Astronergy Product Introduction

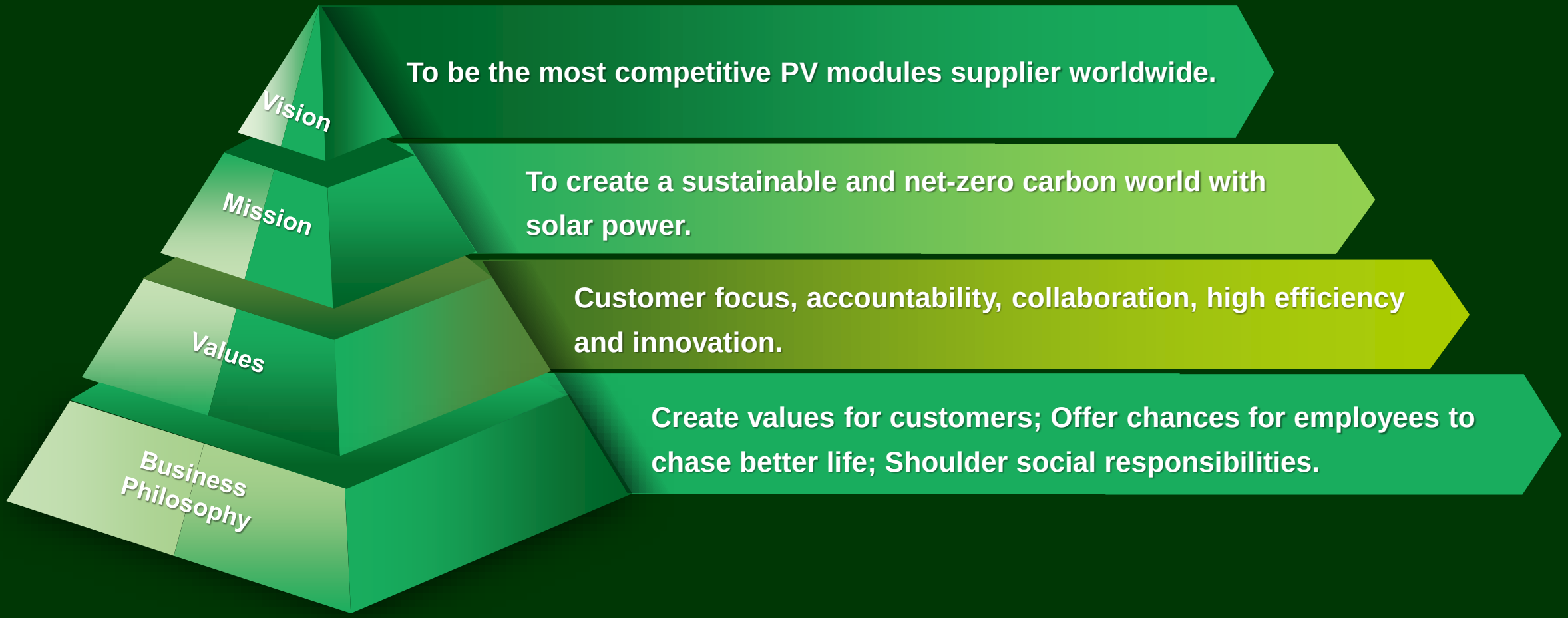
ASTRONERGY

Global Technical Service

20/11/2023

CONTENT

OUR POSITIONING



MILESTONES

ASTRONERGY

2006 — **Astronergy was founded**

2007 — Mass production of crystalline silicon (c-Si) cell started

2008 — Production capacity of c-Si modules reached 100MW

2012 — Module production line in **Jiuquan Manufacturing Base** was completed

2015 — **Haining Manufacturing Base** was established

2016 — Intelligent factory in Hangzhou was put into operation

Thailand Manufacturing Base started module production

2018 — The renamed product brand (ASTRO) was officially launched

Total Global Shipments reach 3GW

2020 — Mass production efficiency of high-efficiency bifacial PERC cell reached a new peak

2021 — **Yancheng Manufacturing Base**'s first module rolled off the assembly line

2022 — **ASTRO N series n-type TOPCon modules were launched globally**

CHINT GROUP & ASTRONERGY

About CHINT Group

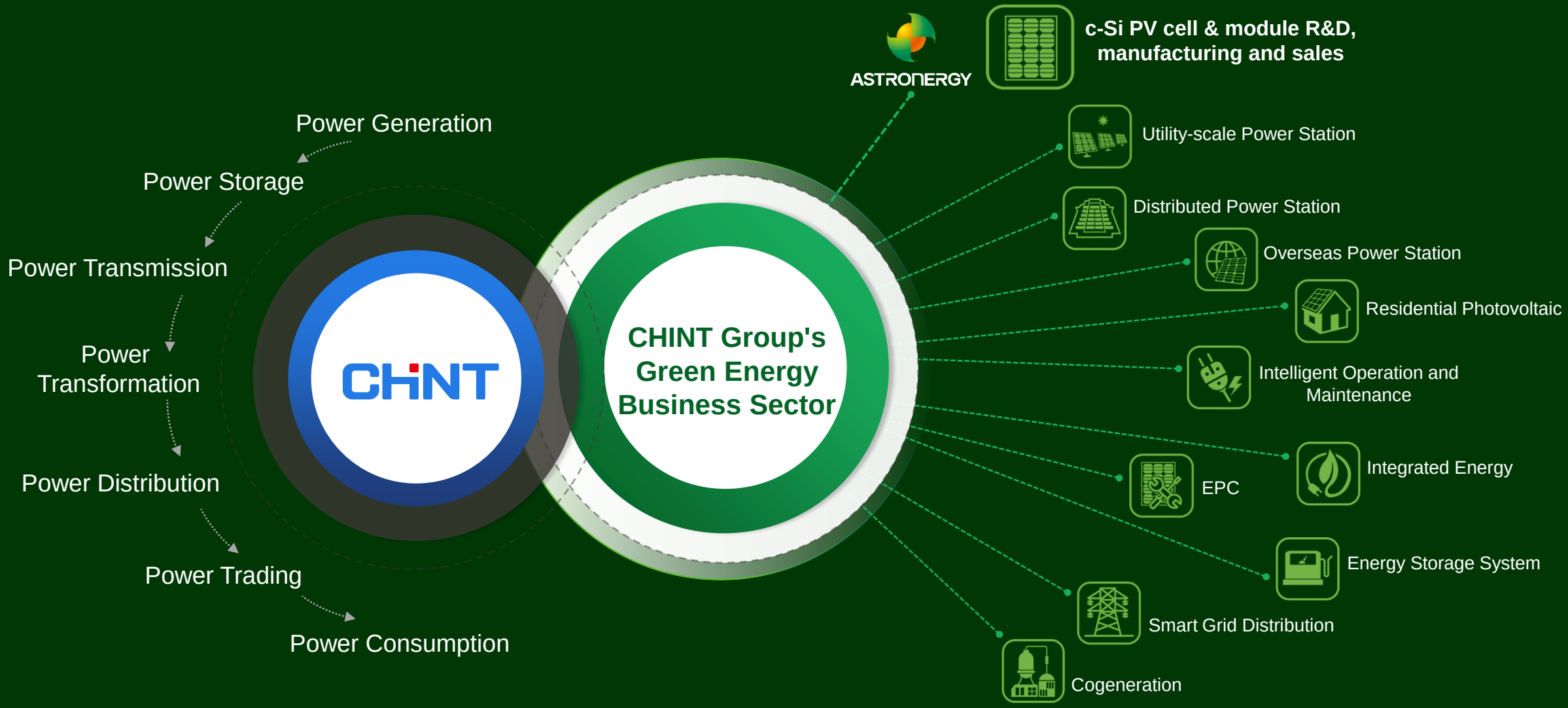
Founded in 1984, CHINT Group Co., Ltd. (hereinafter referred to as "CHINT") is a global leading smart energy solutions provider. Over the past 39 years since its establishment, CHINT has always focused on industry and brand building, deeply implemented the strategy of "Industrialization, Technologization, Internationalization, Digitalization and Platformization", and formed three major segments of "Green Energy, Intelligent Electric and Smart Low-carbon" and two major platforms of "CHINT International Platform and Sci-tech Innovation Incubation Platform", with its business covering more than 140 countries and regions and employees of more than 40,000 worldwide.

About Astronergy

Focusing on PV cells and modules, Astronergy is an intelligent manufacturing company under CHINT Group, with its photovoltaic business started from 2006. Astronergy is committed to the R&D, production and sales of high quality, high performance and high efficiency crystalline silicon solar cells and modules, and has been a pioneer in n-type TOPCon PV modules.

THE ENTIRE INDUSTRY CHAIN

ASTRONERGY



To create a sustainable and net-zero carbon world with solar power

KEY FIGURES

ASTRONERGY

18.34 Billion USD
2022 CHINT Group Revenue

45000+
Employees Worldwide

140+
Countries and Regions Where Businesses Cover

3.02 Billion USD
PV Modules Revenue in 2022

TOP 6*
2023 H1 PV Modules Shipments among All Suppliers Worldwide

20 GW
2022 PV Modules Production Capacity Worldwide

11 GW
Cumulative Capacity of PV Power Stations Owned by CHINT Group

8.3 Million Tons
CO_2 Emissions Reduced per Year

8.3 Billion kWh
Green Electricity Provided for the Whole Society per Year

To create a sustainable and net-zero carbon world with solar power

Source: Infolink

HONORS

ASTRONERGY

No. 1 in " **China's Top 100 Private Enterprises in Social Responsibility"** in 2021

