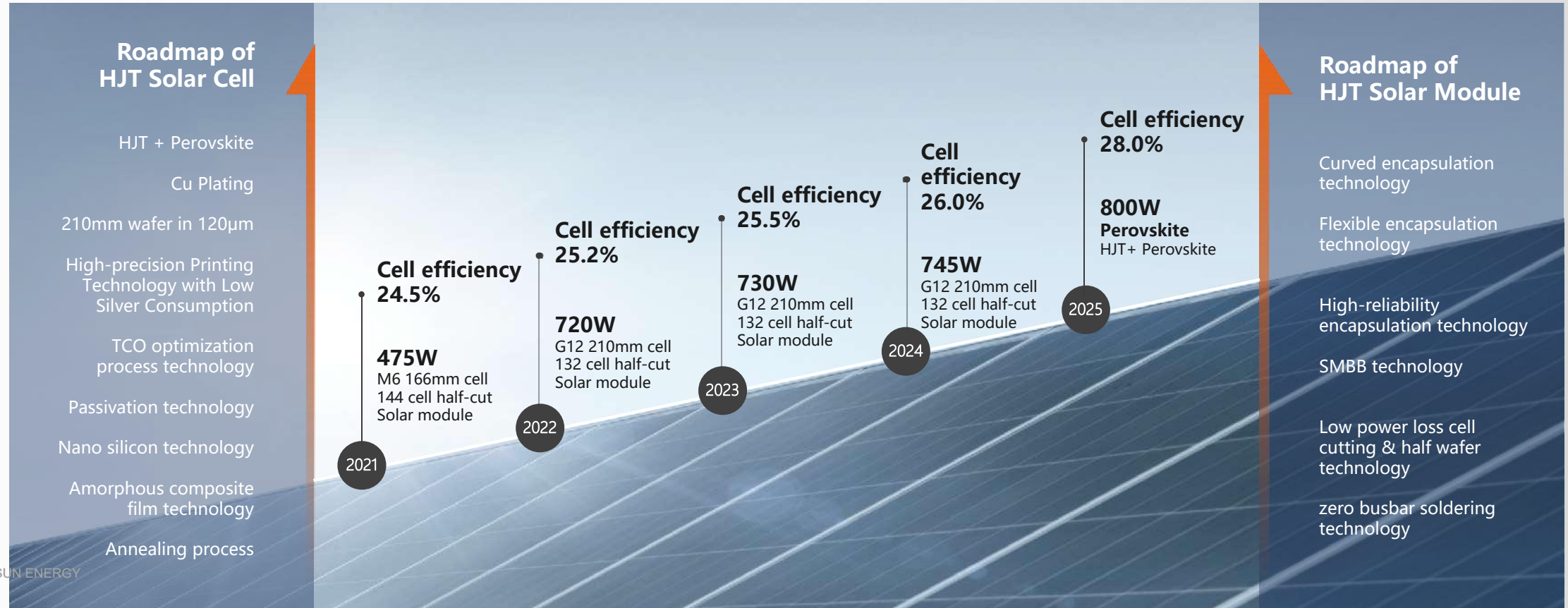
Technology leads the future

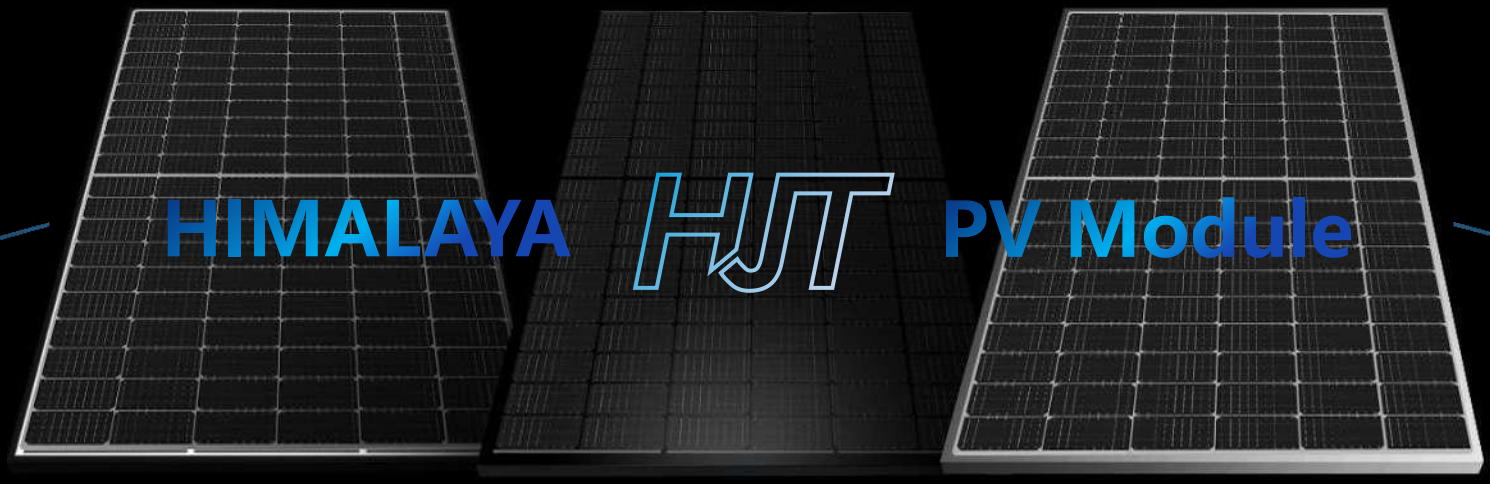
Taking HJT as the core, Huasun would like to enhance clients' confidence of solar energy's future via higher product efficiency, more stable power generation performance, better quality assurance and platform-based technology expansion capabilities.

Huasun simultaneously laid out the R&D of single-microcrystalline, double-microcrystalline, HBC, copper electroplating and heterojunction-perovskite tandem cells, which continuously improves the efficiency of solar cells and reduces product costs.

