this webinar is powered by
Huasun

pv magazine webinars

Market impacts of high efficiency HJT

21 August 2024

10:00 am – 11:00 am | CEST, Berlin, Madrid
1:30 pm – 2:30 am | IST, Delhi
6:00 pm – 7:00 pm | AEST, Sydney

Mark Hutchins
Magazine Director
pv magazine

Christian Comes
Director of Business Development Europe
Huasun

Chris Williams
UK Sales Manager at Renewables wholesaler
Solartricity

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. 👀 💡

Heterojunction in 2024
Focus on Reliability

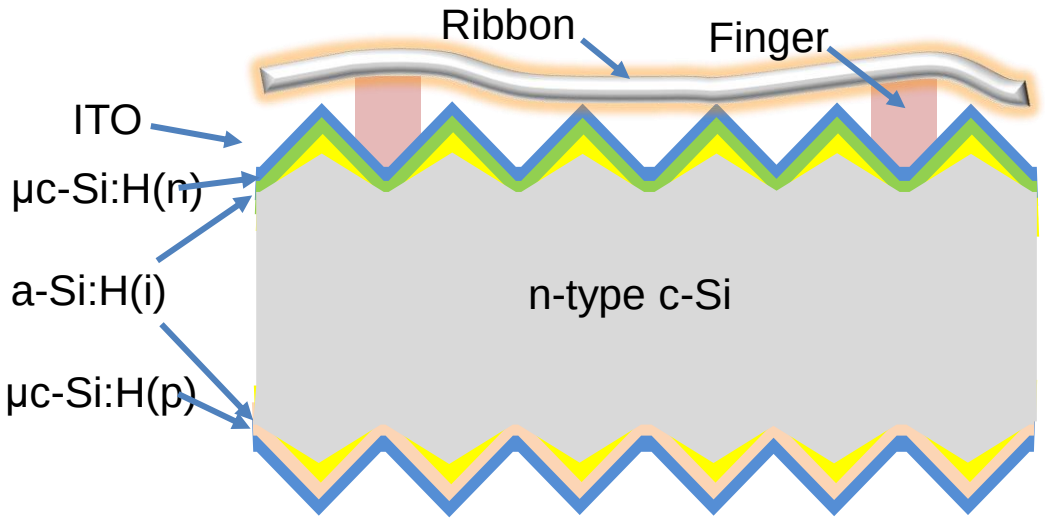
Christian Comes

Head of Business Development Europe

Anhui Huasun Energy Co., Ltd

CONTENTS

Structure of a HJT cell - 2024



0BB cells (HJT 3.0) have µc-Si on both sides

The ITO is conductive

- Passivation of the wafer is done with aSi:H (i)
- Successive layers are done with µc-Si:H (n) (p)
- The p-n junction is at the cell rear side
- Back Contact structure is possible (R&D)
- Cell efficiency is at 26% in production

