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Strengthening Supply Chains: Exploring Domestic and Global Opportunities for Resilient Procurement

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Head, R&D Center of SEG Solar

SEG SOLAR BORN AND RAISED IN THE USA



WHO IS SEG?



About SEG Solar

U.S.-owned company

100%

Founded in

2021

Global headquarters in

HOUSTON, TEXAS

Module Capacity

6GW

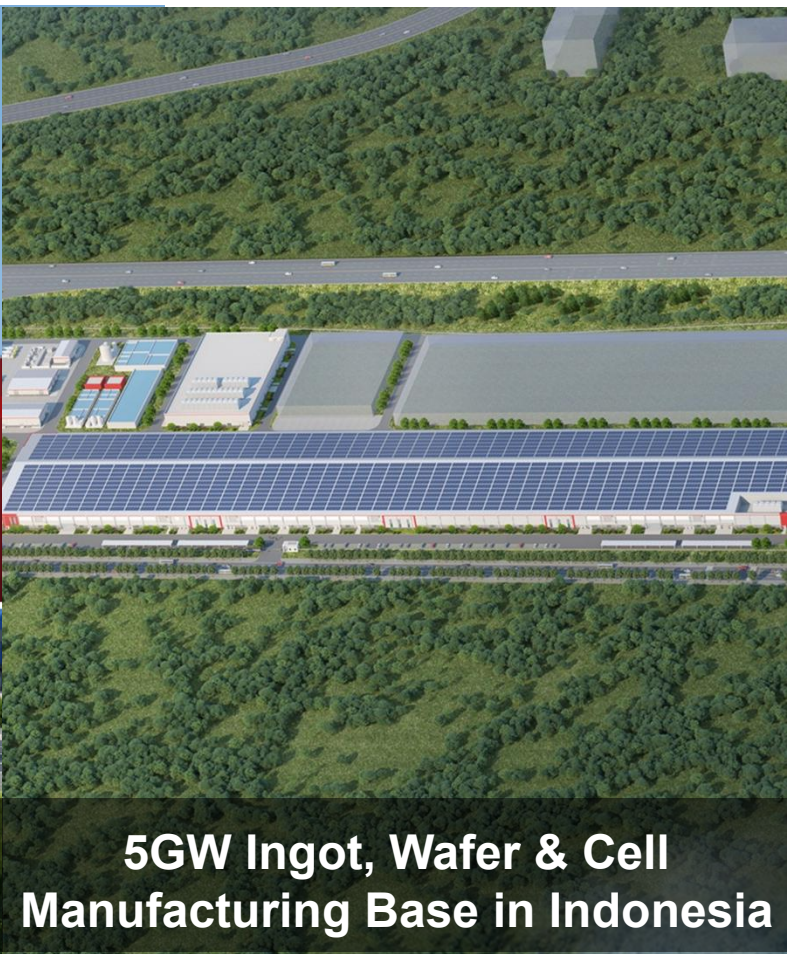
Cell Capacity

5GW





What will we do in 2026





SEG Strategic Roadmap

1. U.S. Localized Manufacturing
2. Vertical Integration and Expansion
3. R&D-Driven Differentiation





First U.S. Manufacturing Base

\$60 Million

Total Investment

250,000SF

Manufacturing and Warehouse Space