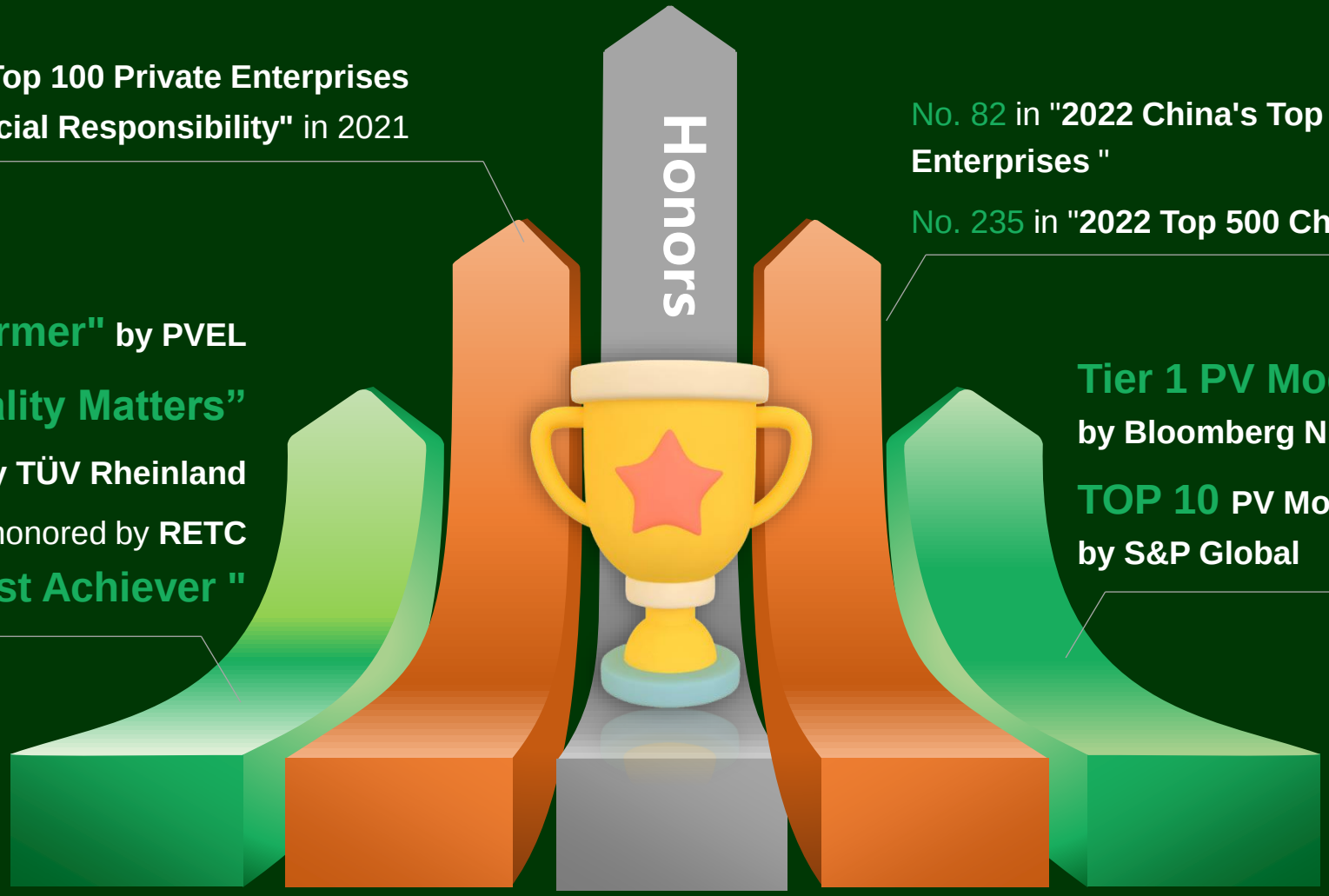
7x **"TOP Performer" by PVEL**

4x **"All Quality Matters"**

by TÜV Rheinland

Astro N-Series has been honored by **RETC**

" 2023 Overall Highest Achiever "



No. 82 in "**2022 China's Top 500 Private Enterprises** "

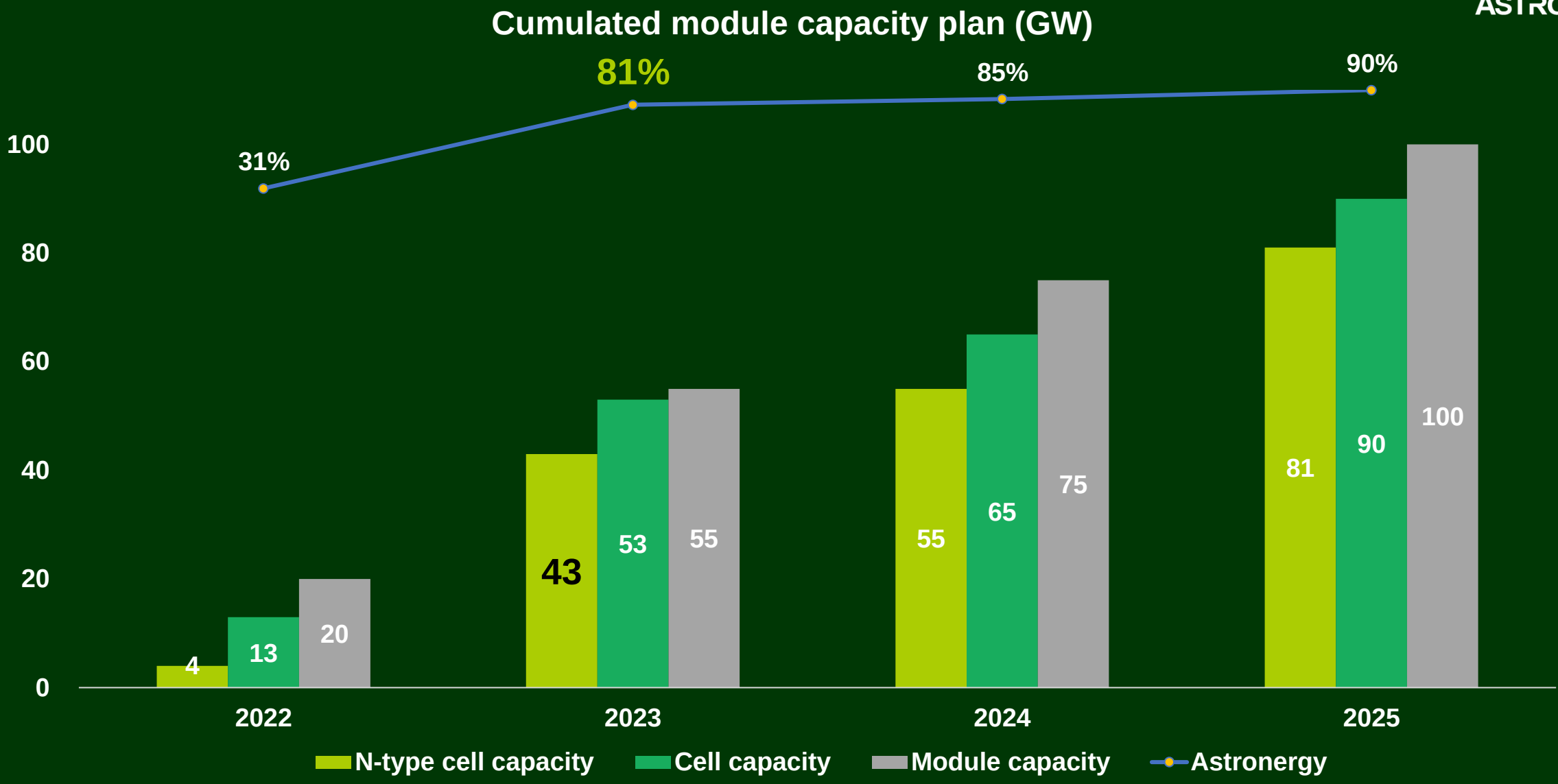
No. 235 in "**2022 Top 500 Chinese Enterprises**"

Tier 1 PV Module Manufacturers by Bloomberg NEF Q2,2023

TOP 10 PV Modules Suppliers released by S&P Global

CONTENT

Astronergy Capacity Layout Planning



GLOBAL PRESENCE

ASTRONERGY

60 GW+
Total Global Shipments

140+
Countries

Global Headquarters
Global R&D Center
Global Sales Offices
Global Manufacturing Bases (mass production)
Global Sales Channels
Global Manufacturing Bases (under construction)