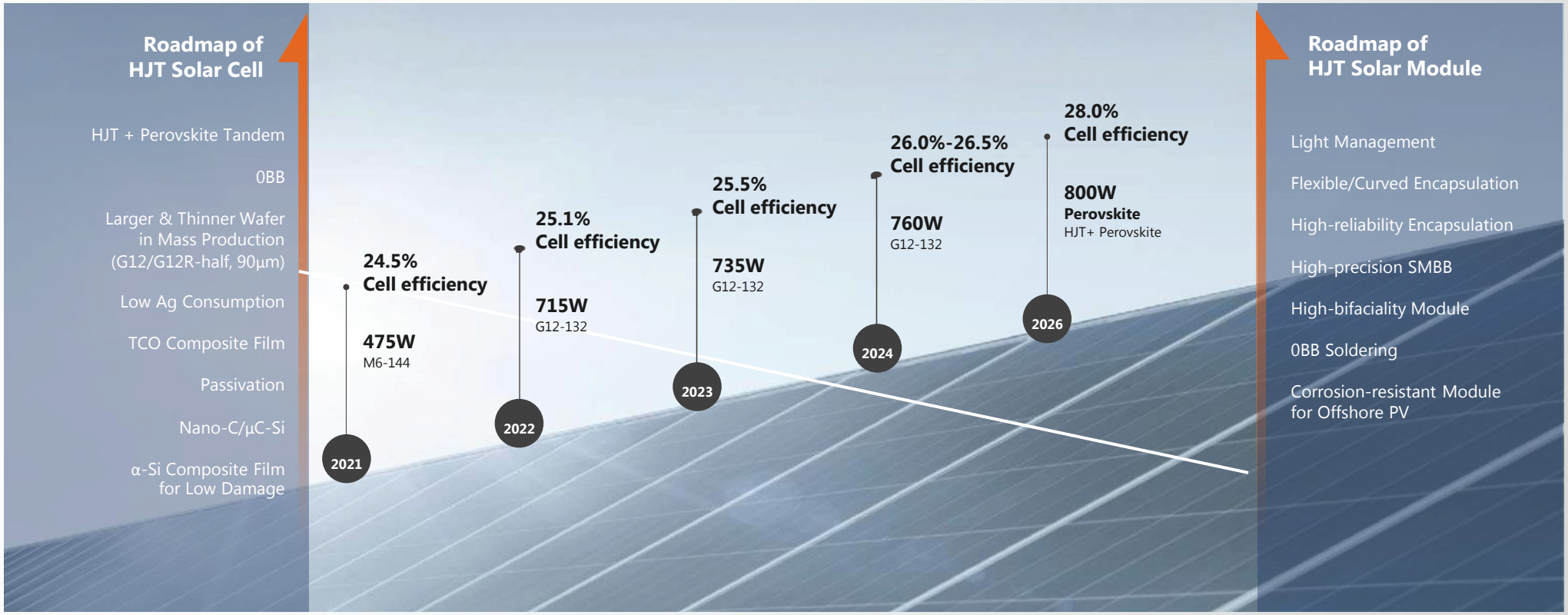
Cell Efficiency Past and Future

Technology leads the future

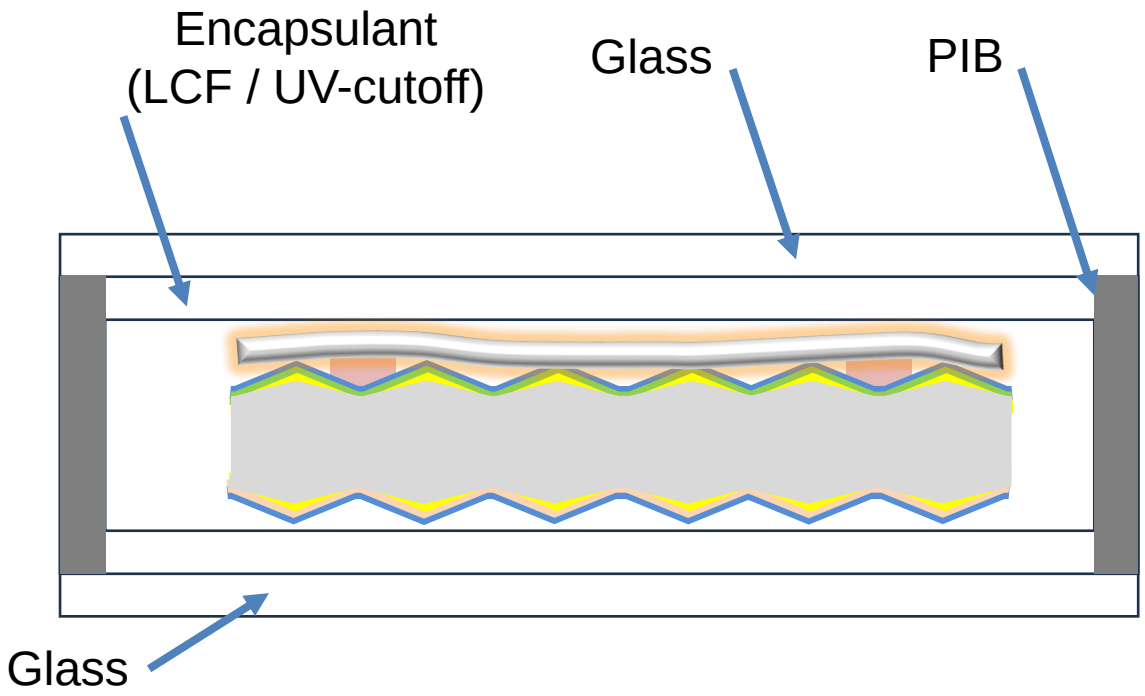
Huasun keeps striving to combine HJT with other advanced technologies, which allows us to realize the goal of raising efficiency while lowering product costs.

800W+

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



Structure of a HJT module - 2024



- PIB sealing against H_2O
- Encapsulant EVA/EPE with UV protection
- Junction-box level extra H_2O (POE/PIB)
- Limited amount of cells per diode < 24

Other manufacturers may have different structures

CONTENTS

Degradation and Failure modes for HJT

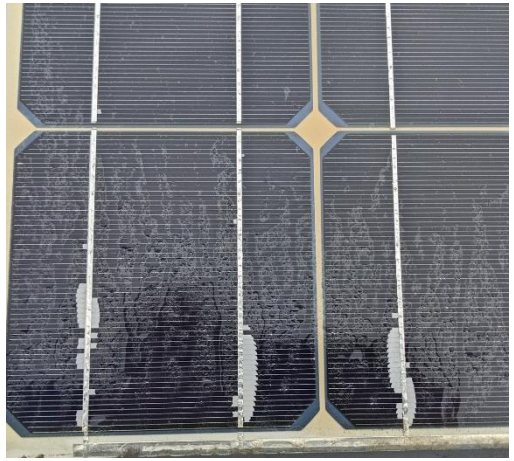
HISTORICALLY

- EVA yellowing
- Flux-excess Delamination
- Hotspot due to edge shunting
- H_2O Corrosion
- UV degradation
- PID (not same as PERC)
- H_2O delamination

RELEVANT FOR HJT 3.0

- Ingress of H_2O (cell degradation, corrosion)
- UV degradation
- Ribbon-busbar loss of electrical contact
- Hot Cells for more than 22 cells/diode
- PID (not same as PERC)