2GW

Module Capacity

500+

New Local Jobs





Strike While The Iron Is Hot

Path To Becoming the Largest U.S. Crystalline Module Manufacturer



\$200 Million

Total Investment

500,000 SF

Total Site Area

4GW

Module Capacity

HJT

PV Modules

800+

New Local Jobs



Everything is bigger in Texas

The Largest U.S. Crystalline Module Manufacturer



1,150,000SF

Total Site Area

HJT

PV Modules

4.6 GW

Module Capacity

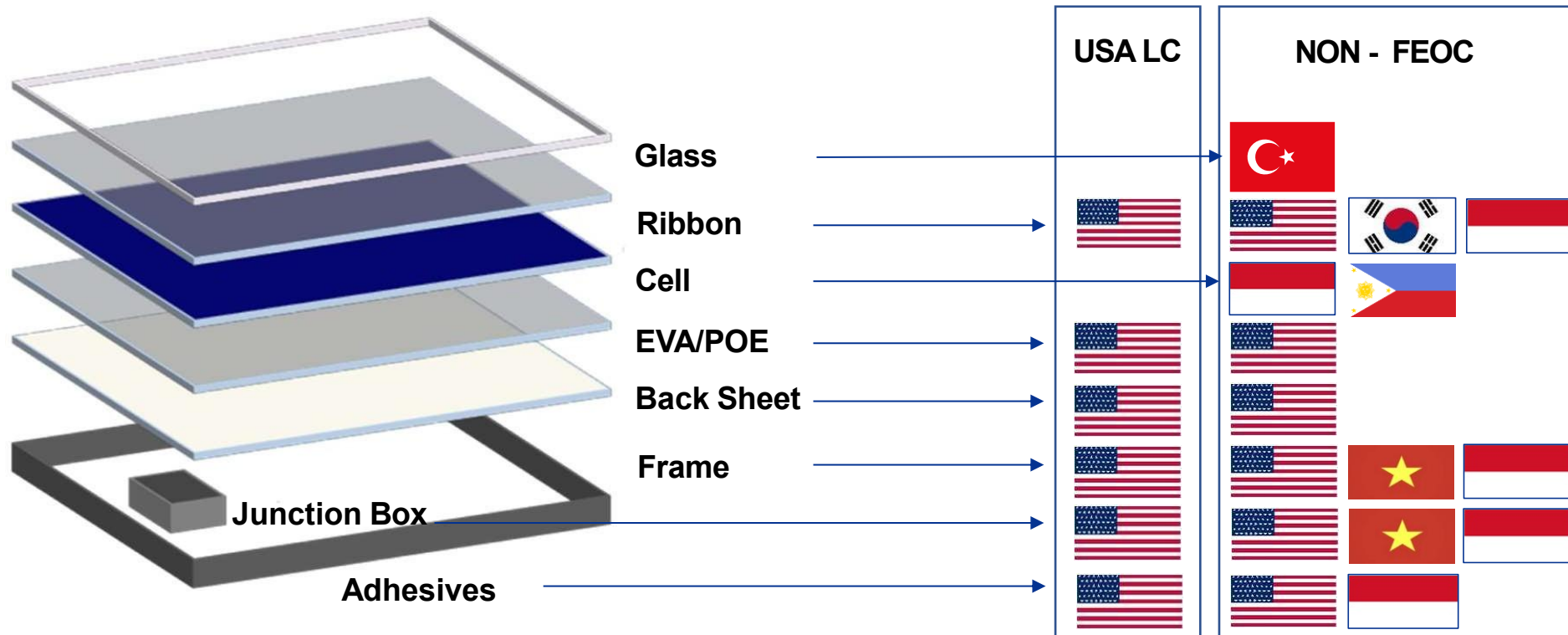
10.6 GW

Annual Module Capacity



SEG Achieves Non-FEOC Compliance

SEG has achieved **over 50%** compliance with OBBBA's Non-FEOC requirements, ensuring alignment with U.S. policy standards, and will continue to increase this share while guaranteeing ongoing full compliance.