Haining, HQ
R&D, MFG Center

Manufacturing Base In Yancheng

Manufacturing Base In Jiuquan

Manufacturing Base in Thailand

To create a sustainable and net-zero carbon world with solar power

Astronergy Manufacturing Sites

ASTRONERGY

Hangzhou

Wenzhou

2

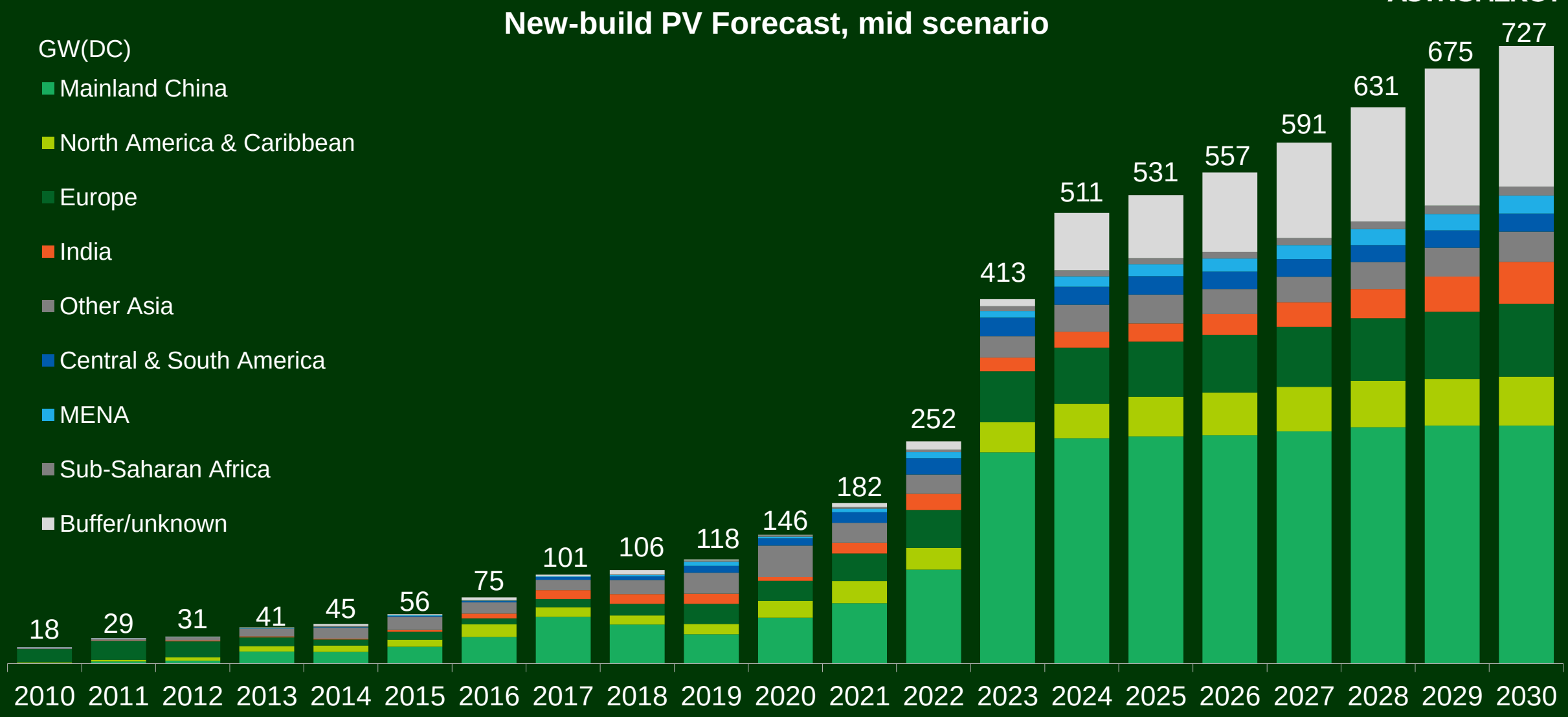
Under Construction

8

In operation

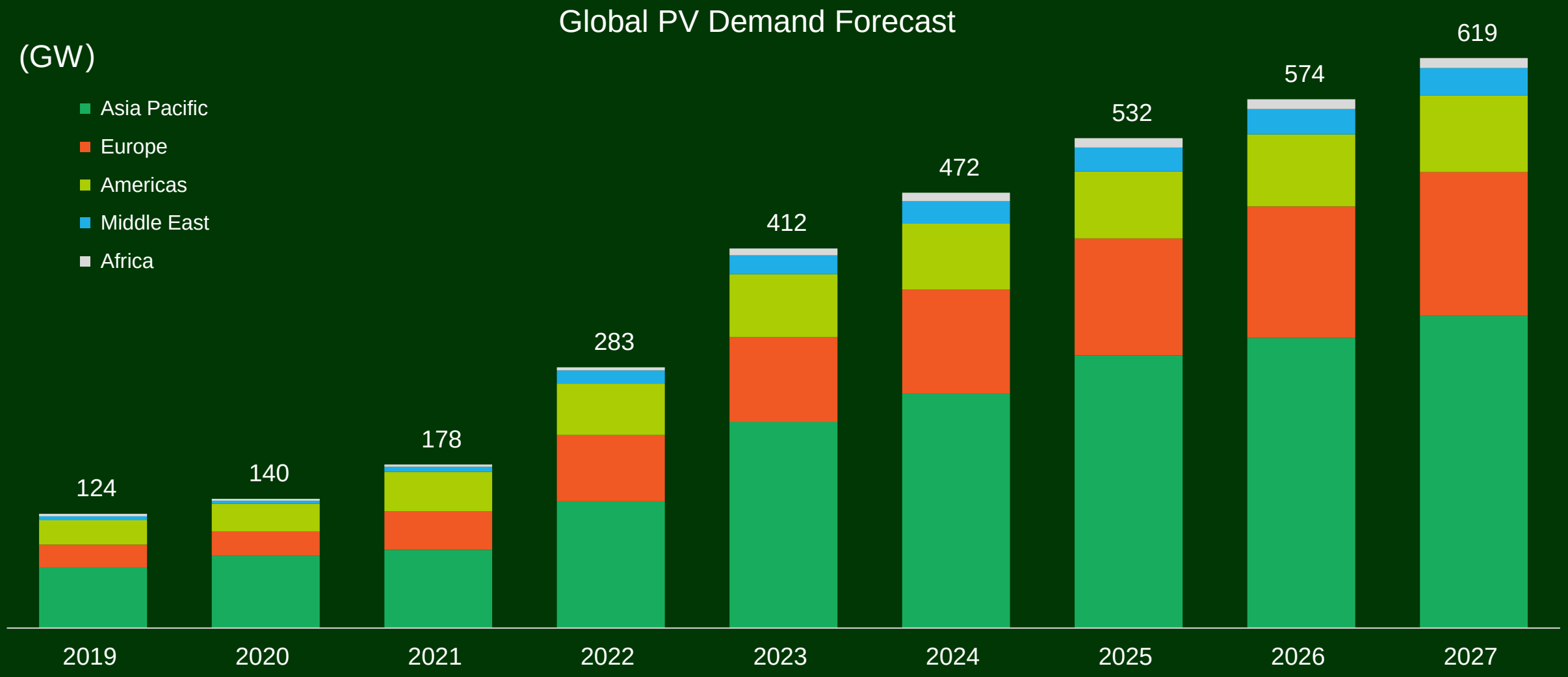
CONTENT

Forecast - PV Demand



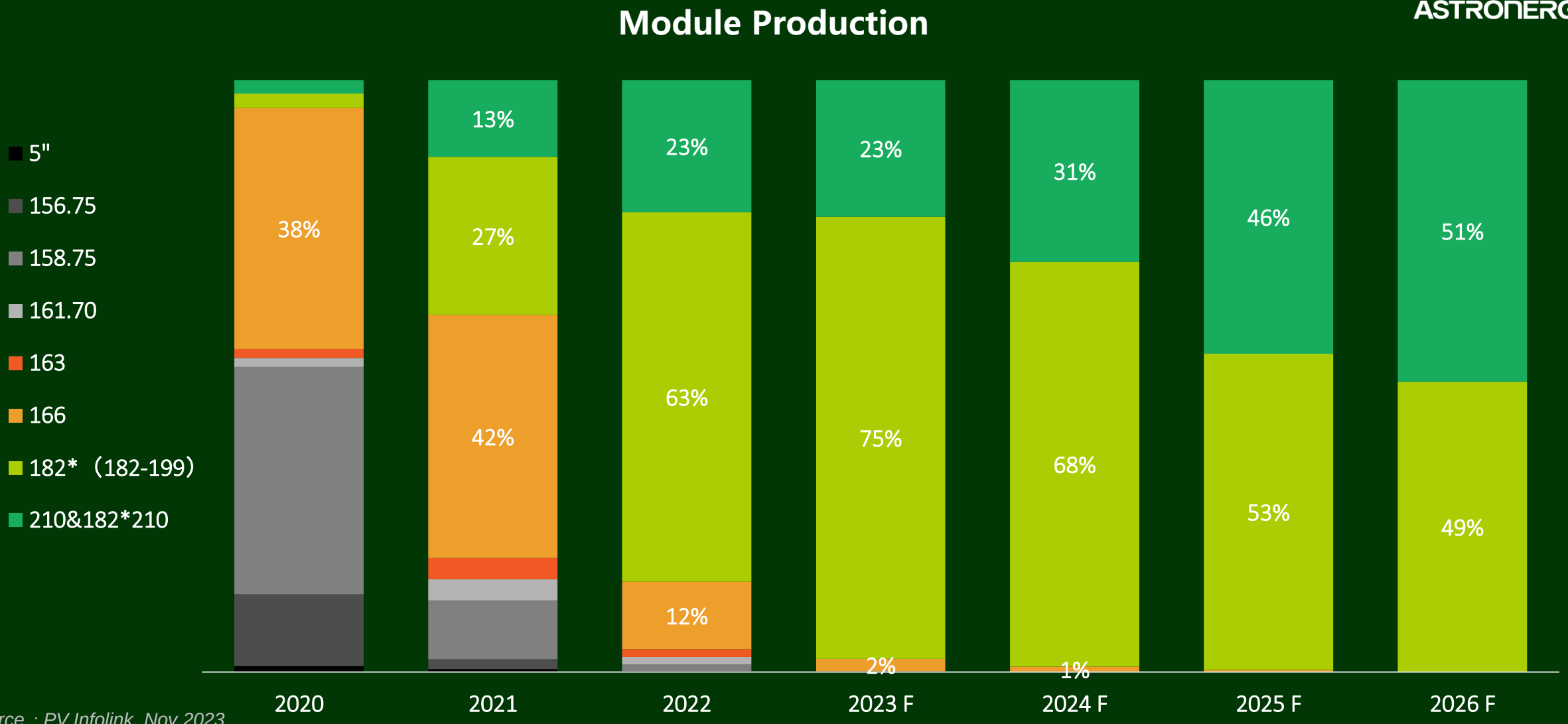
Source BloombergNEF Q4,2023

Forecast - PV Demand



Source : PV Infolink, Sep 2023

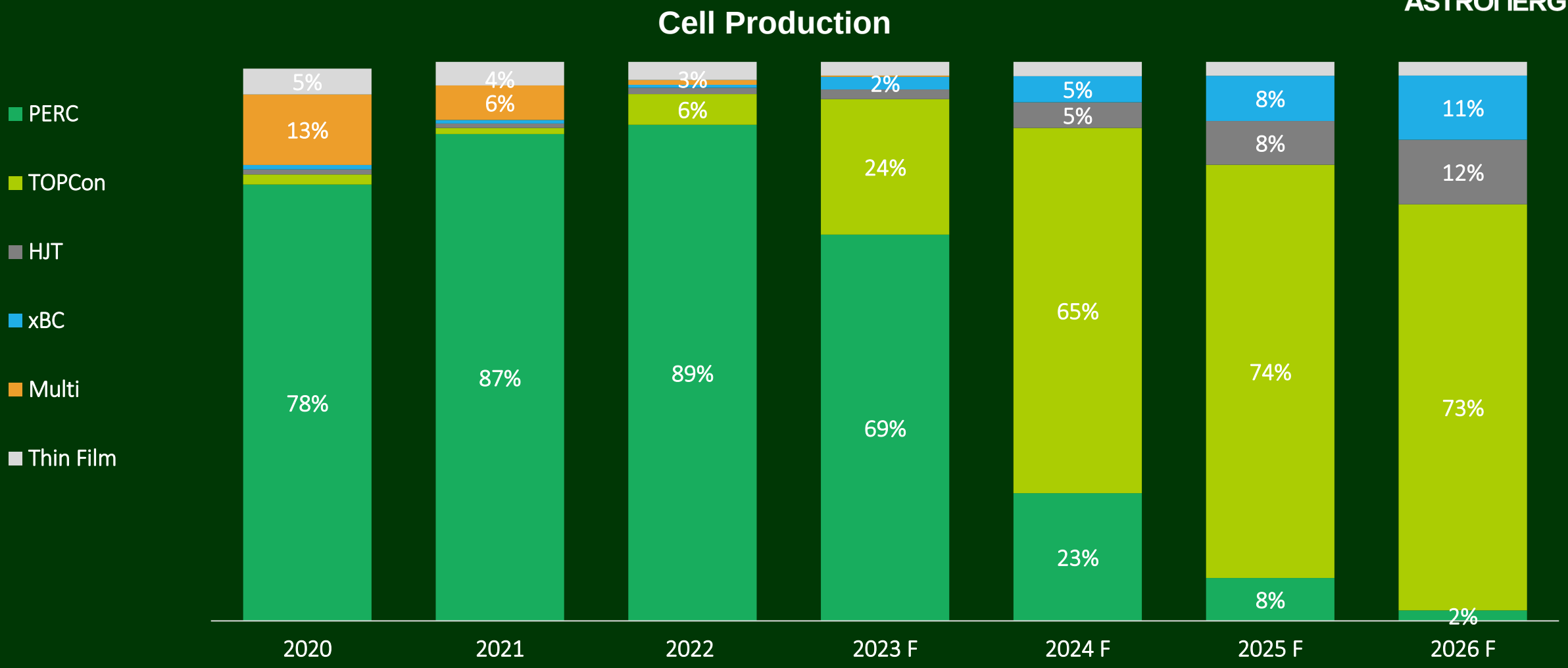
Wafer Size Forecast



Source：PV Infolink, Nov.2023

182mm will be the mainstream size in the next 4 years.

Cell Technology Forecast

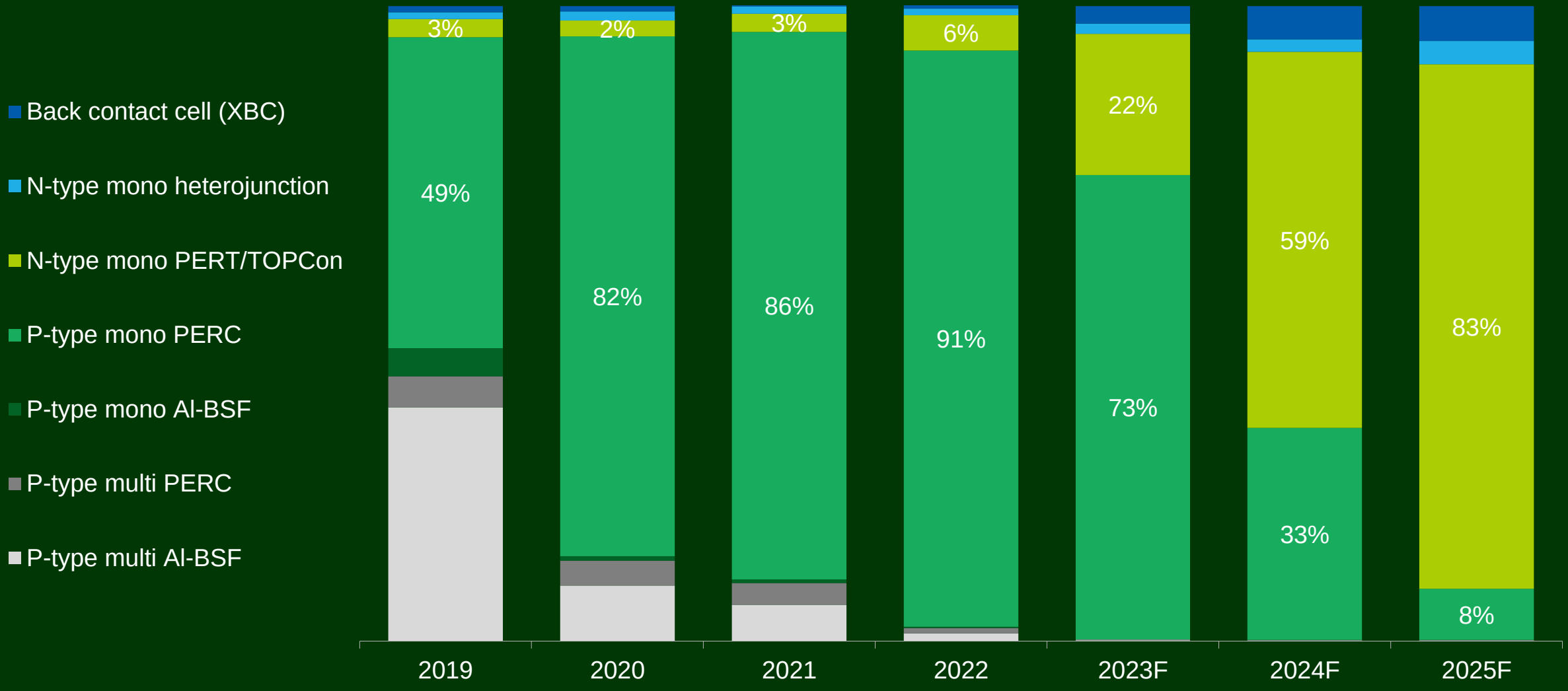


Source : PV Infolink, Nov. 2023

The rapid growth in TOPCon production capacity has made it clear that TOPCon will become the next generation mainstream cell technology after PERC.