About historically relevant failure modes

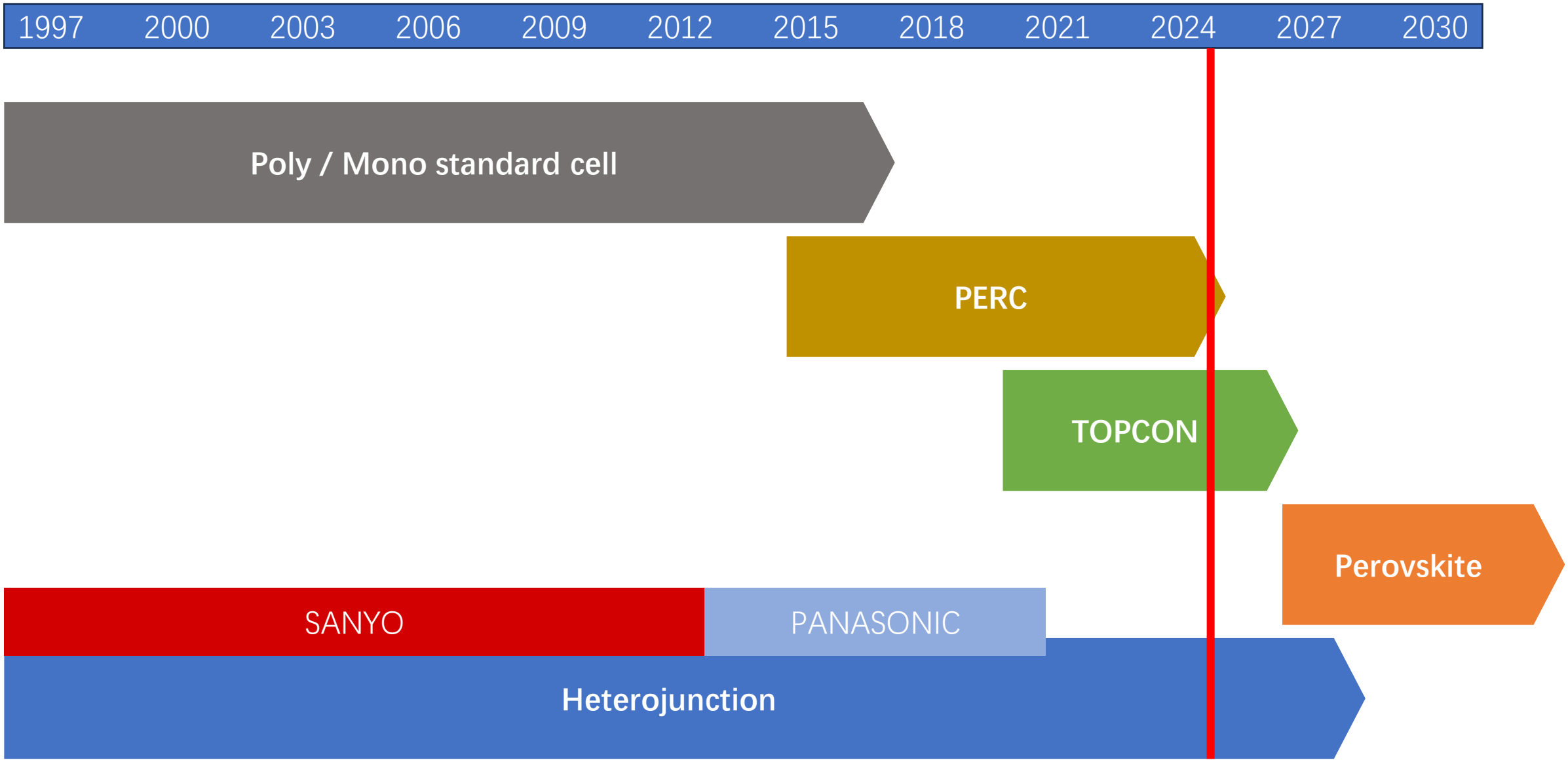


- HJT entered the market in **1997** in Japan
- EVA yellowing was found to not cause degradation over 5%
- Flux excess delamination was controlled pre 2010
- Edge shunting was controlled pre 2010
- Early glass-glass modules had H_2O based delamination
- UV degradation was controlled via additives to encapsulation
- EVA + Al Backsheet was a good protection vs. H_2O
- Backsheet damage led to isolation failures
- **By 2018, HIT® was a fully mature product**

With over 10 years sales:

<50 pcs/Mio warranty cases

HJT is the one truly field proven silicon technology today

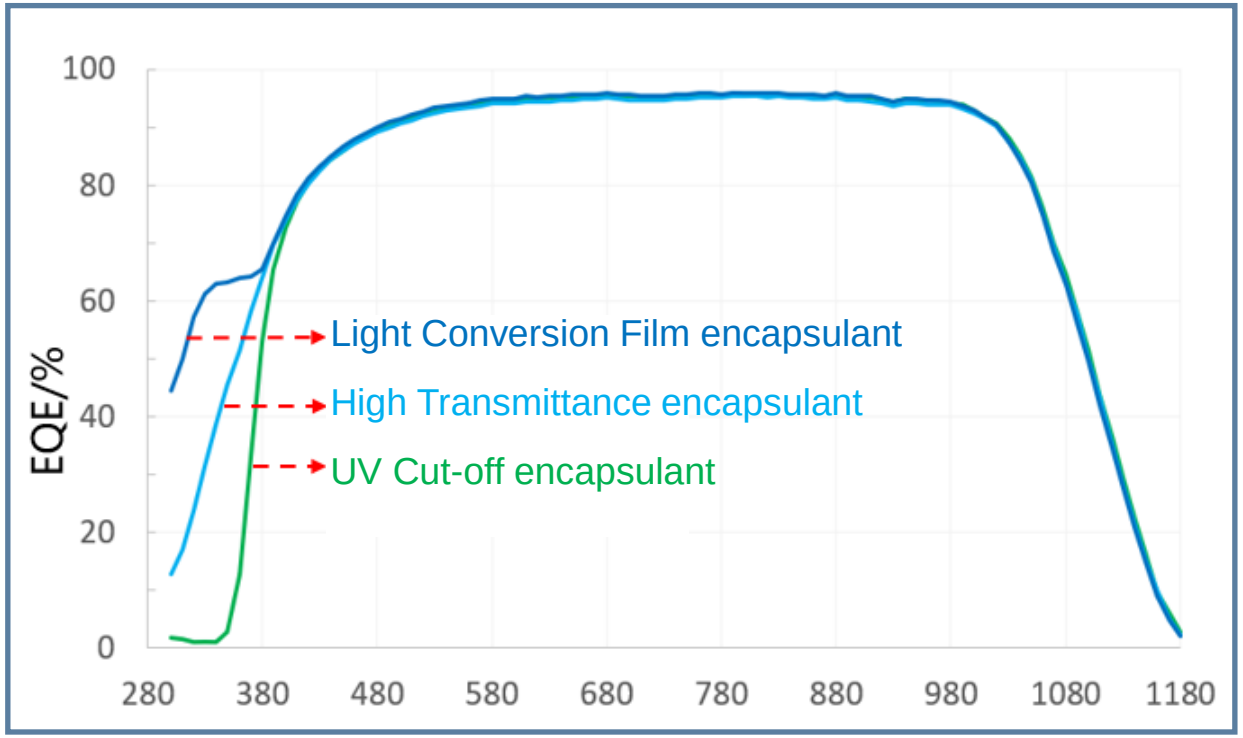


CONTENTS

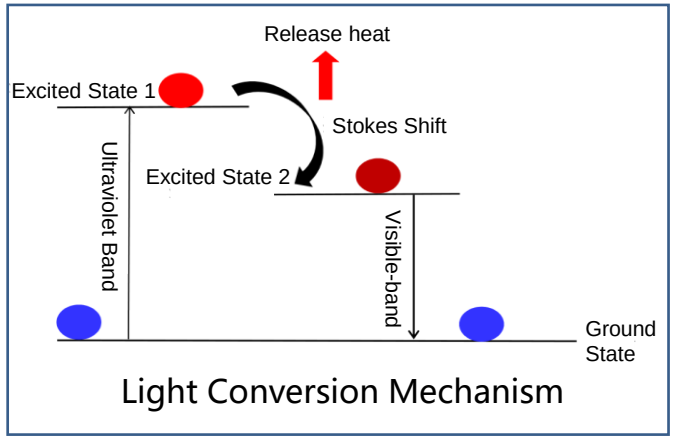
UV Degradation

UV protection - Light Conversion Film

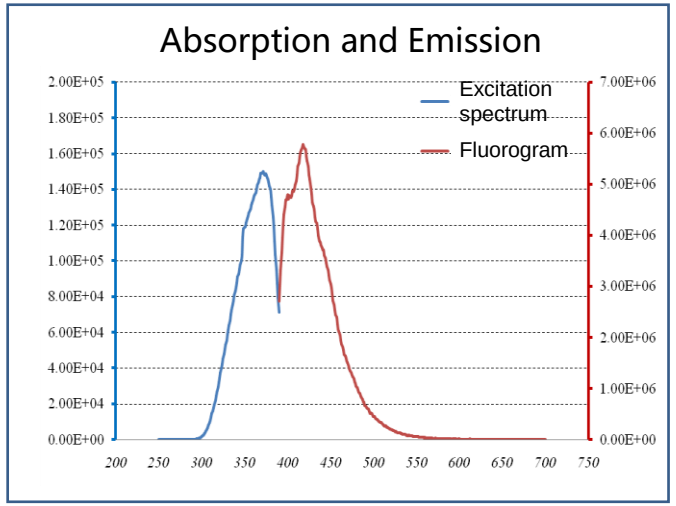
Encapsulant with LCF function changes the wavelength of the incoming light for the portion of spectrum in the UV range. This reduces the UV energy arriving to the cell.