Key Insights & Experience Sharing



**Talent
Development**



**Technology
Accumulation**



**Management
Experience**

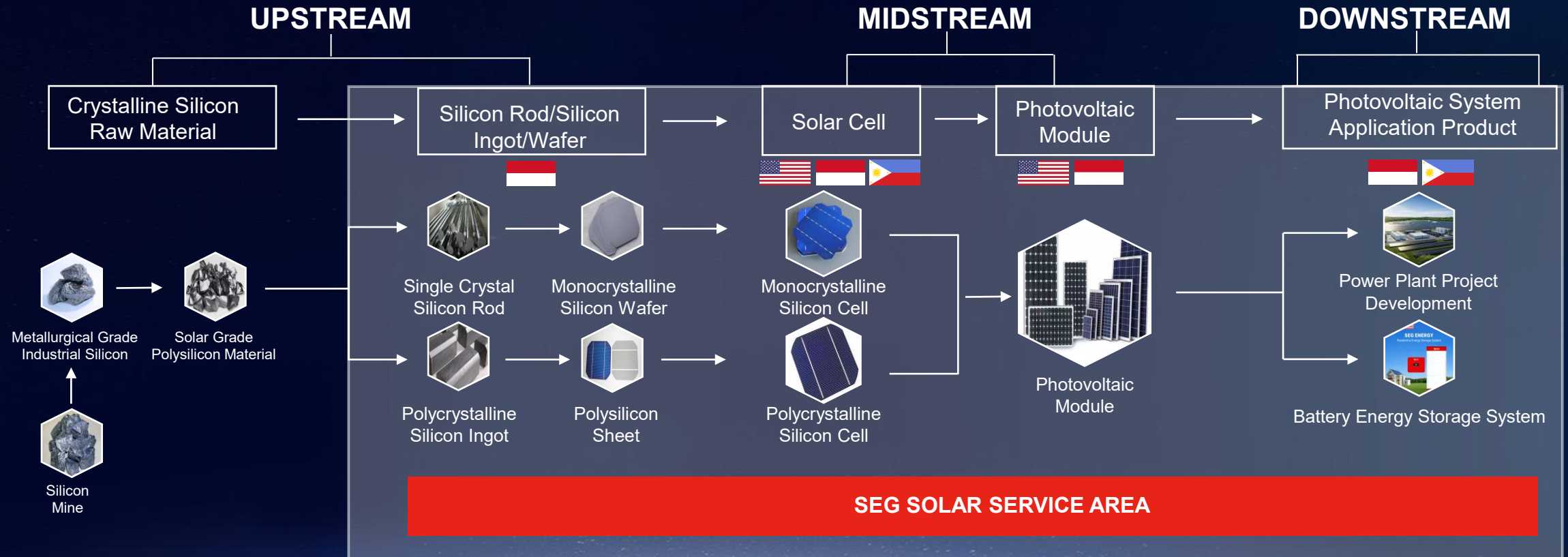


Vertical Integration and Expansion





Fully Integrated Photovoltaic Supply Chain





SEG Solar Global Supply Center

The Largest Integrated Solar PV Industrial Park in Southeast Asia



\$500 Million

Total Investment

105 Acres

Total Site Area

5GW

Ingot Capacity

5GW

Wafer Capacity

5GW

Cell Capacity

3000+

New Local Jobs



HJT Technology Strategy at SEG Solar

Quality first. Innovation always

Dr. Shehroz (Zack)
Head, SEG Global PV Research Institute (SPRI)



Why SEG Choose HJT?

Indicator	TOPCon	BC	HJT (SEG)
Cell Mass Production Efficiency	25.5%–26%	26%–27%	25.8%–26.2%
Module Efficiency	23.8%–24.8%	25%–25.6%	23.8%–24.8%
Temperature Coefficient	-0.30%/°C (approx)	-0.26%/°C (approx)	-0.24%/°C (lowest)
Bifaciality	85% (82% standard)	75% (HPBC 2.0 up to 85%)	90%±5% (Best)
CTM Loss	2%	3%	1.5% (lowest)
Ag Consumption	9.0 mg/W	11.92 mg/W (highest)	5.5 mg/W (lowest)
Process Steps	10	8	4
Process Temperature	1000°C	Depends on Route	200°C (lowest)
Low Water Consumption	554 t/MW	623 t/MW	218 t/MW
Low Electricity Consumption	52000 kWh/MW	64000 kWh/MW	44000 kWh/MW

HTJ Supplement

- Low Carbon Footprint: **HJT 301.0 kg CO₂/kWc**, Green benchmark **395 CO₂/kWc**
- High specific power (~2 W/g) due to ultra-thin wafers
- Better radiation tolerance

SEG HJT Roadmap (2026-2030)

HJT-S1.0

23.82%
740W+

2026

HJT-S2.0

0BB+1/3 cut-cells

≥ 24.5%
765W+

2027

≥ 25.20%
785W+

2028

HJT-S3.0

HBC & Tandem

≥ 25.85%
810W+

2029

≥ 27.40%
860W+

2030

- Module Eff(%)
- Module Power(W)

Key R&D Focus Areas: Technical Deep Dive

1

Advanced metallization: the pathway to Ag-free.