800W+

HJT+Perovskite+210mm wafer to realize module power up to 800W+





HIMALAYA HJT PV Module

Himalaya Series
HJT Solar Module

HUASUN

Himalaya G12 Series

Bifacial double-glass HJT module

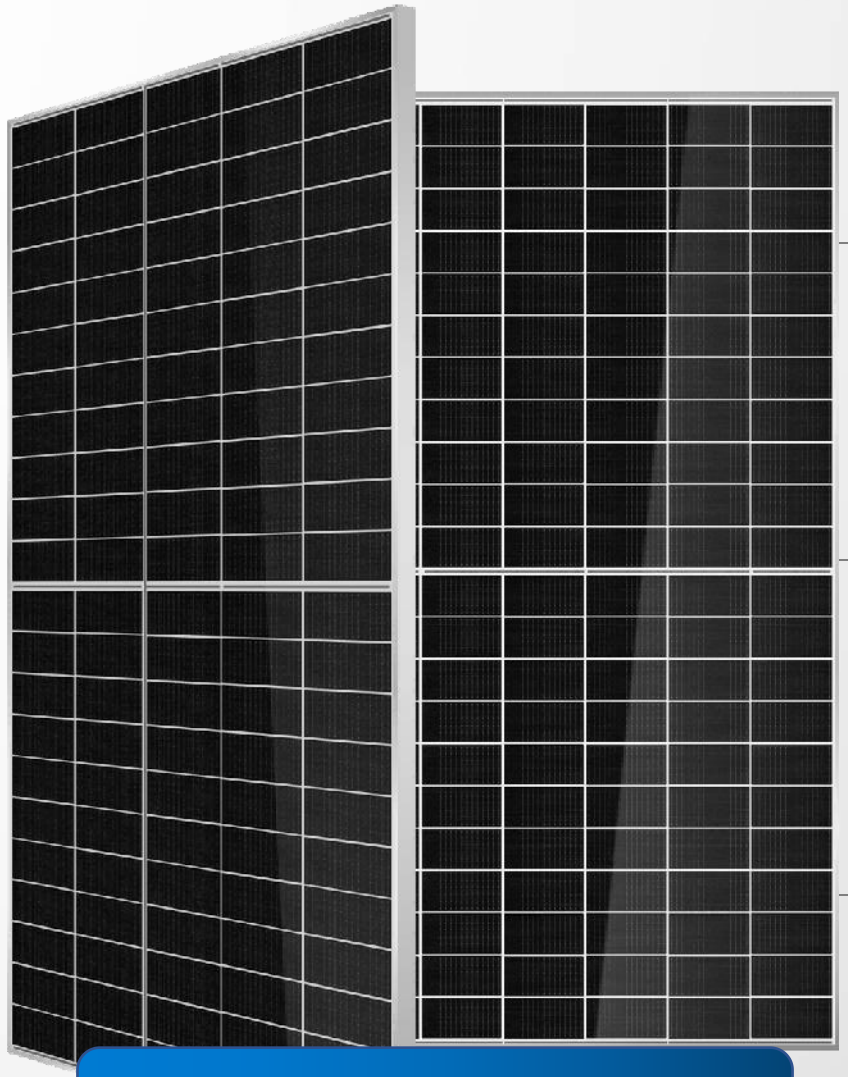
710w
Maximum Power Output

22.9%
Maximum Module Efficiency

- N-type 210mm solar cell
- SMBB multi-busbar technology
- Pre-cut half cell technology
- >85% bifaciality
- 15-year product warranty, 30-year performance warranty
- Suitable for commercial and utility projects

15 Years
PRODUCT WARRANTY

30 Years
PERFORMANCE WARRANTY



Launched in 2022 Q2

Up to 710W | 132 Cells | 15BB

Maximum module efficiency up to **22.9%**
2384*1303*35mm
38.7KG

Up to 635W | 120 Cells | 15BB

Maximum module efficiency up to **22.4%**
2172*1303*35mm
35.3KG

Up to 580W | 110 Cells | 15BB

Maximum module efficiency up to **22.2%**
2384*1096*35mm
32.3KG

HUASUN

Himalaya M6 Series

Bifacial double-glass HJT module

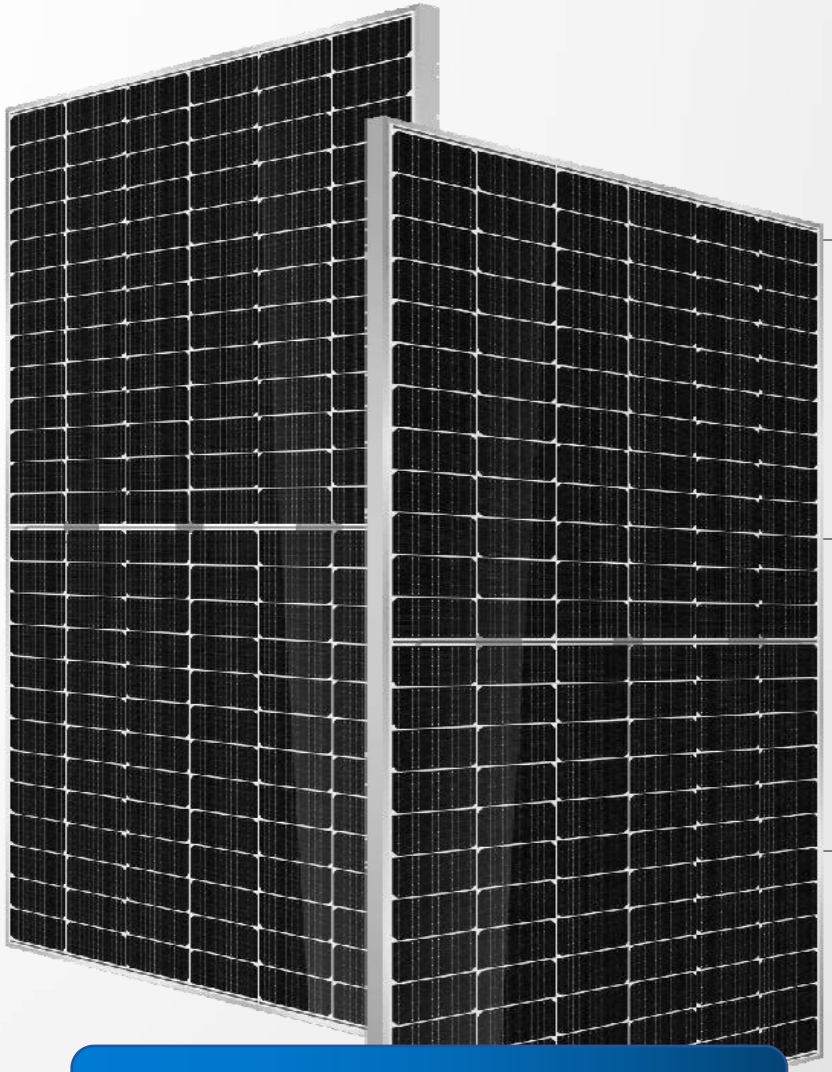
500w
Leading power Output

23%
Maximum Module Efficiency

- N-type 166mm solar cell
- SMBB multi-busbar technology
- Pre-cut half wafer technology
- >85% bifaciality
- 15-year product warranty, 30-year performance warranty
- Suitable for rooftop, commercial and utility projects

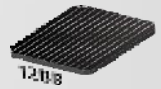
15 Years
PRODUCT WARRANTY

30 Years
PERFORMANCE WARRANTY



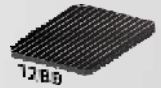
Launched in 2021

Up to 520W — 156 Cells



Maximum module efficiency up to **22.1%**
2263*1038*30mm
29.5 KG

Up to 500W — 144 Cells



Maximum module efficiency up to **23%**
2094* 1038*30mm
27.5 KG

Up to 400W — 120 Cells

Maximum module efficiency up to **22.0%**
1755* 1038*30mm
23.5KG

HUASUN

Himalaya M6 Series

Full Black Bifacial double-glass HJT module

- Aesthetic design in all black
- Class A fire rating, safety guarantee
- Ideal choice for rooftop system