EQE shows increased yield of LCF

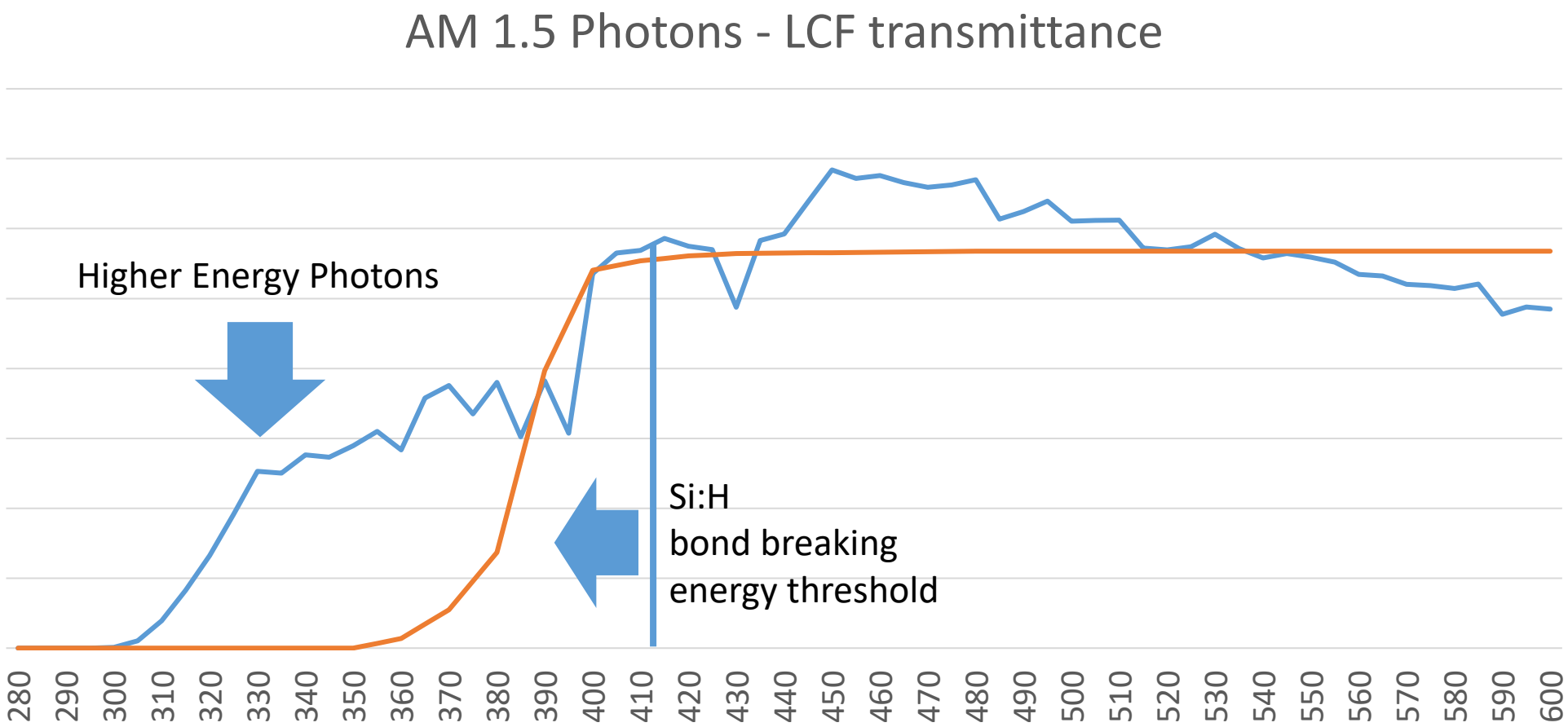


Light Conversion Mechanism



Source: Cybrid

UV degradation - Light Conversion Film Transmittance



Reminder: AM1.5 is just a reference spectrum for specific weather conditions

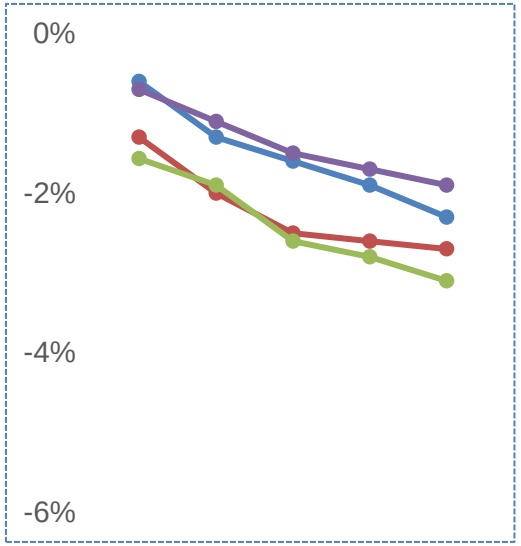
UV degradation - Lab and Real Field Data

Example from Japan (Osaka)

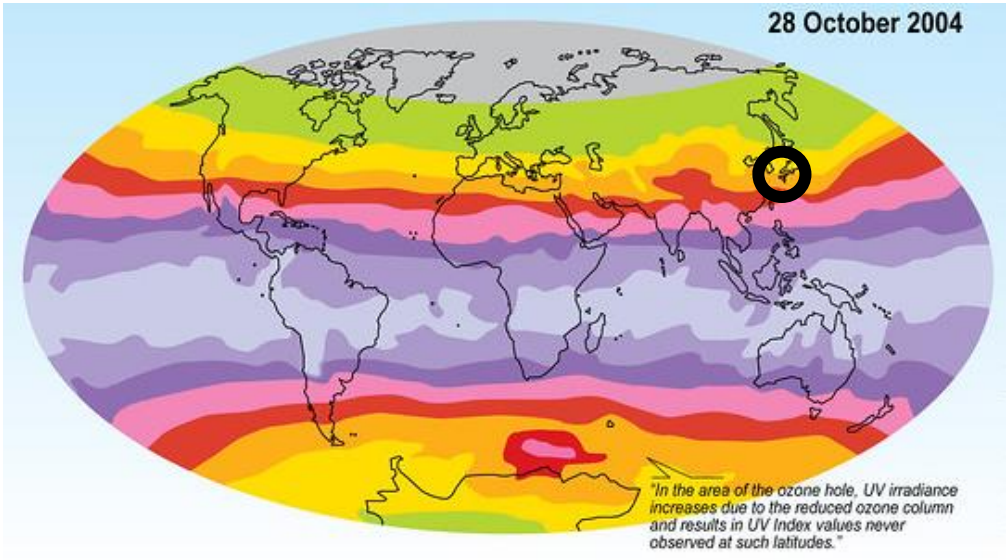
In 2014, customers in Osaka, Japan adopted Panasonic HJT optical conversion technology modules, with a **cumulative degradation of only 1.6% after more than 8 years of operation**. The PERC modules installed in 2022 experience a 2% degradation after 1 year of operation, which is greater than the degradation rate of the HJT modules after 8 years of operation.