Cell Technology Forecast

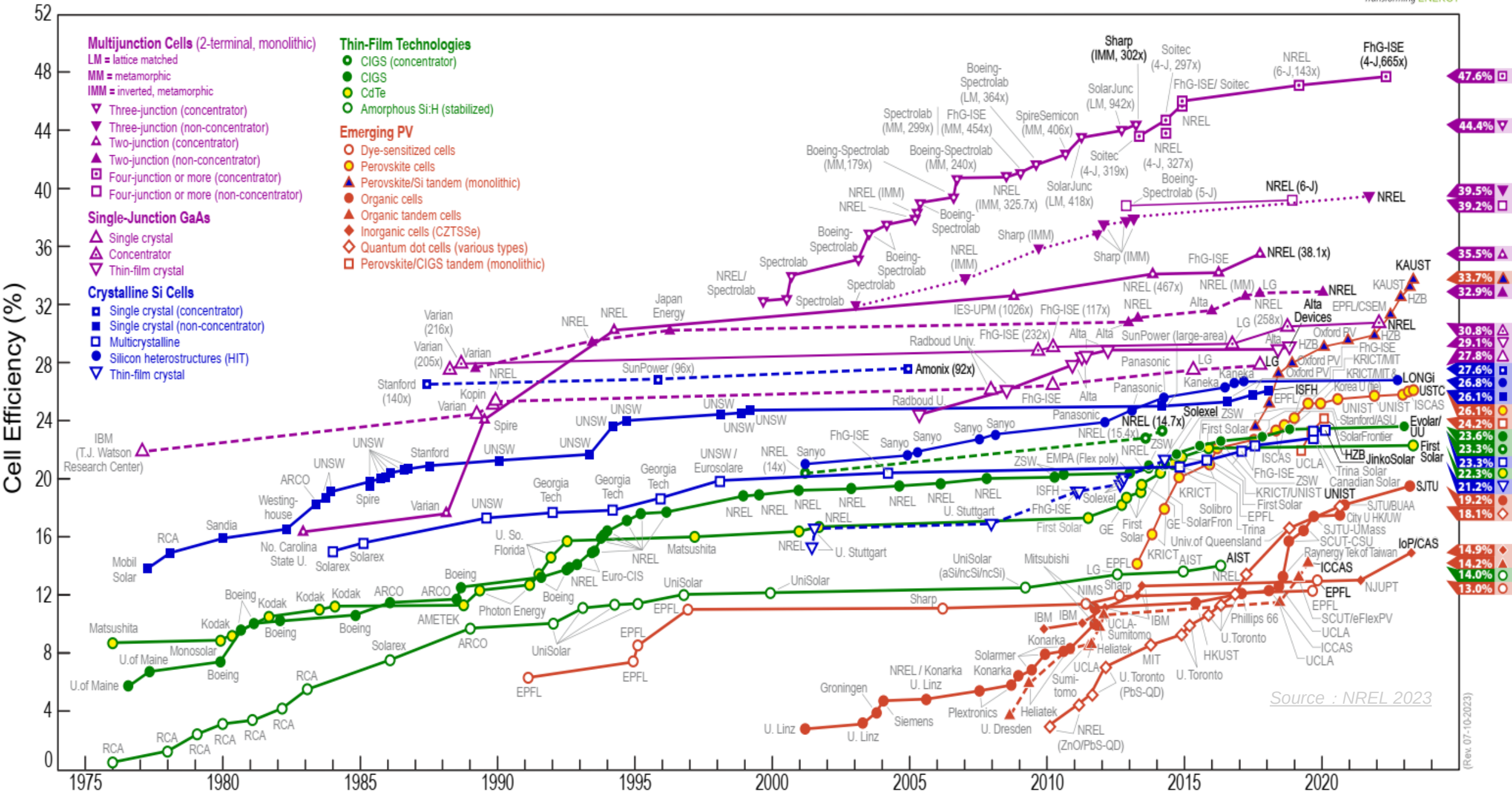
Market share of different crystalline silicon solar cells



Source BloombergNEF Q4,2023

Best Research-Cell Efficiencies

NREL
Transforming ENERGY



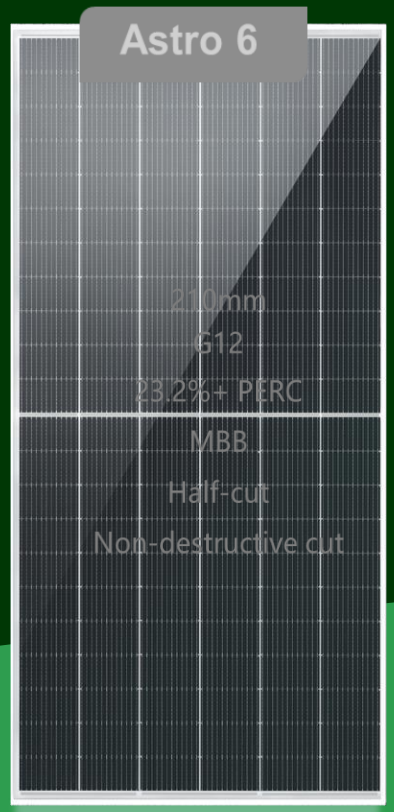
CONTENT

ASTRO Series Product

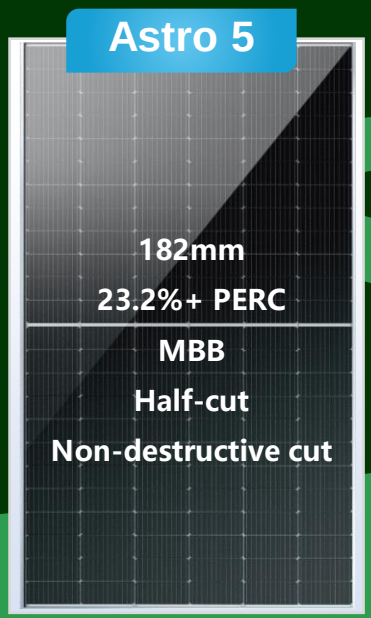
ASTRONERGY

2023

2022



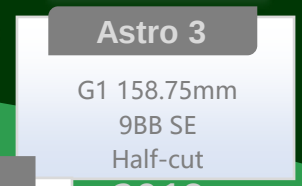
2021



2020

2017

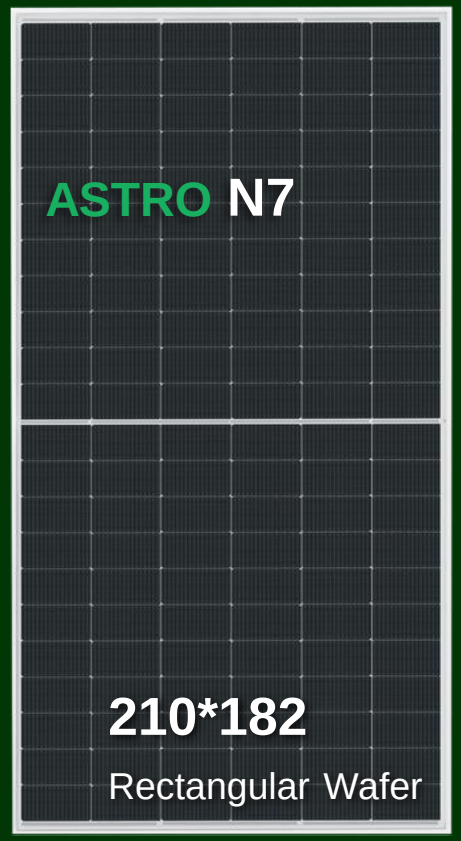
2016



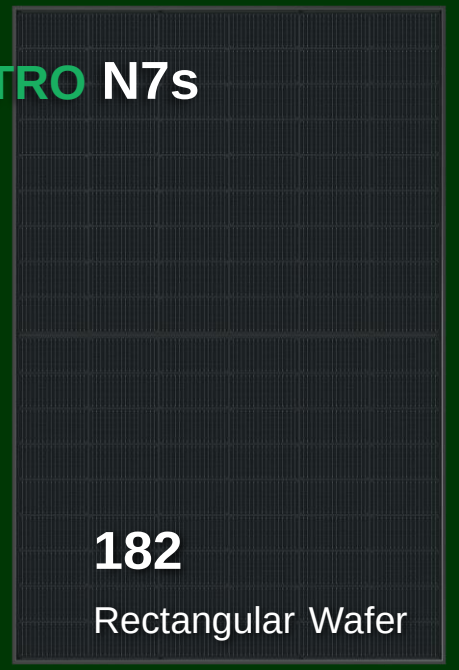
2018

2019

MAIN PRODUCTS



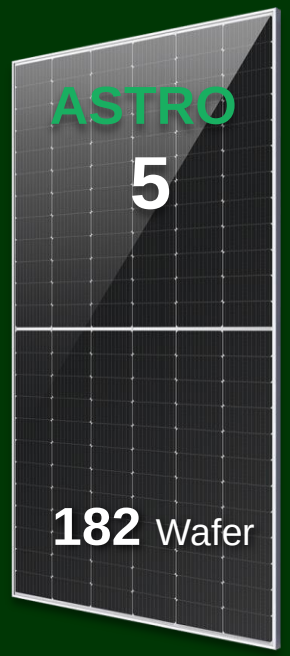
- n-type **TOPCon 4.0** PV cell
- Light redirecting film (for double-glass series)
- SMBB tech
- Higher power
- Higher efficiency
- Higher reliability
- Higher power generation per watt
- Lower BOS & Lower LCOE



- n-type **TOPCon 4.0** PV cell
- ZBB tech
- Higher power
- Higher efficiency
- Higher reliability
- Higher power generation per watt
- Lower BOS & Lower LCOE
- RSD device (Optional)

MAIN PRODUCTS

- n-type **TOPCon** cell
- The series includes two products to meet variable PV application scenarios



- High-efficiency **PERC+**
- Suitable for utility-scale power stations and distributed power stations

- High–efficiency **PERC+**
- Featuring “light, efficient, quality and aesthetic”, especially for residential PV rooftops

To create a sustainable and net-zero carbon world with solar power

Core Technologies

ASTRO

SMBB
ZBB(Ns)