Matte Frame in black

Glass with black grid line

HJT solar cell

Aesthetic design

15 Years
PRODUCT WARRANTY

30 Years
PERFORMANCE WARRANTY

Up to
400W

120 Cells

Maximum module efficiency up to **22%**
1755*1038*30 mm
23.5 KG

Himalaya M10 Series

Bifacial double-glass HJT module

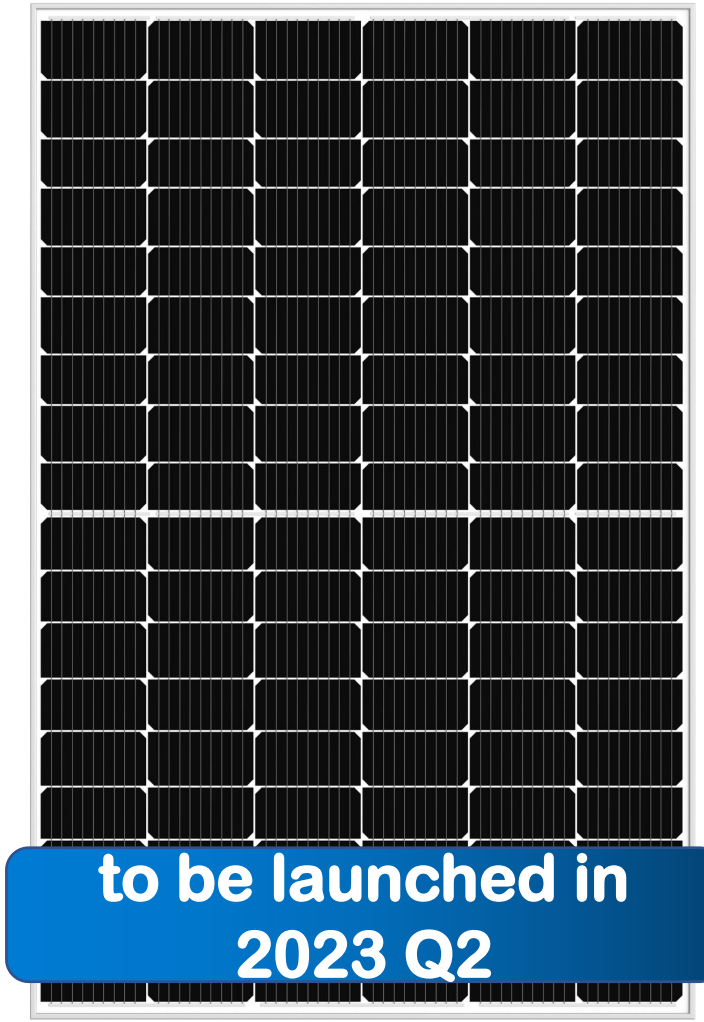
445w
Leading power Output

22.8%
Maximum Module Efficiency

- N-type 182mm solar cell
- SMBB multi-busbar technology
- Pre-cut half wafer technology
- >85% bifaciality
- 15-year product warranty, 30-year performance warranty
- Best rooftop solar module

15 Years PRODUCT WARRANTY

30 Years PERFORMANCE WARRANTY



Up to 445W | **108 Cells** | 9BB

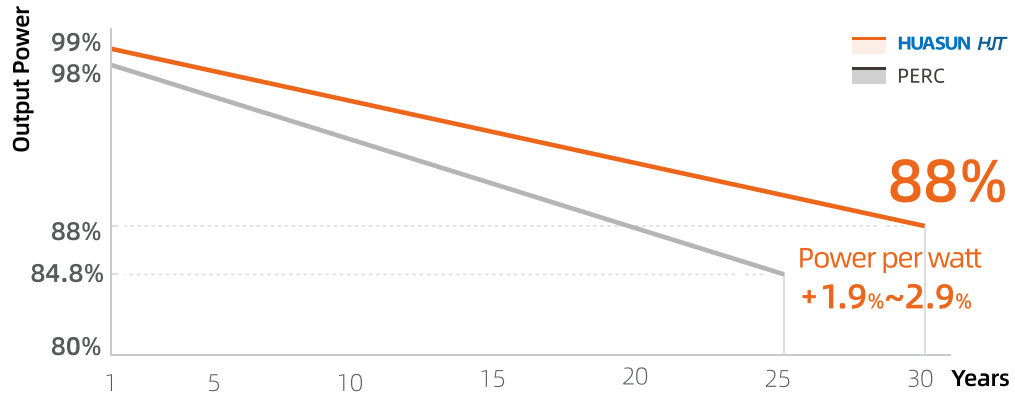
Maximum module efficiency up to **22.8%**
1722* 11134*30mm
22 KG (Ultra light with 1.6mm glass)

Up to 590W | **144 Cells** | 9BB

Maximum module efficiency up to **22.8%**
2278* 1134*30mm
32KG

Excellent Module Eminent Warranty

Huasun’ s HJT solar modules all have 15-year product warranty and industrial leading 30-year linear performance warranty. Huasun has absolute confidence in our module manufacturing. Compared to traditional modules, HJT modules have more power output and higher reliability, and can save more cost. Huasun’ s HJT products all passed the industry's professional third-party tests to ensure the best quality and yield guarantee.



Factory system certification

Huasun ensures that all aspects in manufacturing are in the leading position in the industry via continuous efforts.
The company has passed the latest ISO system certification, and will continue to actively improve various system in the future to provide sufficient guarantee for customers.

Product certification

Huasun HJT modules have passed the most stringent tests in the industry and obtained a range of certifications about product quality and safety. At present, Huasun HJT products have gained the following certifications.

TÜV

CQC(IEC 61215-1:2016，61730-1:2016)

Green Building Material Certification of HIT Module Technology from CTC

JP-AC

Product Safety Certification

HJT

The choice of benefits to enpower the world

Huasun continuously explores the deep integration of advanced technology, intelligent manufacturing and clean energy, and actively promotes the practice of carbon neutrality in China and the world.

With the completion global projects built by its HJT modules, Huasun has contributed to lowering energy costs, reducing carbon dioxide emissions and further promoting the use of renewable energy.

HUASUN

HIMALAYA • G12 SERIES

Application·Hainan China

Located in Anding, Hainan（19.30°N），Grass ground，install capacity 100MW；
Fixed Mounting structure by 15° install，1m distance to ground from the lower side，string inverter，1500V.