Residential modules in Osaka, Japan (installed in 2014)

HUASUN UV Test in Laboratory



Accelerated Factor 5 @ UV180 < 3%



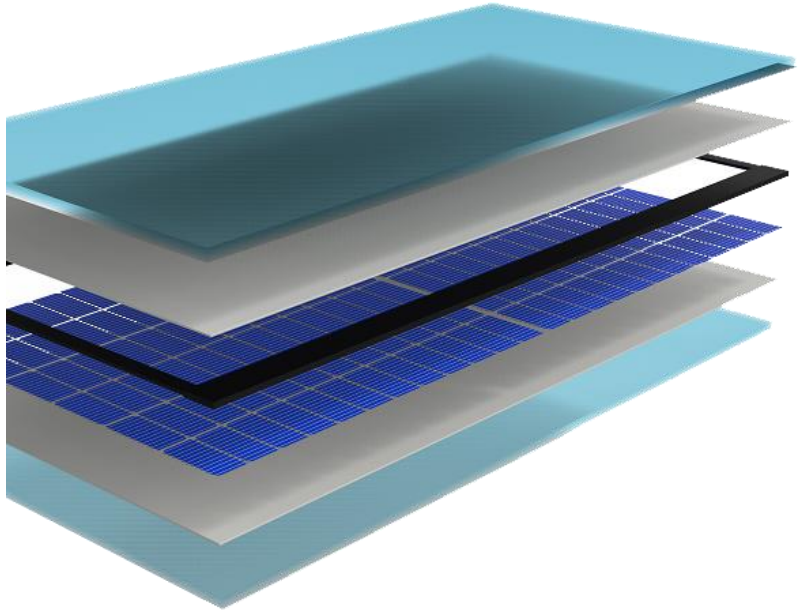
Source: GRID-Arendal, Emmanuelle Bournay

CONTENTS

Water Vapor Ingress

H2O degradation

- For n-type cell technologies (TOPCON / Heterojunction), there exists the risk of degradation caused by the **ingress of humidity** until reaching the cell (Natrium, Acetic Acid Corrosion, Other)
- Huasun uses **sealing of the module edges**, using a material (PIB) 100x better than the best current option (POE/EPE), in terms of resistance to water penetration
- We have run the tests (DH6000) that emulate a very hostile environment for the complete module lifetime, and they show **very low and stabilized degradation**
- We exclusively use **glass-glass**, eliminating additional backsheet risks (quality, ageing, scratches, etc)



100 times ↑

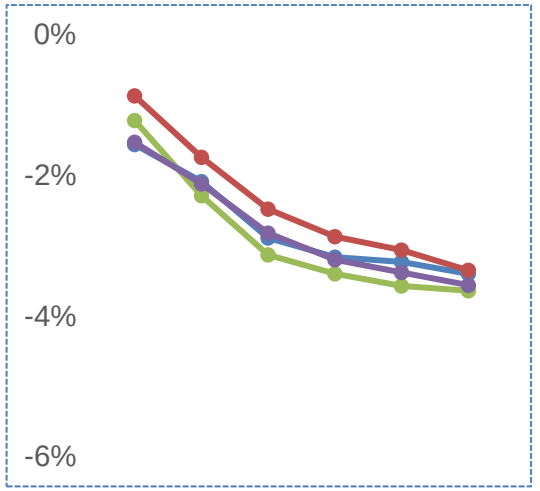
Water penetration resistance

Silicon penetration rate

30~50 g/m²•d

Butyl rubber penetration rate

< 0.3 g/m²•d



DH6000 power degradation < 4%

Reliability verification of the use of PIB

Using PIB to encapsulate cobalt chloride test paper samples, the vapor barrier edge performance is excellent during extreme DH test, and the water vapor permeation rate is slow.

Initial (0h)

DH 4500h

DH 6000h

Reliability verification of the use of PIB

Using PIB to encapsulate HJT3.0 microcrystalline cell sample, there are no abnormalities in EL (such as defect due to water) even after Hast 196h aging. Indicating that PIB can effectively protect the cell.

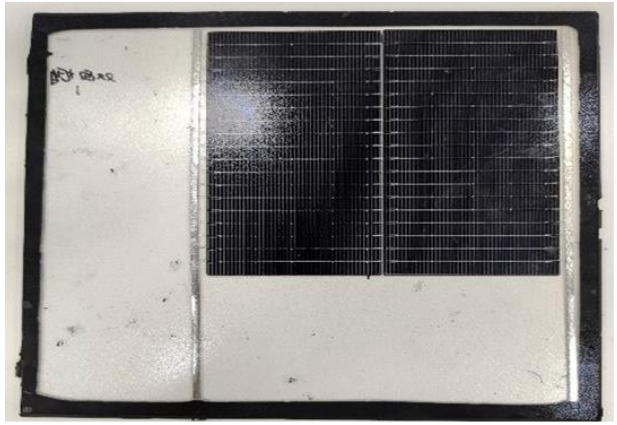
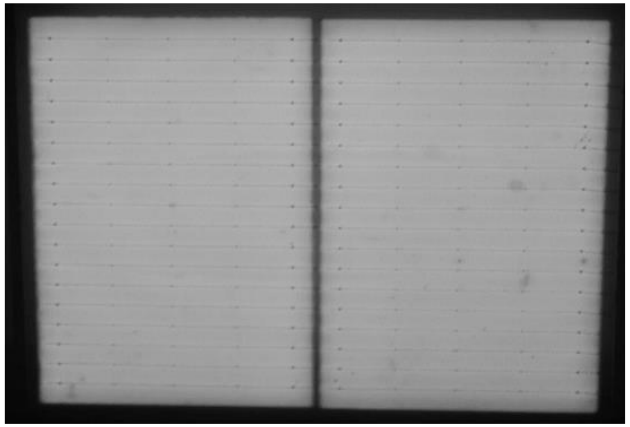
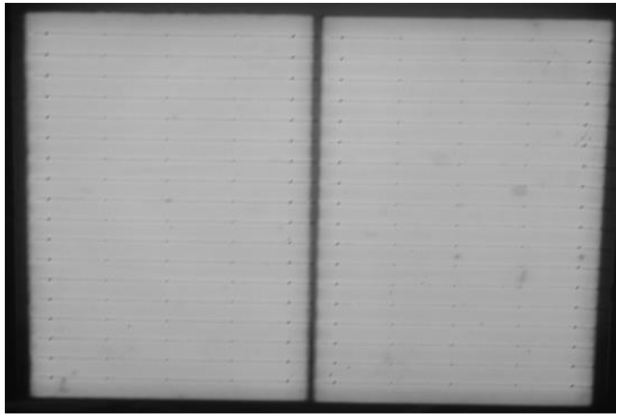


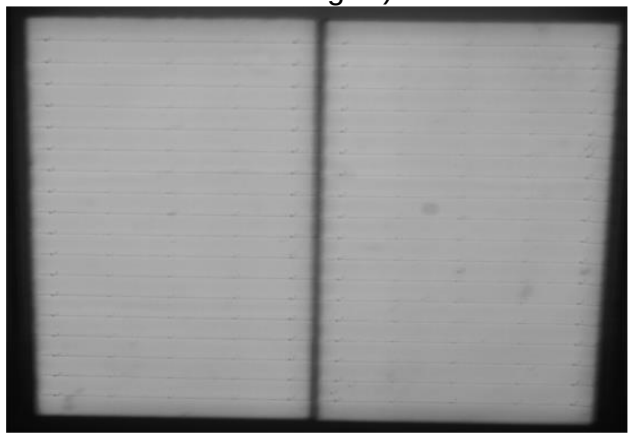
Photo of the sample under visible light.)