High
transparency
glass

Light
Redirecting
Film

TOPCon
4.0

High
efficiency

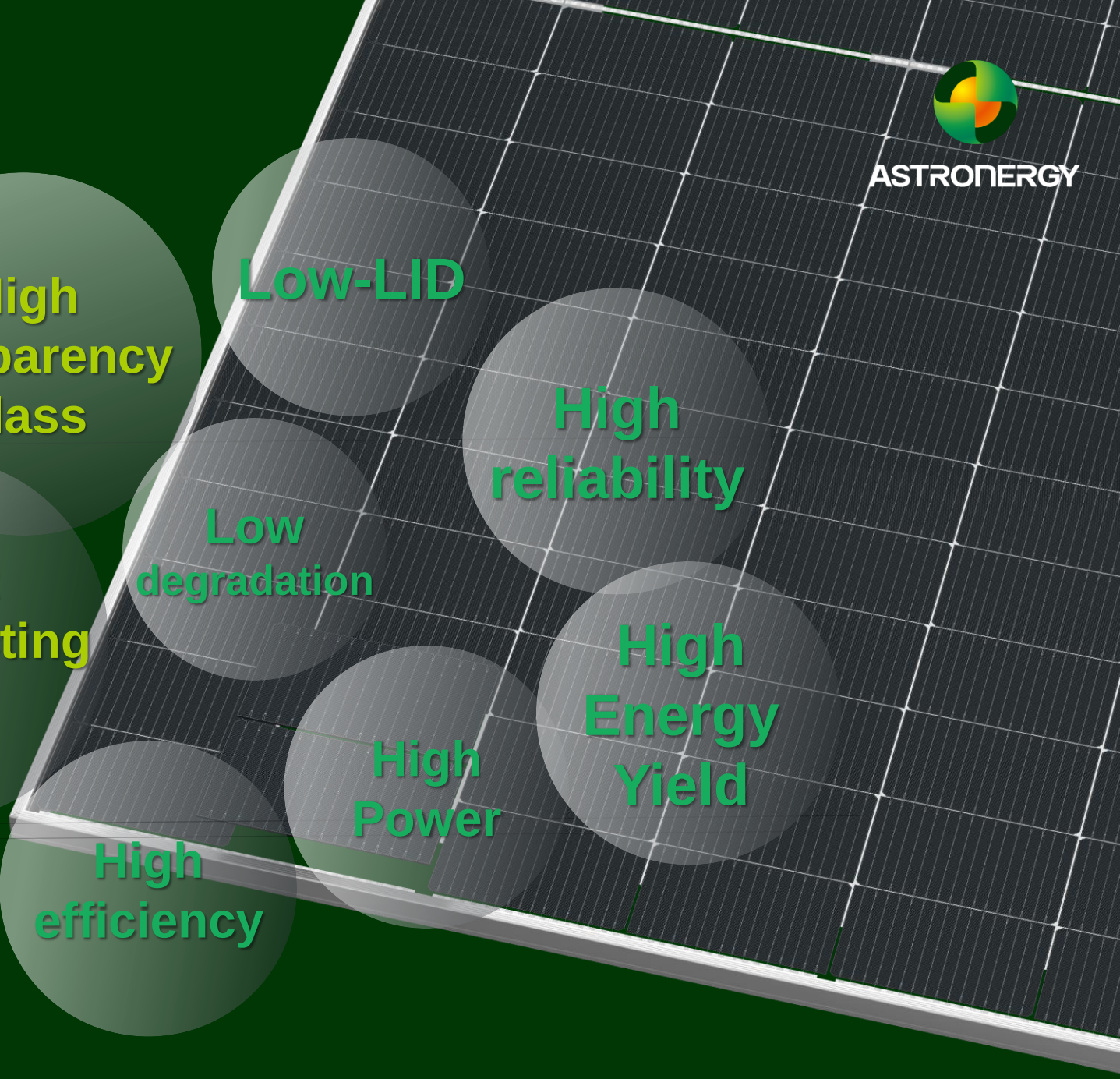
Low-LID

Low
degradation

High
reliability

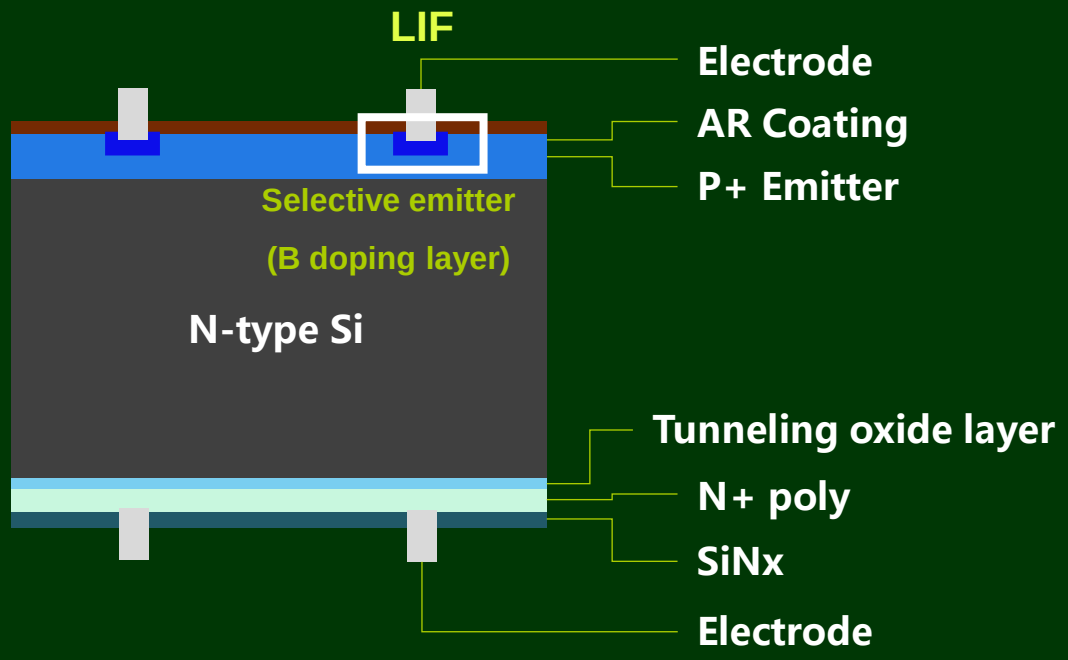
High
Power

High
Energy
Yield



ASTRONERGY

TOPCon 4.0



ASTRONERGY

Boron-LDSE

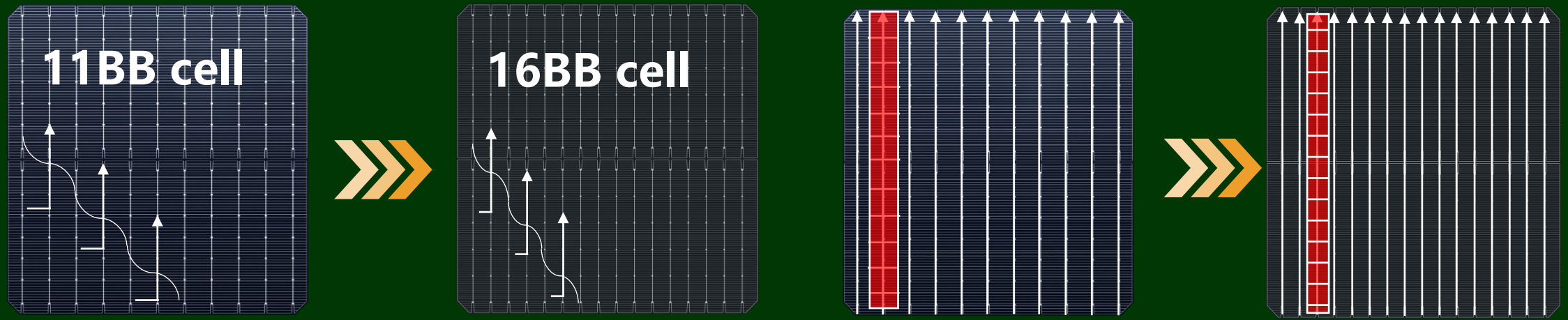
Selective emitter reduces the contact resistance in metal contact region by heavy doping and reduces carrier recombination in non-contact region by light doping, thus achieving higher cell efficiency.

LIF (Laser induced firing)

During LIF process, bias voltage + strong light injection produces high current density and localized high temperature, which allows silver and silicon diffuses into each other to form ohmic contact. LIF reduces the damage to passivation layer while improving conductivity, hence increasing open circuit voltage and reducing contact resistance.

SMBB

ASTRONERGY



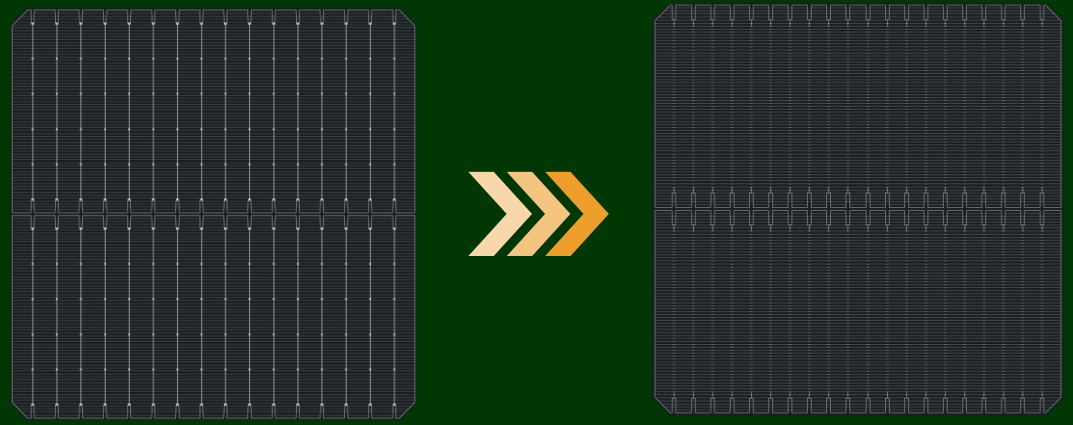
Reliability Gain

- Better tolerance for hidden cracks and broken grids
- More uniform stress distribution due to the increased number of weld joints in the main grid line

Electrical Gain

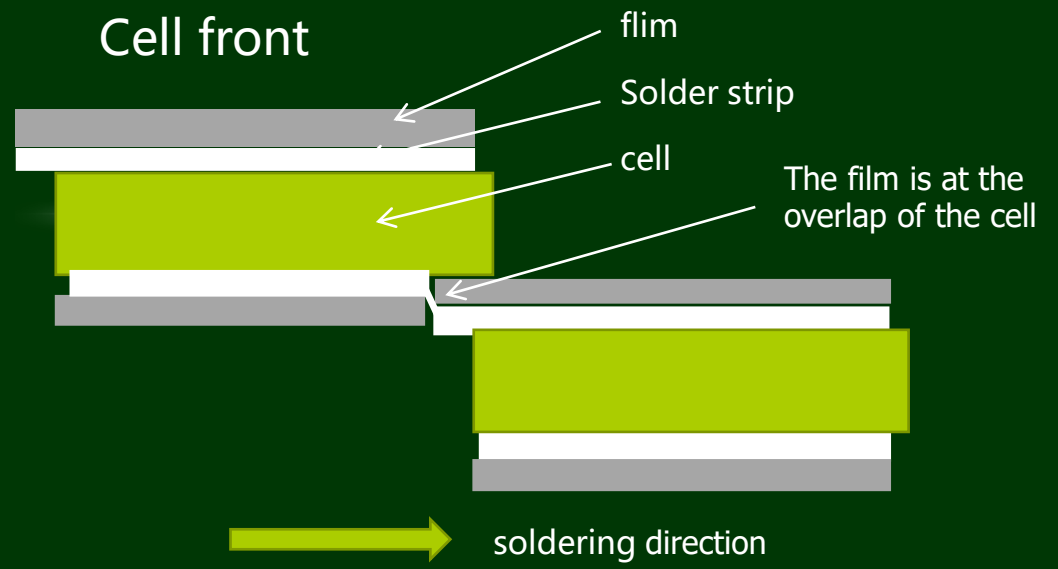
Shorten current transmission path, reduce series resistance, reduce cell power loss and improve module efficiency