Labor **-17.26%**

land **-6.84%**

Non-module BOS **-4.14%**

LCOECost **-6.6%**

Module(glass-glass)		PERC Bifacial，182,72C（144）	TOPCON Bifacial，182,72C（144）	PERC Bifacial 210，66C 132）	HJT Bifacial 210,66C（132）
Power（W))		540	560	650	700
No. of Module / String		28	28	32	28
String Power（W）		15120	15680	20800	19600
BOS	Mounting System	baseline	-2.15%	-1.29%	-9.4%
	Foundation	baseline	-3.63%	-5.44%	-15.1%
	Cable	baseline	-3.33%	-8.71%	-13.1%
	Labor	baseline	-3.96%	-9.96%	-17.26%
	Land	baseline	-2.55%	0.22%	-6.84%
	BOS	baseline	-0.64%	-1.66%	-4.14%
LCOE		baseline	-4.42%	-0.73%	-6.60%

Case Study

Bulgaria
350MW
Utility Project

The biggest HJT module utility project in the world at present

Location: **PAZARDZHIK, Bulgaria**

Capacity: **350MW**

Annual power generation:

650,000,000Kwh

Annual coal saving:

260,000 tons

Annual CO_2 emission reduction:

648,000 tons

Case Study

Shandong Shouguang 14MW Coastal Power Station

Location: **Shouguang, Shandong province, China**

Capacity: **14MW**

Annual power generation: **17,690,000Kwh**

Annual coal saving: **7,076tons**

Annual CO_2 emission reduction: **17,600tons**

* Huasun provided 10MW HJT modules to this project

Case Study

Anhui Xuancheng 4MW Commercial Rooftop

Location: **Xuancheng, Anhui province, China**

Capacity: **4MW**

Annual power generation: **4,260,000Kwh**

Annual coal saving: **1,706tons**

Annual CO_2 emission reduction: **4,251tons**

Case Study

Germany
5KW
Rooftop Project

Location: **Euskirchen, Germany**

Capacity: **5KW**

Annual power generation: **5,492Kwh**

Annual coal saving: **2200kg**

Annual CO_2 emission reduction: **5500kg**

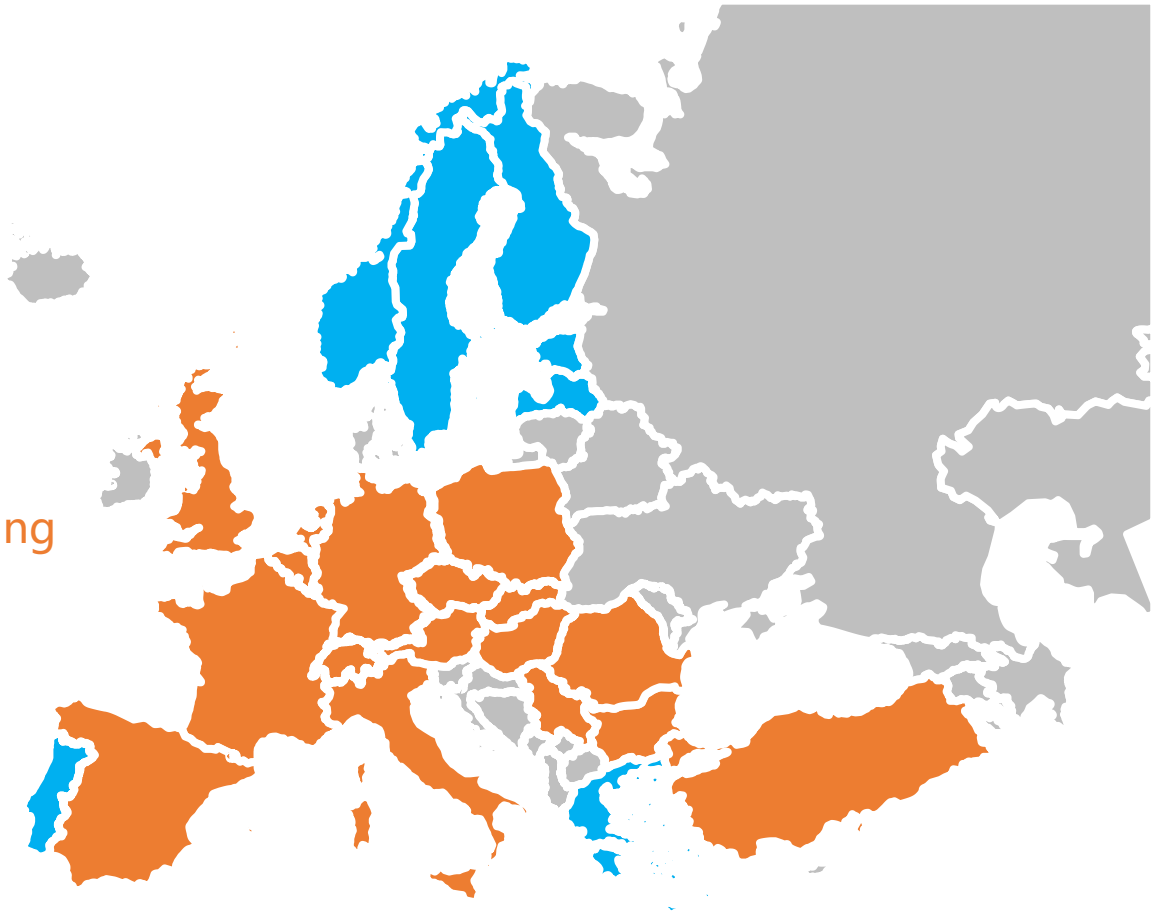
EU market Development

17 European Countries with HuaSun HJT installed

- Bulgaria: Inercom for 600MW+ project cooperation
- Swiss: Partnership and distribution with 3S Swiss Solar
- German: PVSelect & 2 major partners
- France: With 1 major partner
- Spain: Sales office in Madrid, over GW pipeline
- Benelux: distribution with CKW, over 100MW project in bidding
- Hungary: Partnership with Ecosolifer

...

Portugal, Greece, Scandinavia Project in development
Partner with iNet Tech develop over GW in pipeline



Build a ZERO Carbon World

Intelligently produce clean energy
Together share the warm sunshine

HUASUN

We enpower the world with solar energy ,
to restore a green earth!
In such a tremendous energy project, we keep looking for new ways to improve the efficiency and performance of solar energy, to make life better.

Relying on the strong capability of technology innovation and development, Huasun has realized the large-scale production and application of HJT products, to provide higher yield return and added value to partners around the globe.

To lead the new photovoltaic era!

www.huasun.net

HEADQUARTERS

No.99 Qingliu Road, Xuancheng Economic Development Zone, Xuancheng, Anhui, China

+86-563-2626509

SALES CENTER

No.411-C3 Greenland Building, Yuhuatai District, Nanjing City, Jiangsu, China.