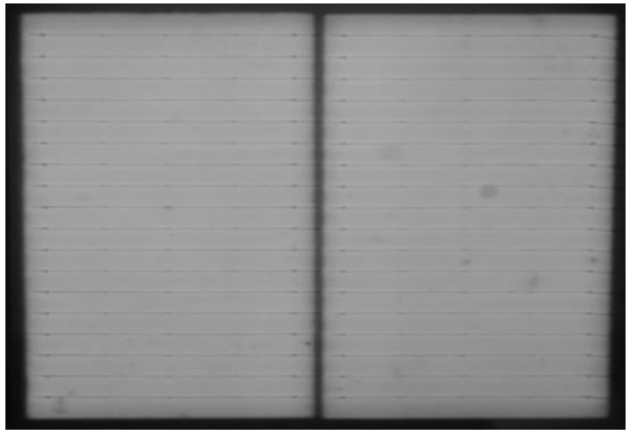
Initial (0h)



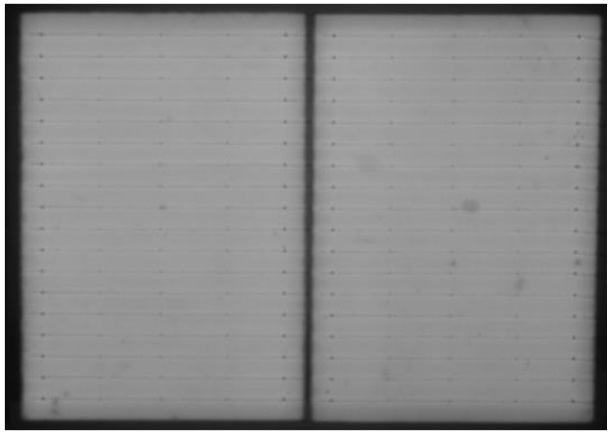
Hast 48h



Hast 96h



Hast 144h



Hast 196h

CONTENTS

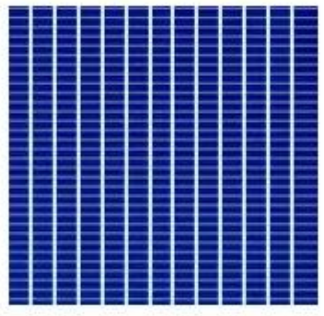
Testing new technology: Zero Busbar (0BB)

Reliability verification of new technologies in HJT: 0BB

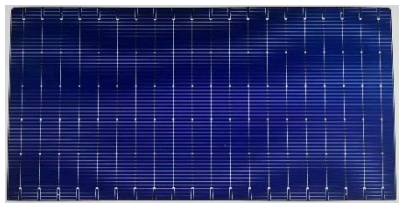
Evolution of Busbar Design for Solar Cells

2BB-6BB → MBB(9-15BB) → SMBB(≥16BB) → 0BB(No Busbar)