- 0BB architecture. 20%–30% Ag-coated Cu paste in production. (Ag Content 6%–10%, ~5mg/W.)
- Pilot qualification for pure Cu paste by PTP.
- Cu electroplating pilot & Cu screen printing Ag-free production.

2

Ultra-thin wafers & edge engineering.

- 110–130 μ m SEG BSL; 65 μ m capability validated.
- 100 μ m in production (till 2027) & 80–90 μ m in volume production (2028).
- Key challenge: recombination loss at cut edges increases as wafer thickness decreases. SEG R&D is exploring edge passivation methods to recover 0.2–0.4% abs efficiency.

3

Low UVID at Cell & Module Level.

- Optimized PECVD process to lower UVID from 1.59% to 0.71% at the cell level.
- UV-DS (380-420nm) films increase the Jsc 36.1mA/cm², expected to increase module power by 8-10W.
- Use of Photonic Crystals (PC) increases the HJT cell efficiency 0.192% abs.

Relation between UV power, time and temperature

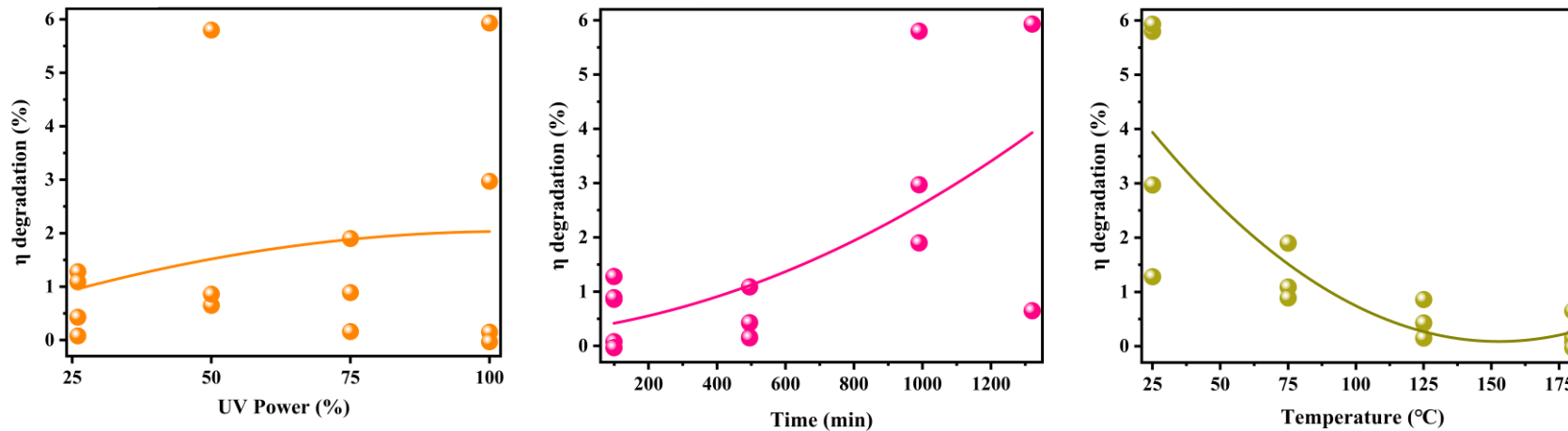


Figure. 1. Relationship between UV power and Time, and Influence of UV power, time and temperature on Eff degradation

- Houston receives ≈ 2584 h/year with an average summer $T = 34^{\circ}\text{C}$.
- Like Las Vegas, Phoenix experiences higher sunshine hours, exceeding 3890 h/year, $T = 34^{\circ}\text{C}$ to 42°C .
- These regions are characterized by elevated levels of UV radiation and temperatures.
- Fig.(a)-Increasing UV power causes slight efficiency degradation but with significant data variations.
- Fig.(b)-Indicates that longer exposure time results in higher efficiency degradation, following a nonlinear increasing pattern.
- Fig.(c)-Degradation is more severe at lower temperatures and decreases as the temperature increases, indicating thermal recovery effects.