sales@huasun.net

+86-25-86216170

High Performance at Scale with HJT

BELECTRIC GmbH
Djaber Berrian, 11.08.2022

BELECTRIC®

From PV pioneers to global leader

1st EPC company
Worldwide with an installed capacity of > 1 GW

2 decades one of TOP 10 –EPC worldwide

< 10 years
from a start-up to a global player

> 480
realized PV Power plants

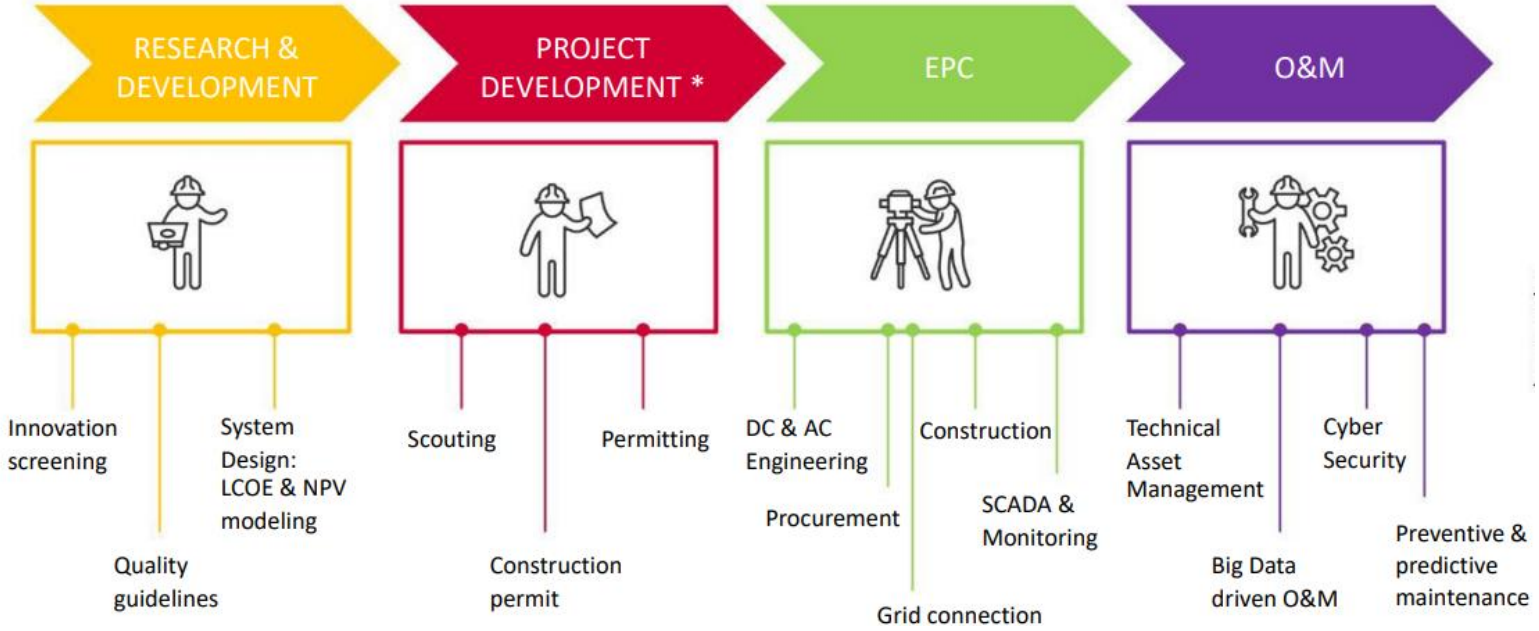
> 4.2 GW
installed capacity

"Early Mover"
in developing new markets

Pioneers
in developing utility scale PV

Allround expertise inhouse

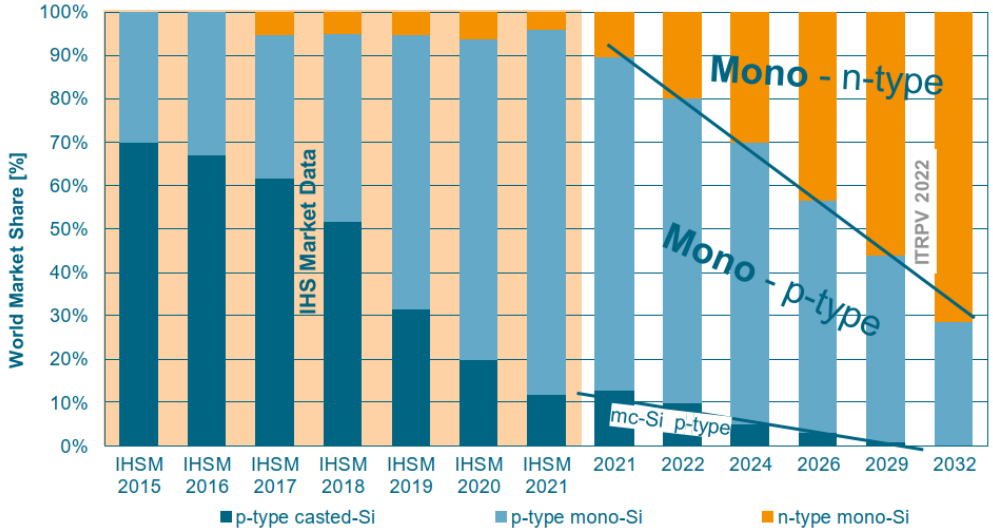
Elevion Group | GERMANY



Agenda

1. Solar **Cell Types** **Market** Overview
2. **Price Competitiveness** Threshold of **HJT PV Modules**
3. **Driving factors** of **HJT** PV modules **profit** in **large scale PV plants**

Cell Type Market share



VDMA

ITRPV 2022

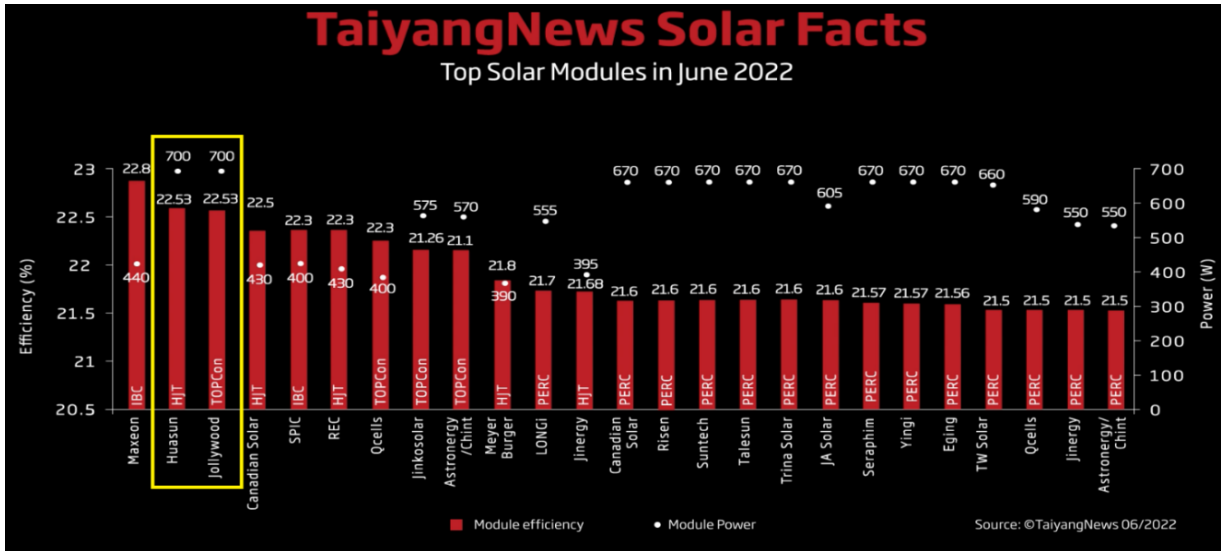
N-type cell concepts are **bifacial ready –** can be also used for **monofacial modules**

- **N-type** to **dominate the market share** by **2030, currently** is **approx. 20%**
- Main **cell concepts** are: TOPCon, **HJT** and IBC

➔ Which n-type cell concept will dominate by 2030?