ZBB-ASTRO N7s Core Technology



Traditional metallization design with multi busbar

Zero busbar design



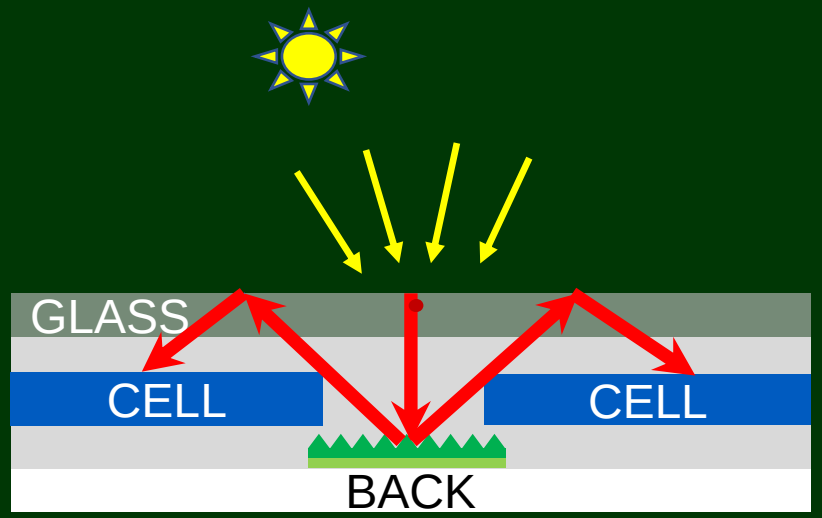
- **Using soldered thin cell connectors to replace cell busbars**
- **ZBB interconnection:**

1) preprocessing with low-temperature soldering to fix the connectors on PV cells;

2) forming ohmic contact during lamination (second soldering)

Light Redirecting Film

ASTRONERGY



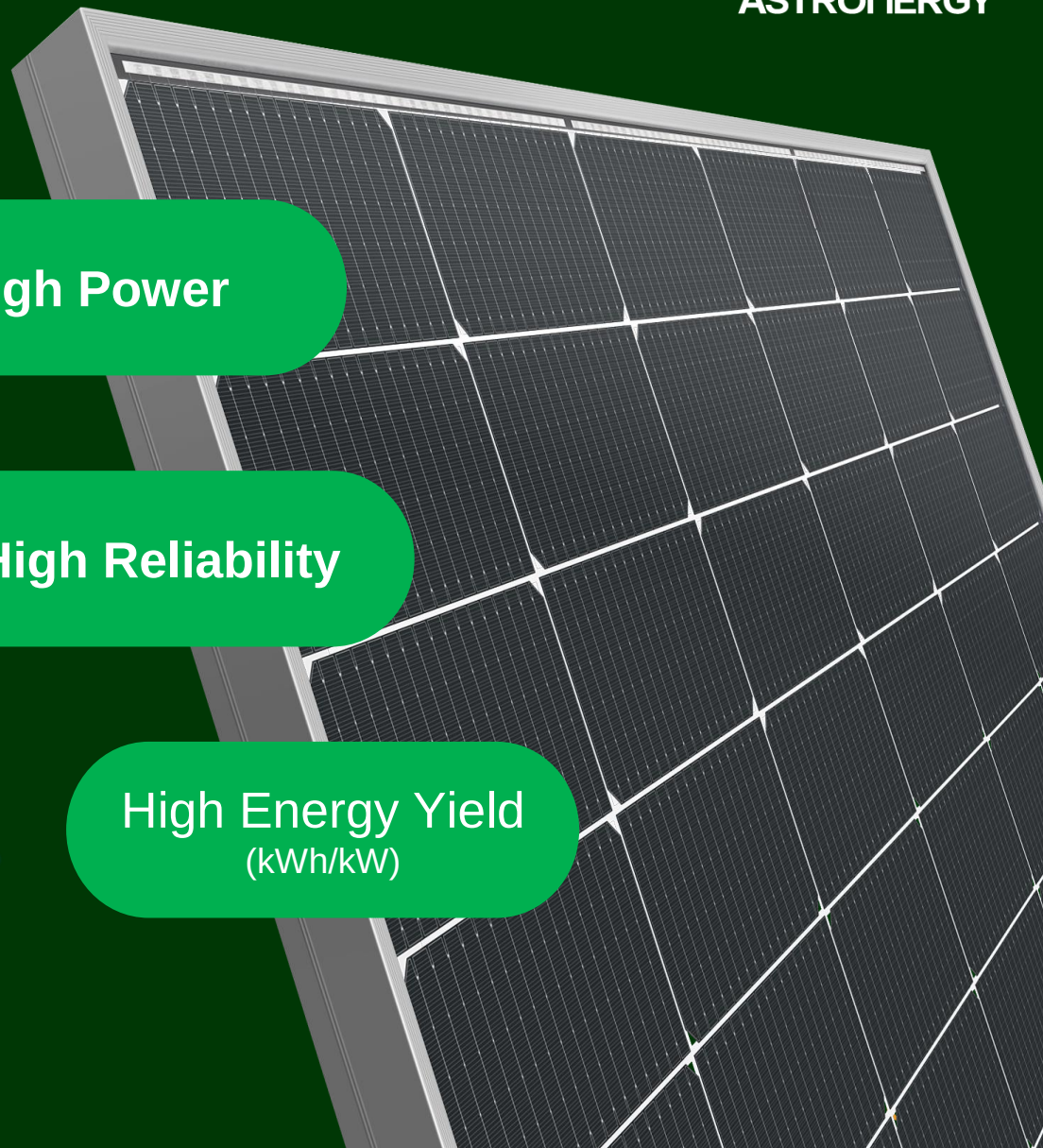
Reflective layer
Angle 120°

Structure

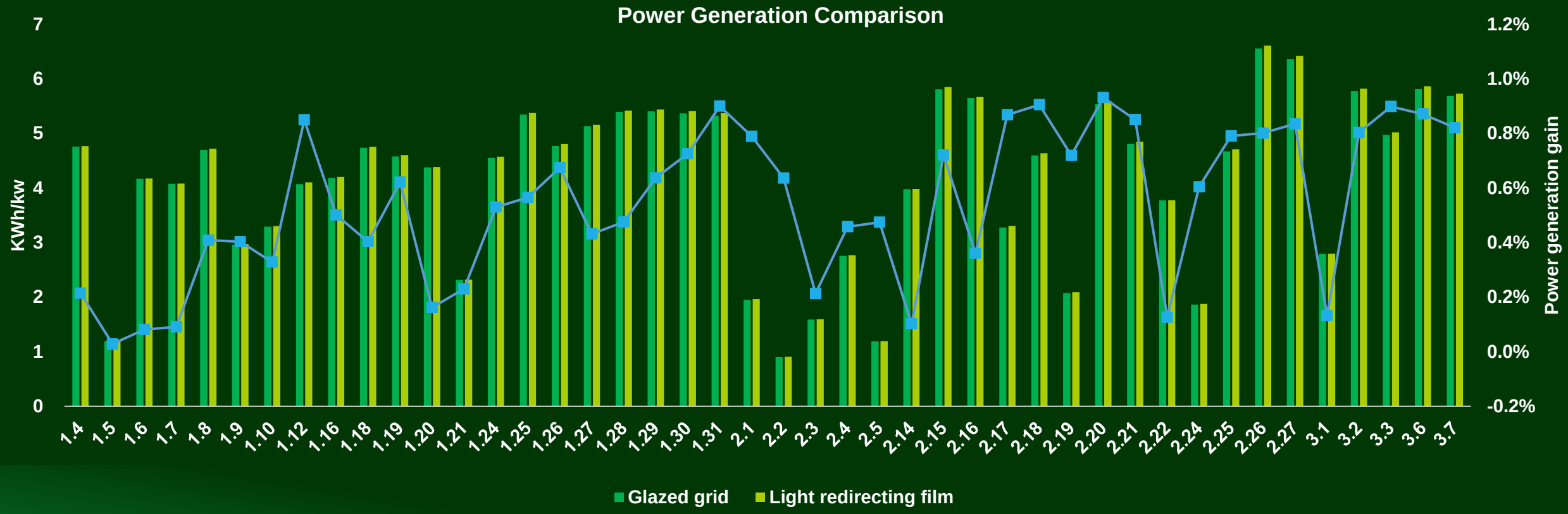
High Power

High Reliability

High Energy Yield
(kWh/kW)