UVID in HJT Modules: Mitigation Strategies

1 Encapsulation Strategy I: UV-Cutoff Films

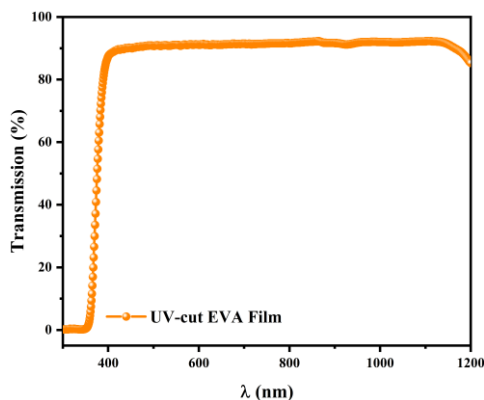


Fig 1. Transmission spectrum of UV-cut (350nm) encapsulation films

2 Encapsulation Strategy II: UV-Downshifting

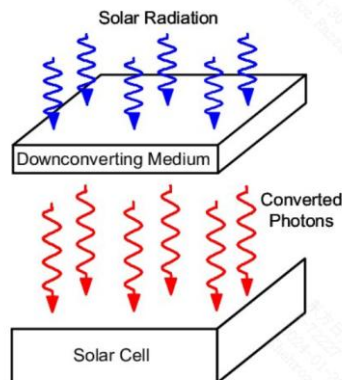


Fig 2. Downshifting materials on SHJ solar cells (380nm to 420nm)

3 Cell-Level Optimization I: Intrinsic & Doped layers

- ☐ Suitable H content is i1 & i2 layers
- ☐ Heavily doped n-type layers exhibit 63.3% Teff loss after UV60
- ☐ Total (C+O) content in selective layers correlates linearly with UVID

Approach: Reduce crystallinity & dope moderately, maintain passivation while gaining UV tolerance

4 Recovery Strategies

- ☐ Light soaking can partially restore performance
- ☐ High-temperature environment is beneficial



SEG Global Collaborations



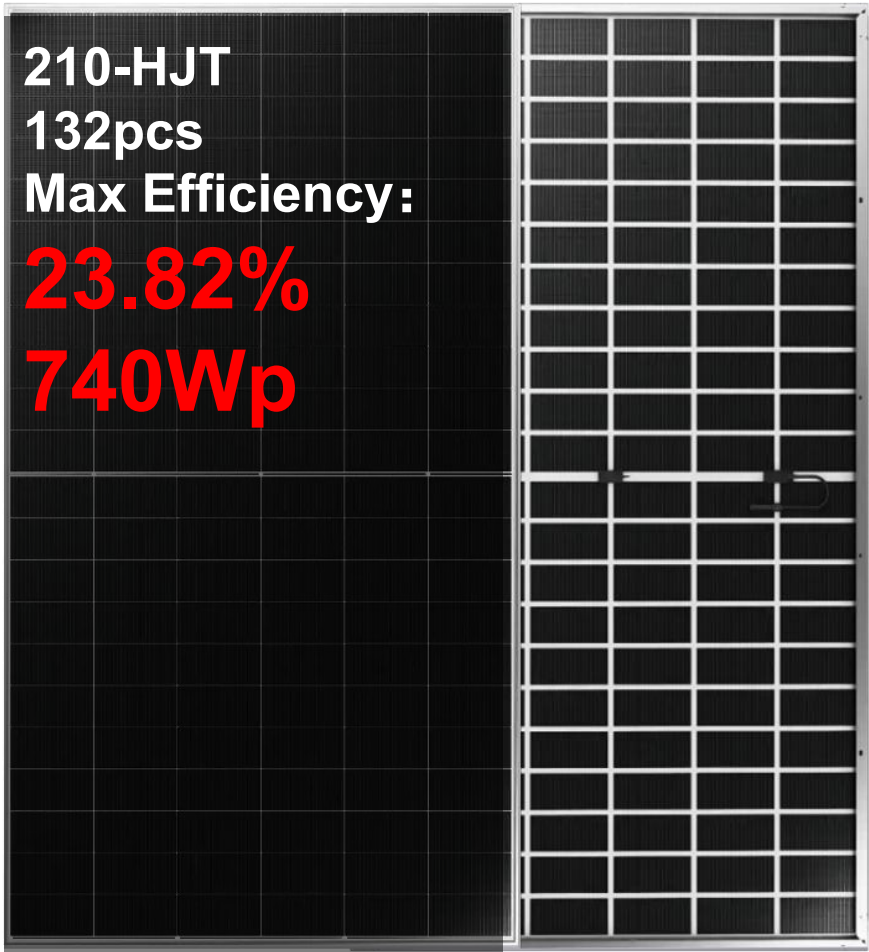
SEG is open to research collaborations with universities and labs worldwide to accelerate the transition toward green energy and reduce carbon footprint.