13th Edition ITRPV 2022 International Technology Roadmap for Photovoltaic

N-Type Power & Efficiency Race



- **PERC has been reaching** the PV module **industrial efficiency limit**
- Both technologies **'Topcon**' and **'HJT**' can have **the same PV module efficiency** which could indicate already **a super-hot-race in PV module efficiencies** between those technologies in the coming years.
- **Volume** and **price gap** will be **decisive** for the **market share leading**

https://taiyangnews.info/

Agenda

1 Solar **Cell Types** **Market** Overview

2 **Price Competitiveness** Threshold of **HJT PV Modules**

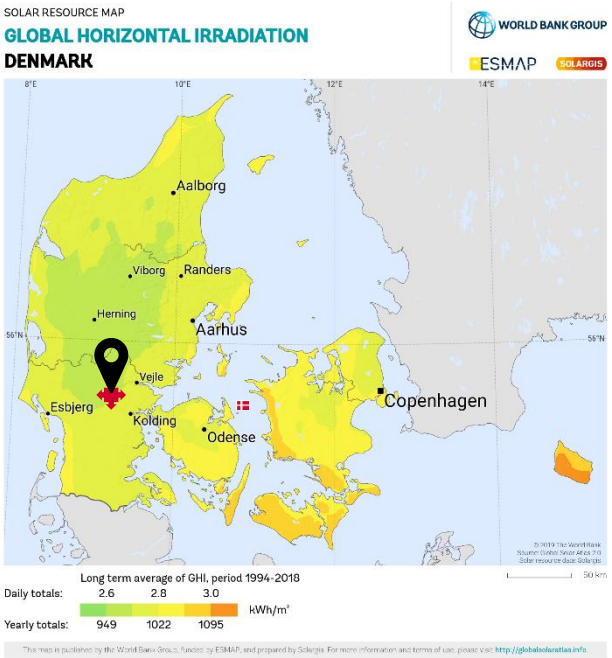
3 **Driving factors** of **HJT** PV modules **profit** in **large scale PV plants**

Bifacial PV Power Plant in Denmark

Project Details	
Project size (MWp)	24-25
Plot size (ha)	18.15
Grid Power limit	No

- The **system configuration** compared for this project:
  FIX South, 4P, 15°, bifacial, 3m row spacing, DC/AC ratio 1.2

- **3 Bifacial PV modules** were compared in terms of **NPV*** for this project:
  - **P-type PERC** bifacial PV modules (540 Wp) – M10
  - **N-Type TOPCon** bifacial PV modules (560 Wp) – M10
  - **N-type HJT** bifacial PV modules (680 WP) – M12
- LID assumptions:
  - P-type: 1.5%
  - N-Type: 0.6%
- Albedo assumption:
  - 20%

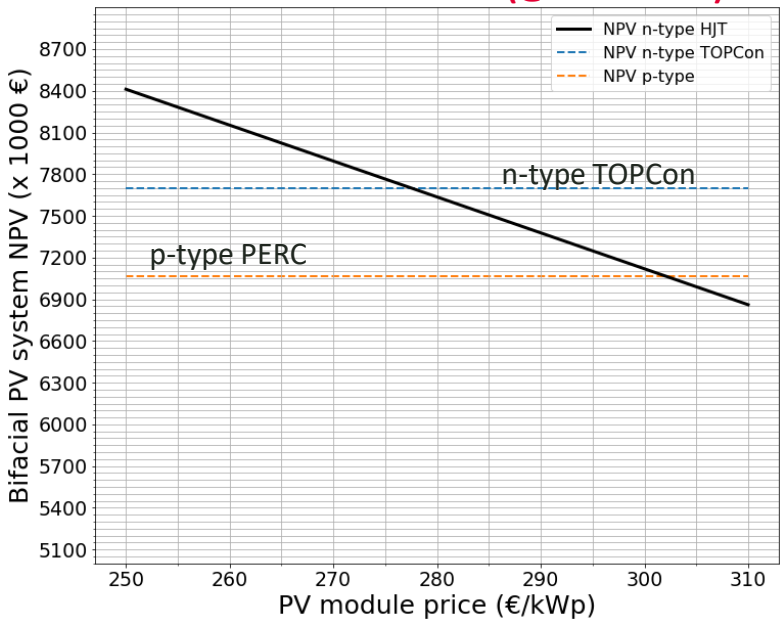


Solar irradiance data: Solargis 2022
www.istockphoto.com
NPV: Net Present Value (€)

Price Competitiveness Threshold of Huasun HJT

- **Case assumptions:**
  - PPA: 7¢/kWh and 4.8 ¢/kWh, discount factor:3%,5%
- **PV module prices 06/2022:**
  - P-type PERC 540Wp: 254 euro/kWp
  - N-type TOPCon 560Wp: 265 euro/kWp
  - **N-type HJT 680Wp: ?**

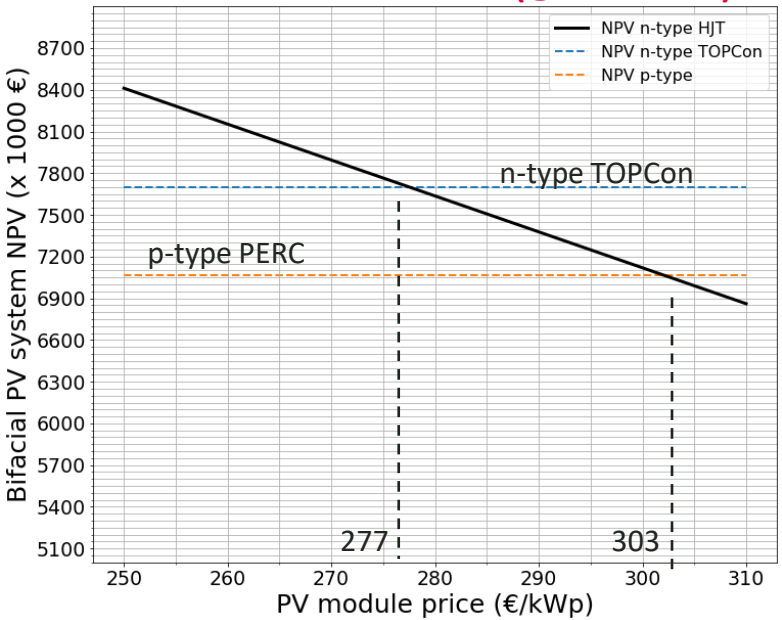
Results from LCOE model (@BELECTRIC)