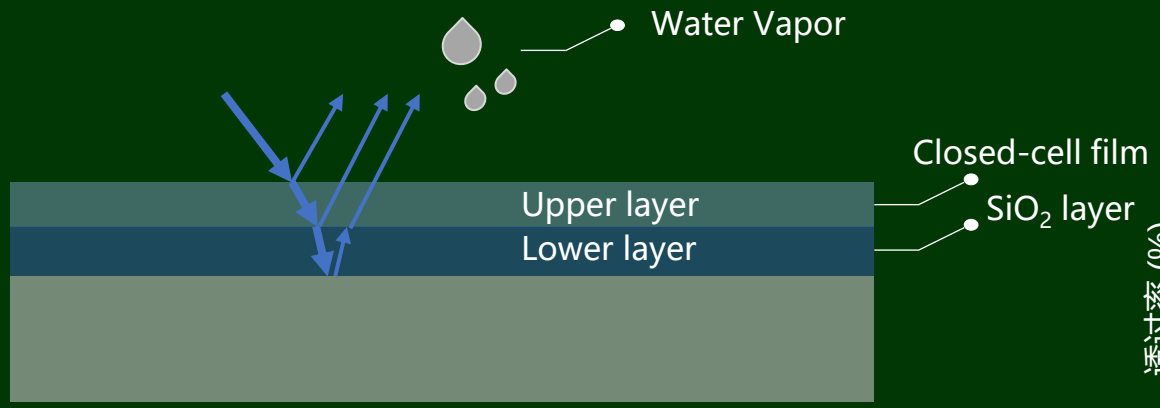


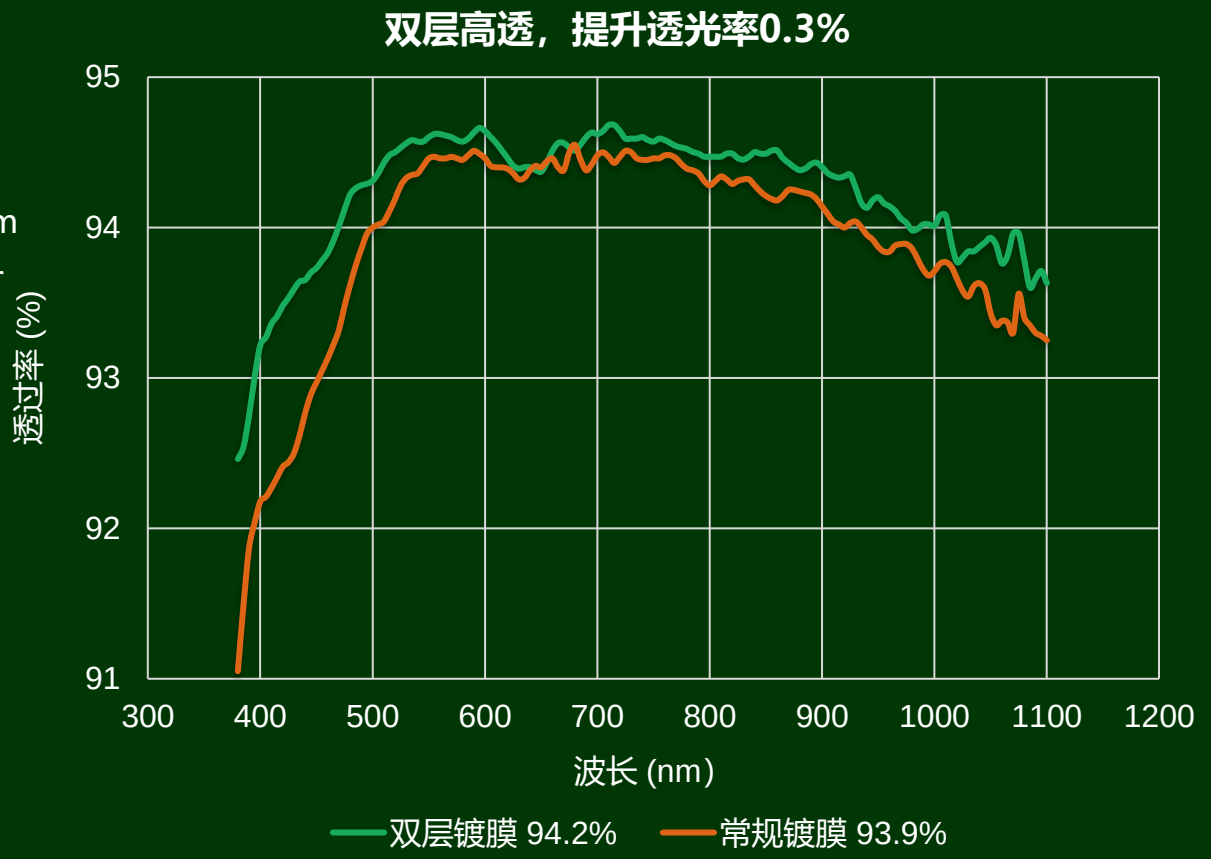
Light Redirecting Film



- Light redirecting film **increases the directional reflection of light to the front side of the module**, increasing the module's power generation;
- Light redirecting film has **a small shading area on the back side**, increasing the power generation on the back side.

High transmittance glass



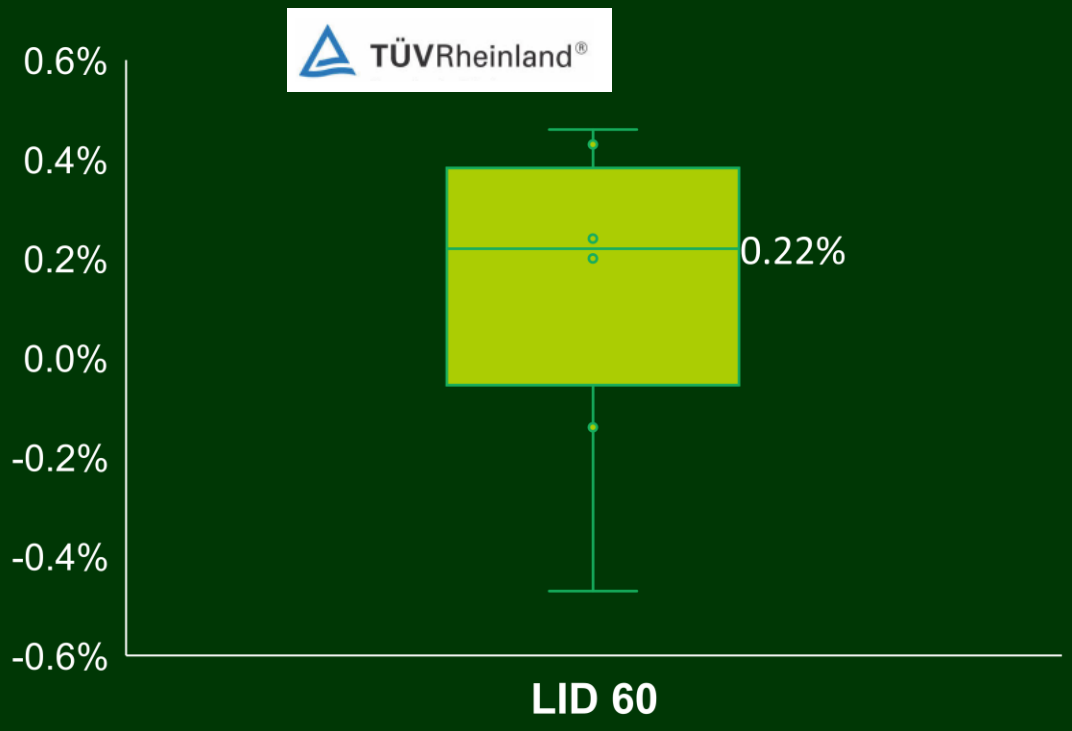


- **The upper layer film is a closed-hole film that can improve light transmittance.**
- **The lower layer is a dense SiO2 layer which can effectively isolate water vapor.**
- **Different refractive indices，achieving a better anti-reflection effect**