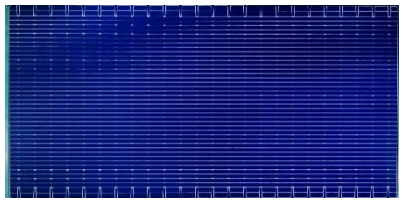
Flat Ribbon Welding



Round / Triangle Ribbon Welding



Round Wire Ribbon Welding Pads

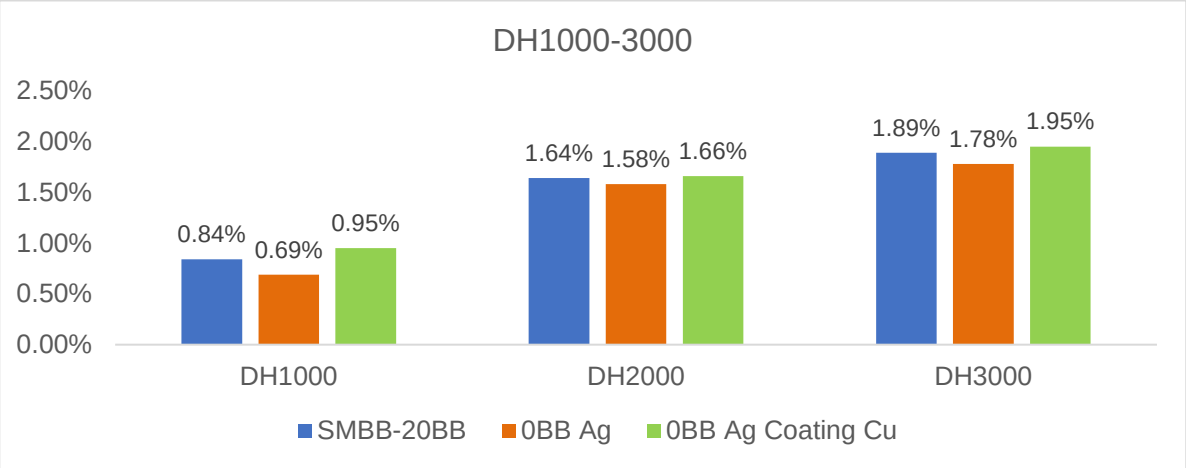


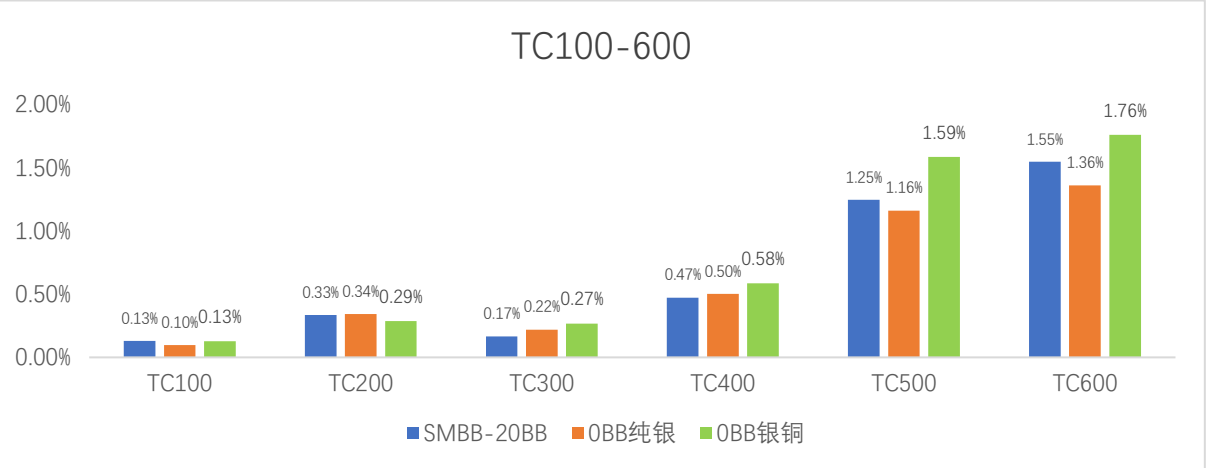
Round Thin Wire Ribbon No Welding Pads

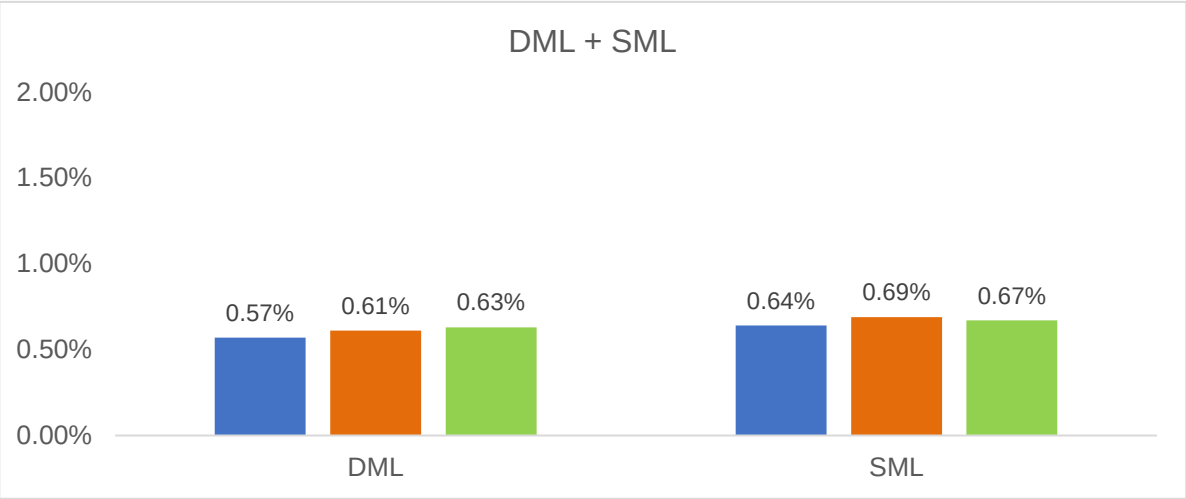
0BB hosts many advantages:

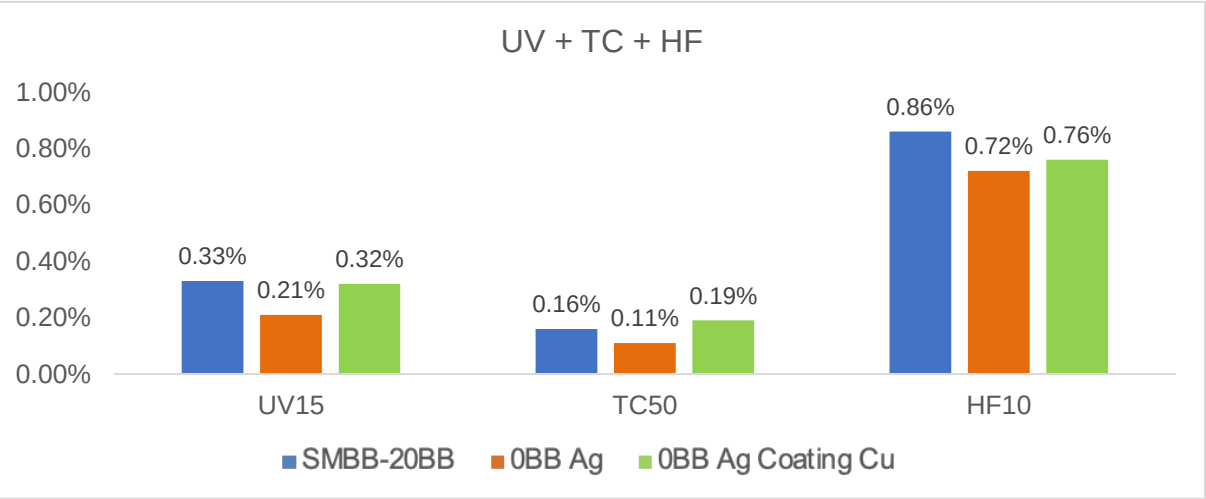
- It decreases the use of silver
- It improves cell electrical connection
- It removes pad soldering mechanical stress in production
- ...