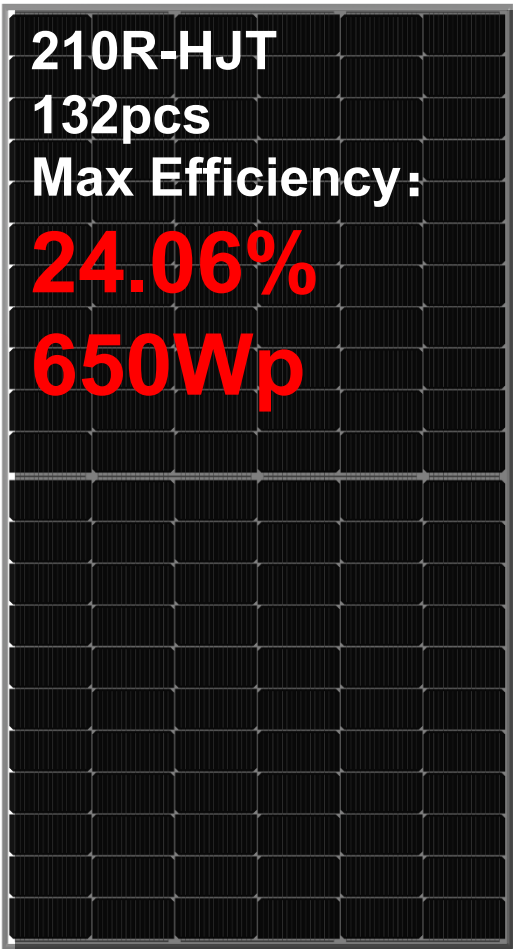


The Future Starts with HJT

SIERRA N Series



SEG-BHC-BG
720-740Wp



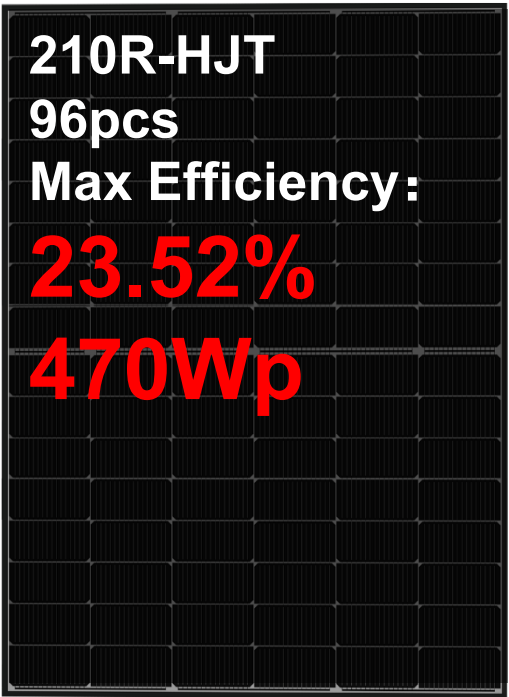
SEG-BHC-BG
630-650Wp

90±5%

Bifaciality

-0.24%/°C

Temperature Coefficient



SEG-BHE-BG
445-470Wp



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CREATING A SUSTAINABLE FUTURE FOR THE NEXT GENERATION



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