Price Competitiveness Threshold of Huasun HJT

- **Case assumptions:**
  - PPA: 7¢/kWh and 4.8 ¢/kWh, discount factor:3%,5%
- **PV module prices 06/2022:**
  - P-type PERC 540Wp: 254 euro/kWp
  - N-type TOPCon 560Wp: 265 euro/kWp
  - **N-type HJT 680Wp: ?**
- **Conclusions :**
  - The price gap between n-type **HJT** and P-type **PERC** must be lower than **49 euro/kWp** to be considered for the bifacial bifacial PV projects in Denmark
  - Or the price gap between n-type **HJT** and n-type **TOPCon** must be lower than **12 euro/kWp** to be considered for the bifacial PV projects in Denmark

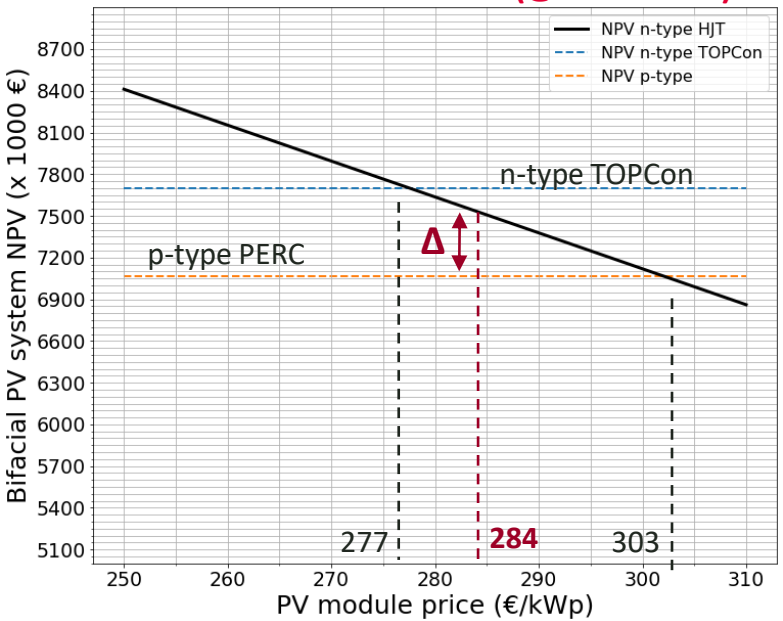
Results from LCOE model (@BELECTRIC)



Price Competitiveness Threshold of Huasun HJT

- **Case assumptions:**
  - PPA: 7¢/kWh and 4.8 ¢/kWh, discount factor:3%,5%
- **PV module prices 06/2022:**
  - P-type PERC 540Wp: 254 euro/kWp
  - N-type TOPCon 560Wp: 265 euro/kWp
  - **N-type HJT 680Wp: ?**
- **Conclusions :**
  - The price gap between n-type **HJT** and P-type **PERC** must be lower than **49 euro/kWp** to be considered for the bifacial bifacial PV projects in Denmark
  - Or the price gap between n-type **HJT** and n-type **TOPCon** must be lower than **12 euro/kWp** to be considered for the bifacial PV projects in Denmark
- Current N-type HJT 680Wp price: 284 euro/kWp

Results from LCOE model (@BELECTRIC)



Agenda

1 Solar **Cell Types** **Market** Overview

2 **Price Competitiveness** Threshold of **HJT PV Modules**

3 **Driving factors** of **HJT** PV modules **profit** in **large scale PV plants**

System Design Optimization: Case Study

Country	Denmark
Geographical Site	NA
No. of Simulations	5,560
Discount factor	3%/5%
Offtake assumption (€ckWh)	7/4.8

Top System Designs with Area Limit (ha)	*181,500*	*NPV Ranking*

Substructure	*Module*	*Inverter System*	*Row Distance (m)*	*DC/AC ratio*	*CapEx deviation (€)*	*discounted OpEx deviation (€)*	*discounted sale of electricity deviation (€)*	*NPV deviation (€)*
FIX South, 4P, 15°, HoG 0.7m, bifacial	HS-210-B132DS675	SG250HX_bifi	3,0	1,25				
FIX South, 4P, 15°, HoG 0.7m, bifacial	LR5-72 HBD 540 M Bifacial	SG250HX_bifi	3,0	1,3	-1.197.285 €	-144.145 €	-1.818.163 €	-476.733 €

- LR5-72 HBD 540 M Bifacial ➔ P-type PERC
- HS-210-B132DS675 ➔ N-type HJT

Key takeaways:

- ***P-type PERC offer much lower CAPEX and OPEX than n-type HJT, however it has much less sales of electricity than n-type HJT.***
- ***HJT can increase the NPV of the project by more than €475,000 over 30 years.***
- ***HJT is more profitable for the project than p-type PERC.***

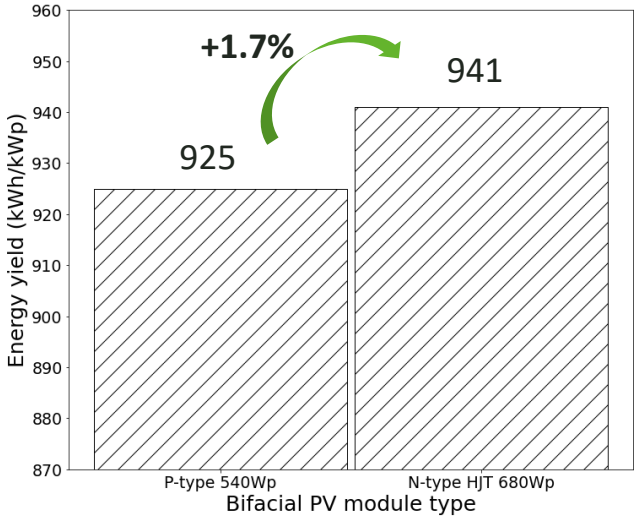
What makes HJT superior to the P-type PERC

Net present value (€) = Sales of electricity (€) (30 years, Discounted) − Total expenditures (€) (30 years, Discounted)

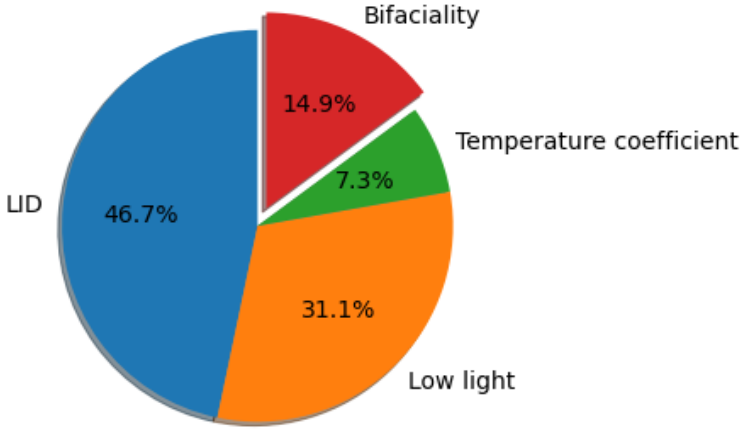
- Yield (kWh/kW),
- Installed capacity (MWp)
- PV module yearly degradation (%)