Reliability verification of 0BB - thorough testing









CONTENTS

The situation today brings memories of 2021-2022

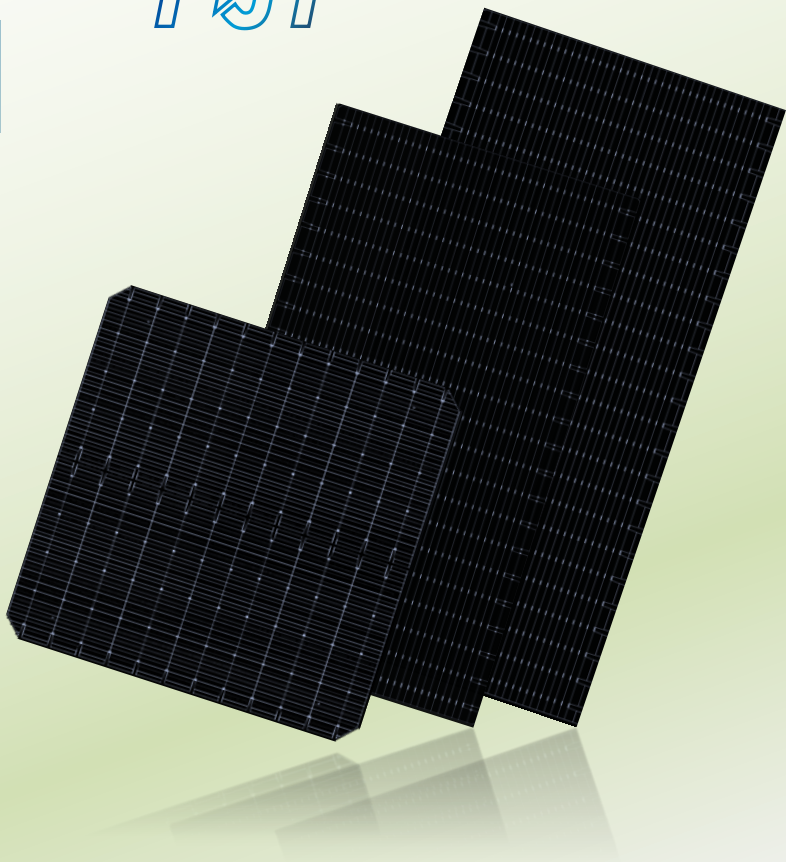
2022 → 2025

Technology	PERC	TOPCON	HUASUN
Efficiency	21.5%	22.5%	>23%
Bifaciality	70%	<80%	90% - 95%
Temp. Coeff.	Baseline	-15%	-29%
Yield	Baseline	+2%	+4%
Price 2024 (USDc FOB)	9.0	10.0	11.0

- Cost parity of Topcon and HJT is expected in 2025
- 95% bifaciality in modules produced for agrivoltaics
- Yield based on 100MW tracker system in Caceres, Spain

Heterojunction in 2024 and beyond

Latest Generation Tech



- HJT combines top performance with proven reliability
- HJT competes with Topcon in manufacturing cost
- HJT easily beats Topcon and Back Contact in yield per kWp
- HJT is the best platform for Tandem with Perovskite

Build a ZERO Carbon World

Intelligently Produce Clean Energy

Together Share The Warm Sunshine

www.huasunsolar.com

HEADQUARTERS

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

customerservice@huasunsolar.com

+86-563-3318095

SALES CENTER

14F, Kingmo Center, 1698 Shuanglong Blvd. , Jiangning District, Nanjing, Jiangsu, China

sales@huasunsolar.com

+86-25-86216170

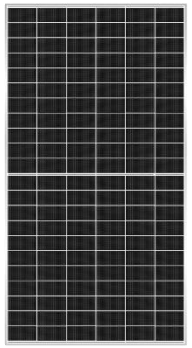
sales@huasunsolar.com

... Scenario 2028

< 0.10 USD/Wp

1997 2000 2003 2006 2009 2012 2015 2018 2021 2024 2027 2030

HUASUN



+145

875W

28.0%

Perovskite-HJT Tandem
(bifacial 90%) n-type

?

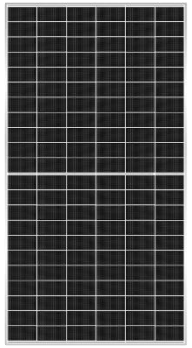
+30

780W

25.5%

BACK CONTACT Topcon
(bifacial 70%) n-type

?



+50

760W

24.5%

TOPCON
(bifacial 80%) n-type

Solartricity

Expertise you can Trust

HUASUN

Solartricity

Expertise you can Trust

HUASUN

Solartricity - Who Are We?

Founded in 2008 by Quentin Gargan

Quentin, a self-confessed "eco-loon" on renewables built a straw bale house powered by wind and solar in 2003 and had one of Ireland's first electric cars in 1998. He has helped to instill a passion in the team at Solartricity about the transition to renewable energy and away from reliance on fossil fuels.

The business has been designing and manufacturing microprocessor based controllers for renewable energy systems worldwide since 2008, with customers in diverse regions including: **Korea, Australia, USA, India, Falkland Islands, Mongolia, other EU countries and we expanded into the UK in 2024 .**

In 2014 we set up a solar division, using our experience gained elsewhere with a mission to provide excellent technical support and quality products, all at a competitive price.

Solartricity
Expertise you can Trust

HUASUN

Partnership With Huasun....

Why HJT?

- Point Of Difference to Competitors
- Evolution Of Solar Sector
- Improved Performance
- Increased Options For Clients

Why Huasun?

- Diligent Selection Process
- Largest Manufacturer In The World
- Investment into R&D
- Collaborative Approach

Solartricity
Expertise you can Trust

HUASUN

Progress....

Launched August 2023

Timing - Challenging Market Conditions

Market - Initially 80/85% Domestic

Commercial Interest Increasing - Agriculture

Currently Selling 1.5 Containers Per Week of the 435W Himalayan

Progressing to 440W and 445W Later This Year

Projected to sell 32,000 Huasun Panels in 2024

Sell With our TreeSystem® GROUND MOUNTINGS Ground Mount - Bi-Faciality/Parasitic Capacitence

Solartricity
Expertise you can Trust

HUASUN

Challenges.....

New Product & Technology

Industry Turbulance

New Brand To Irish & UK Market

Change Management

Competition - Cut through the noise

Comparatively Complex Product

Solartricity

Expertise you can Trust

HUASUN

How....


Clear and Defined Strategy and Expectations


Patience - Allowing The Market Opportunity To Adjust and Adapt


Multi-Channel Marketing Approach - Customer Journey


Mitigate The Complexity - Benefits Not Features


Adding Value and Trust via Additional Services & Warranties


Adopt Advocates & Market Influencers


Hand-Hold Installers


Collaboration - Webinars/Exhibitions


Consideration of the End User - My Customers, Customer

Solartricity
Expertise you can Trust

HUASUN

this webinar is powered by
Huasun

pv magazine webinars

21 August 2024

10:00 am – 11:00 am | CEST, Berlin, Madrid
1:30 pm – 2:30 am | IST, Delhi
6:00 pm – 7:00 pm | AEST, Sydney

Market impacts of high efficiency HJT

Q&A

Mark Hutchins
Magazine Director
pv magazine

Christian Comes
Director of Business Development Europe
Huasun

Chris Williams
UK Sales Manager at Renewables wholesaler
Solartricity

pv magazine webinars

The latest news | print & online

10% off
your subscription
with
Webinars10

Most-read online!

LG launches two new residential air-to-water propane heat pumps

by Emiliano Bellini

Dutch manufacturer unveils gel lead-acid battery for residential us

by Tristan Rayner

pv magazine webinars

Coming up next...

Thursday, 22 August 2024
11:00 am – 12:00 pm EDT, New York City
5:00 pm – 6:00 pm CEST, Berlin, Paris, Madrid

Avoiding costly risks for solar assets

Tuesday, 27 August 2024
1:00 pm – 2:00 pm BST, London
2:00 pm – 3:00 pm CEST, Berlin, Paris, Madrid

Reliable, safe and flexible storage assets for the residential segment

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
Magazine Director
pv magazine

Thank you for joining today!