What makes HJT superior to the P-type PERC

➢ Yield (kWh/kW), installed capacity (MWp), PV module yearly degradation (%)



PVsyst 7.2



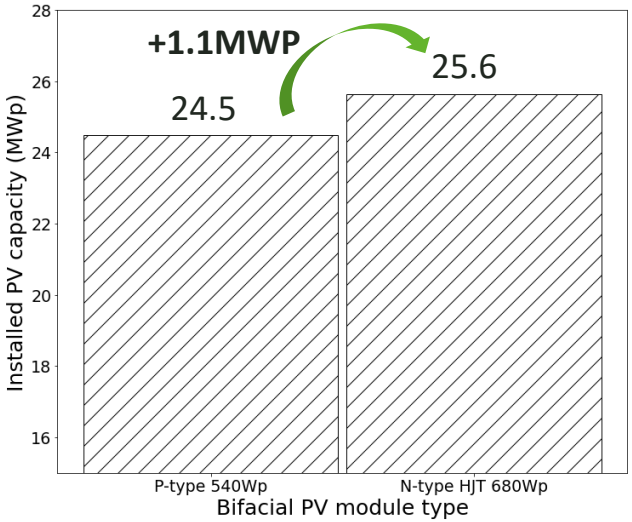
Factors contributing to the improved yield of n-type HJT

Key takeaways:

- ***Better low light behavior and LID have improved the HJT n-type yield the most in comparison to P-type PERC.***
- ***For this project site, temperature coefficient advantage of HJT has the smallest contribution to yield improvement.***

What makes HJT superior to the P-type PERC

➢ Yield (kWh/kW), installed capacity (MWp), PV module yearly degradation (%)



PVcase

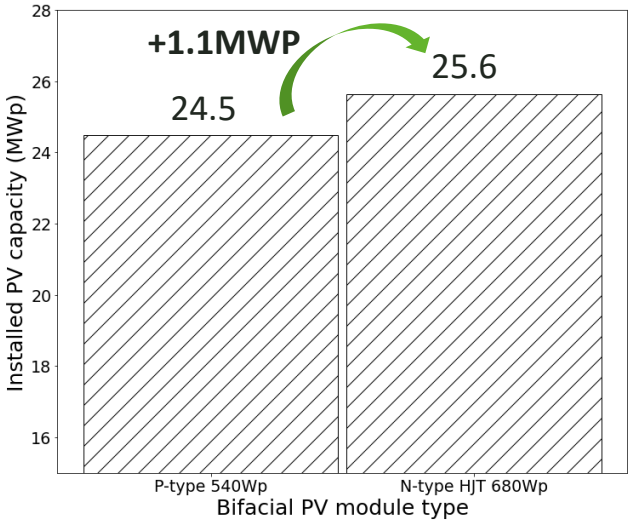
PV Power plant layout

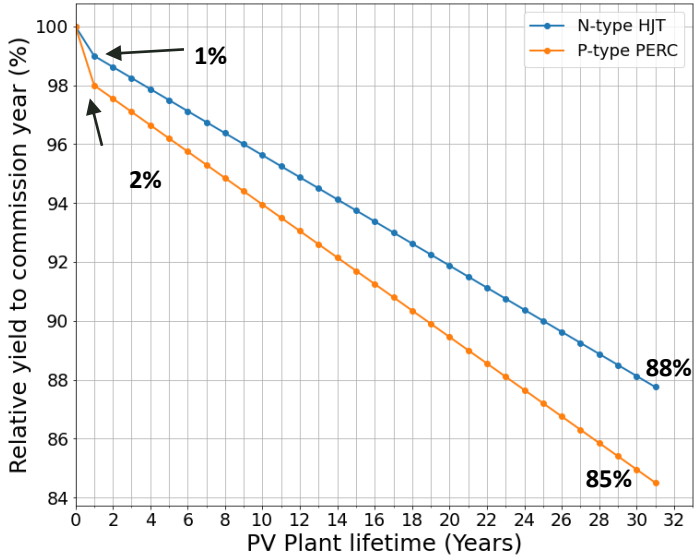
Key takeaways:

➢ ***HJT can achieve 1.1MWp more installed than p-type PERC thanks to the higher PV module efficiency (21.9% vs. 21.1%).***

What makes HJT superior to the P-type PERC

- Yield (kWh/kW), installed capacity (MWp), PV module yearly degradation (%)





Key takeaways:

- ***HJT can achieve 1.1MWp more installed than p-type PERC thanks to the higher PV module efficiency (21.89% vs. 21.11%).***
- ***HJT can generate more yield over the lifetime of the PV project than P-type PERCs, the yield advantage is 3% absolute more***

What makes HJT superior to the P-Type PERC

Net present value (€) = Sales of electricity (€) (30 years, Discounted) − Total expenditures (€) (30 years, Discounted)

- Yield (kWh/kW),
- Installed capacity (MWp)
- PV module yearly degradation (%)

- Balance of system costs (€/kWp)
- Price gap (€/kWp) between HJT and PERC

Conclusion

- **N-type HJT PV** modules are **already competitive** to **P-type PERC** for large scale PV projects

- **N-type HJT** PV modules come with **higher CAPEX and OPEX**, but potentially increase the **profit (NPV) of PV power** plants – by several 100 k€

- Several **factors makes** n-type **HJT ahead** of p-type **PERC** for high profit: **yield, installed capacity, degradation, price gap to p-type PERC**

- **To ensure the profitability** of **HJT PV modules**, their **reliability** is equally important to be investigated and evaluated

Thank You for Your Attention !

BELECTRIC GmbH

this webinar is powered by Huasun

pv magazine webinars

High performance at scale with HJT

Q&A

11 August 2022

10:00 am – 11:00 am | CEST, Berlin
9:00 am – 10:00 am | BST, London
11:00 am – 12:00 pm | EEST, Athens

Mark Hutchins
Editor
pv magazine

Wang Wenjing
CTO
Huasun

Matthew Jin
GM of sales center
Huasun

Dr. Djarber Berrian
PV Innovation and Design Engineer
Belectric

The latest news | print & online

pv magazine webinars

10% off
your subscription
with
Webinars10

Most-read online!

Australian solar park could generate hydrogen for less than $2/kg
by David Carroll

World's largest underground hydrogen storage project
by Emiliano Bellini

pv magazine webinars

Coming up next...

Tuesday, 30 August 2022
2:00 pm – 3:00 pm CEST, Berlin
8:00 am – 9:00 am EDT, New York City

Demonstrating durability in n-type modules

Thursday, 8 September 2022
11:00 am – 12:00 pm CEST, Berlin
10:00 am – 11:00 am, Morocco

What ultra-powerful string inverters mean for utility-scale and EPCs

Many more to come!

In the next weeks, we will continuously add further webinars with innovative partners and the latest topics.

Check out our pv magazine Webinar program at:

www.pv-magazine.com/webinars

Registration, downloads & recordings are also be found there.

this webinar is powered by Huasun

pv magazine webinars

Mark Hutchins
Editor
pv magazine

Thank you for joining today!