ASTRO N – Low LID

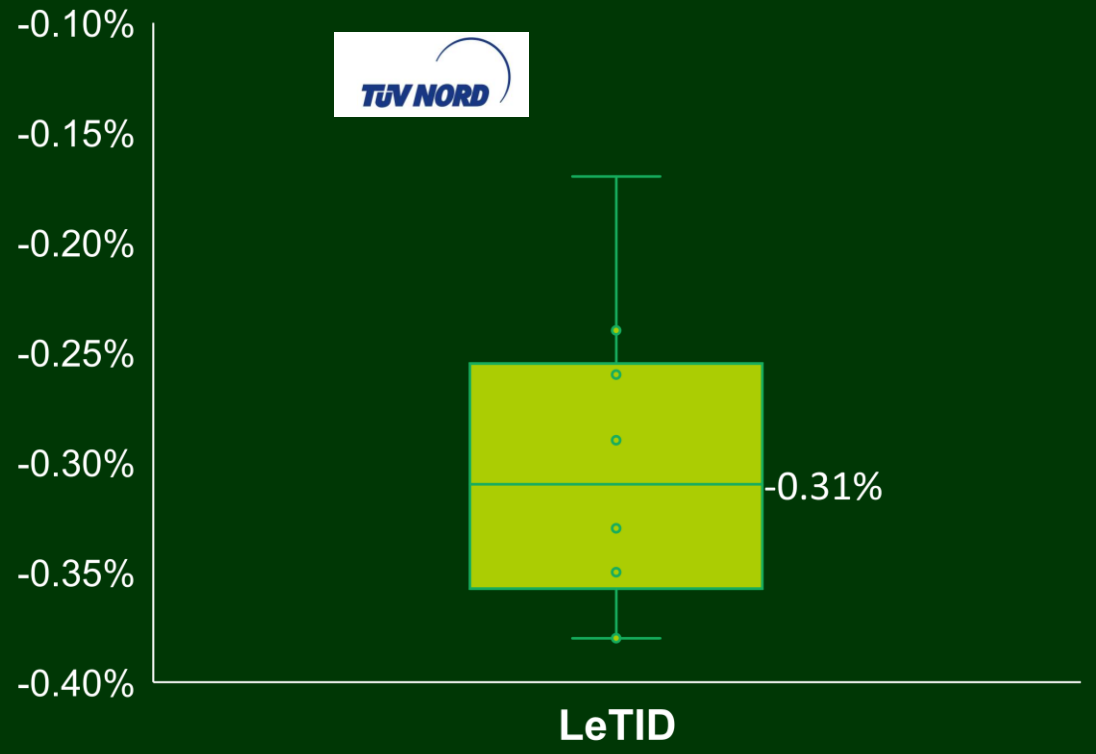
ASTRONERGY

ΔP_{mpp} after 60kWh/m² light soaking



Median value: **0.22%, No LID effect**

ΔP_{mpp} after LeTID

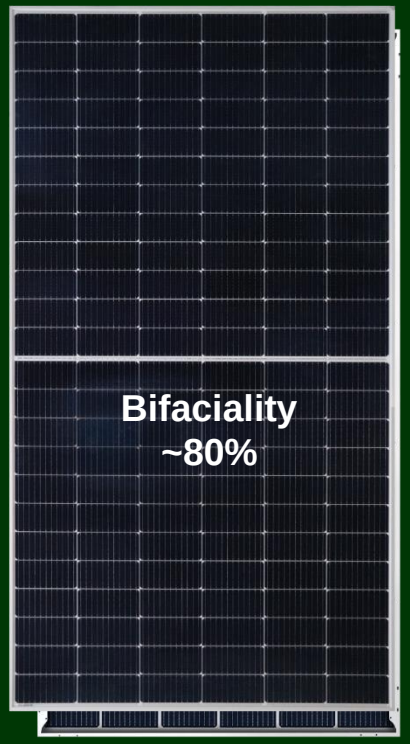


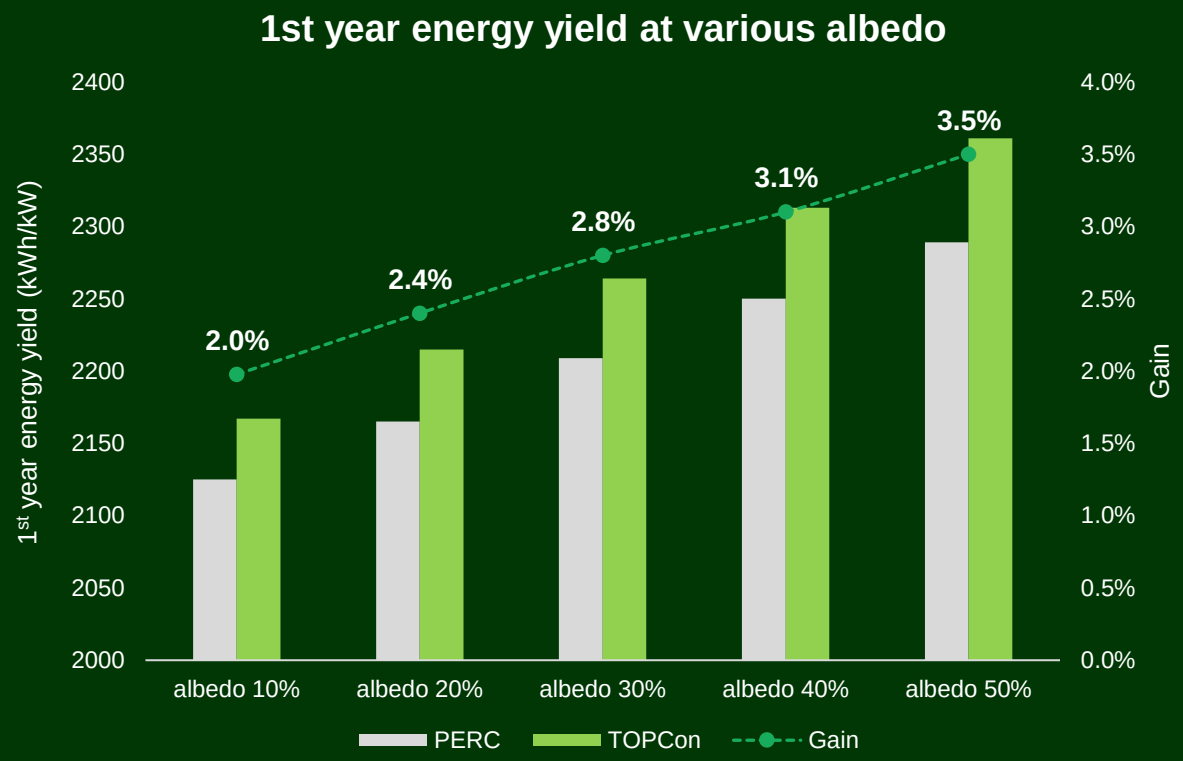
Median value: **: -0.31%**

ASTRO N – High Bifaciality

PERC

ASTRO N





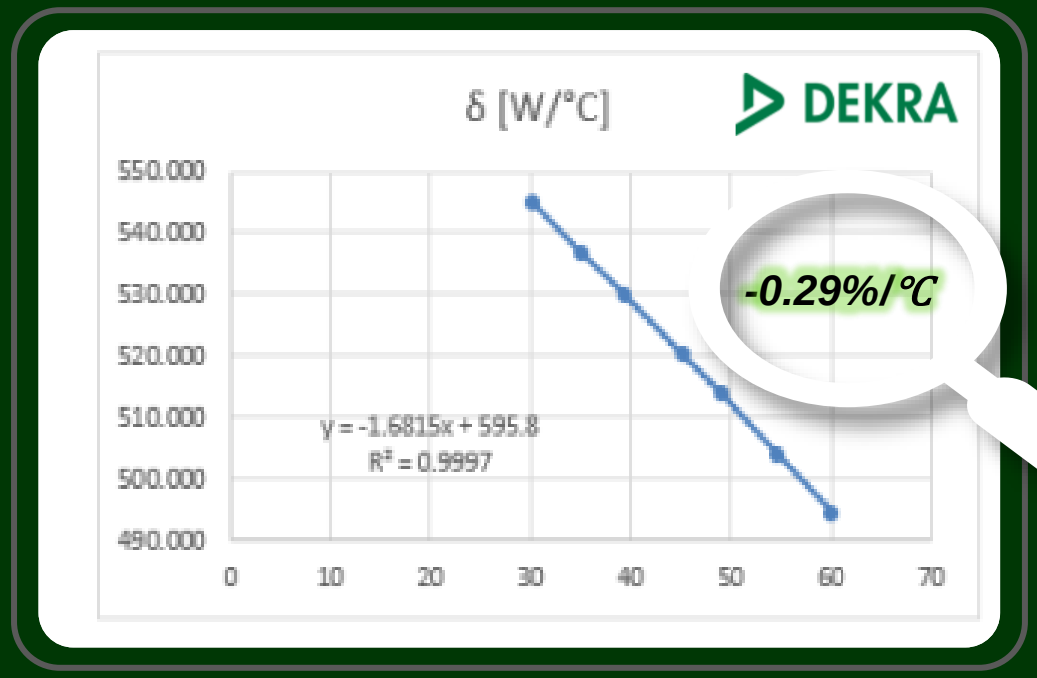
Based on PVsyst simulation results at Abu Dhabi

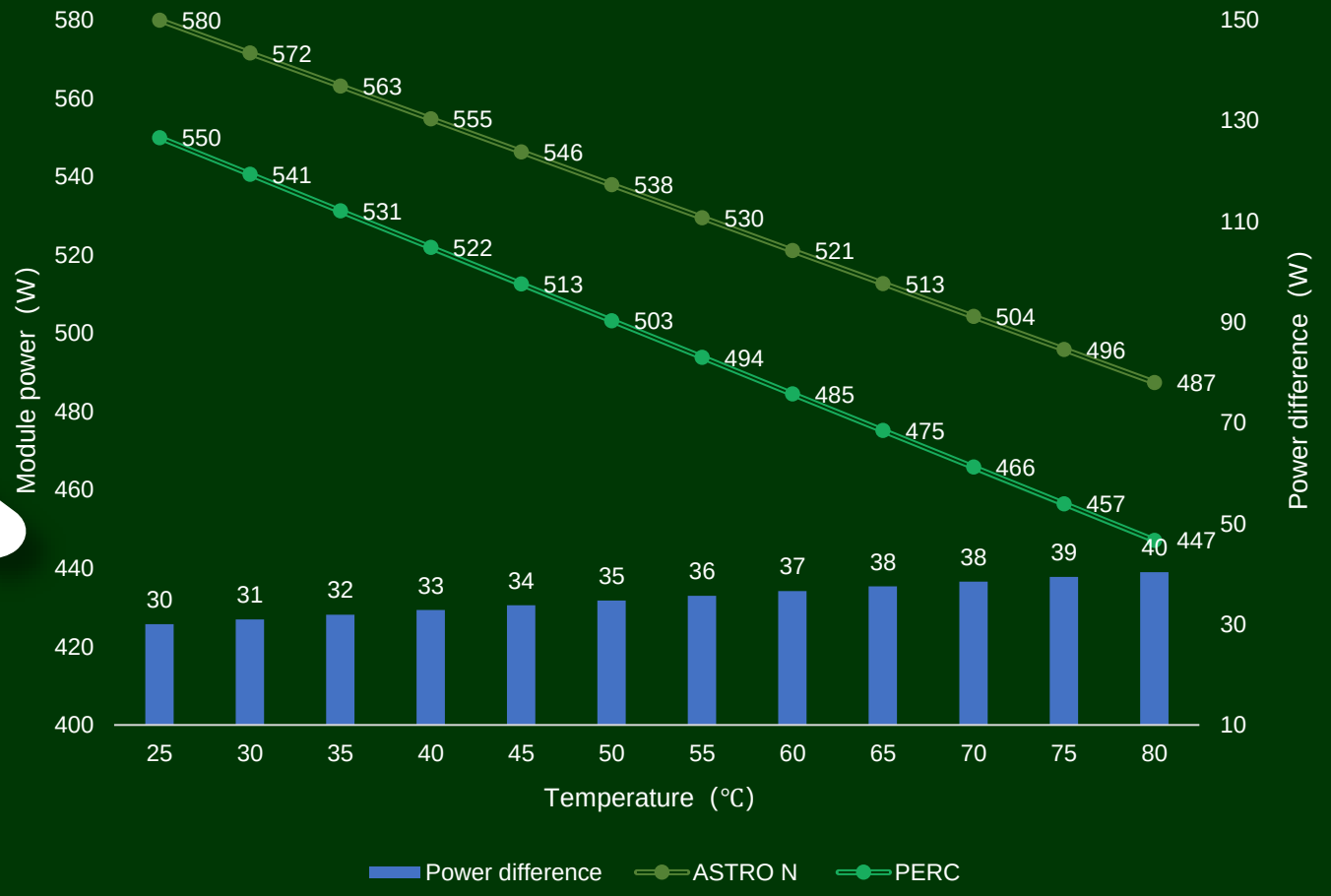
Mounting system: 1P HSAT

Module height above the ground: 1.5m

ASTRO N modules can utilize more rear irradiance.

ASTRO N – Better Temp. Coefficient





Better temp. coefficient: -**0.29%/℃**, better performance at high temperature

Reliability – PVEL Indoor Test

- **ASTRO N Series** has been awarded the **2023 PVEL/DNV GL "Top Performer".**

7x Top Performer (2014,2017,2018,2020,2021,2022,2023)

- **ASTRO N-Series** high-efficiency modules has been honored by **RETC** as**" 2023 Overall Highest Achiever"**

ASTRONERGY
A CHINT COMPANY
TOP PERFORMER 2022 PVEL
PV MODULE RELIABILITY SCORECARD

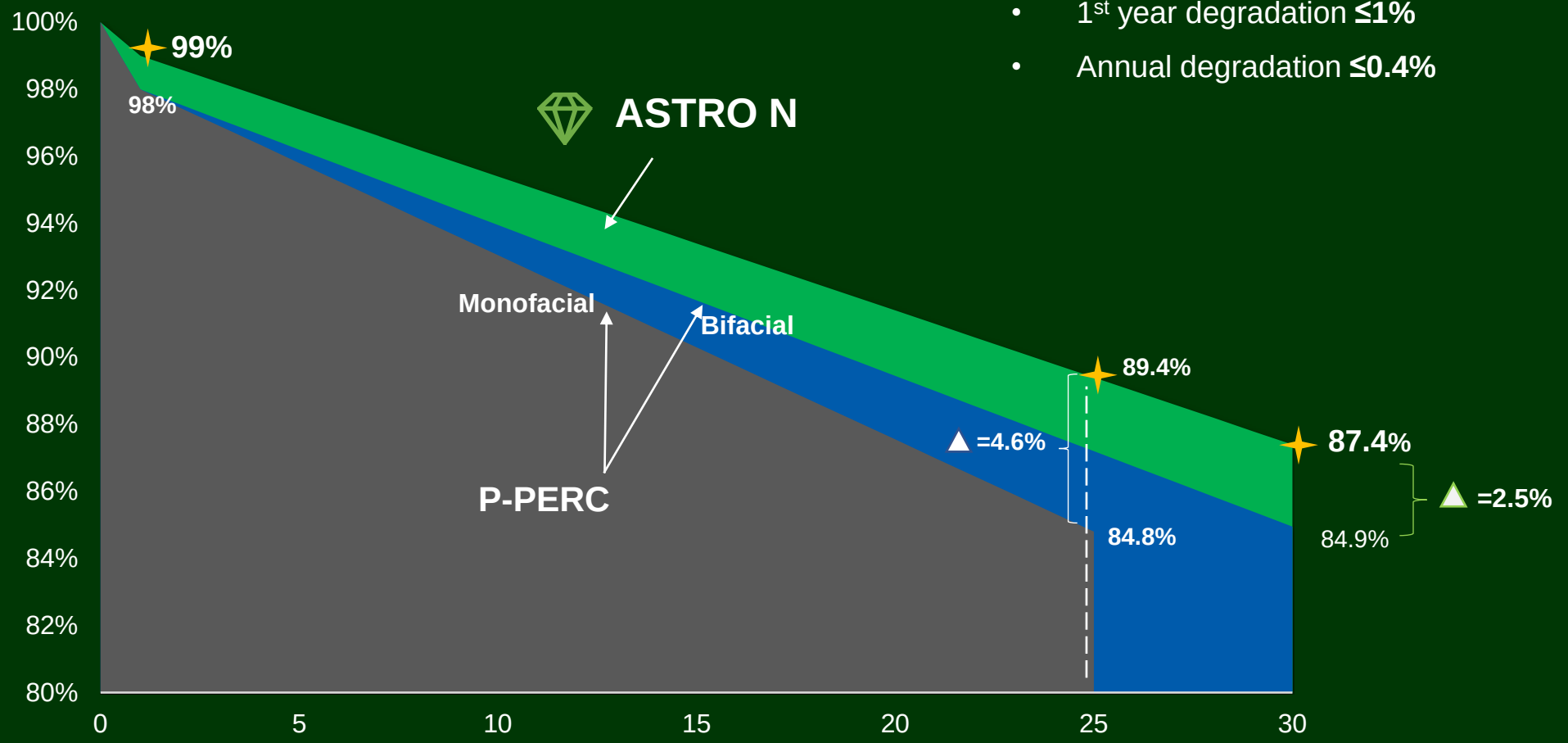
Historical Scorecard

The table below shows the history of top performance for all manufacturers featured in the 2023 Scorecard. Manufacturers are listed by the number of years they have been designated a Top Performer, in alphabetical order.

TOP PERFORMER 2023 PVEL kiwa
PV MODULE RELIABILITY SCORECARD

	2023	2022	2021	2020	2019	2018	2017	2016	2014
	•	•	•	•	•	•	•	•	•
	•	•	•	•	•	•	•	•	•
	•	•	•	•	•	•		•	•
	•	•	•	•	•	•	•	•	
	•	•	•	•	•	•	•	•	
Astronergy	•	•	•	•		•	•		•
	•	•	•	•	•	•			
	•	•	•	•		•	•		
	•	•	•		•	•		•	

Warranty – ASTRO N series



- 1st year degradation **≤1%**
- Annual degradation **≤0.4%**

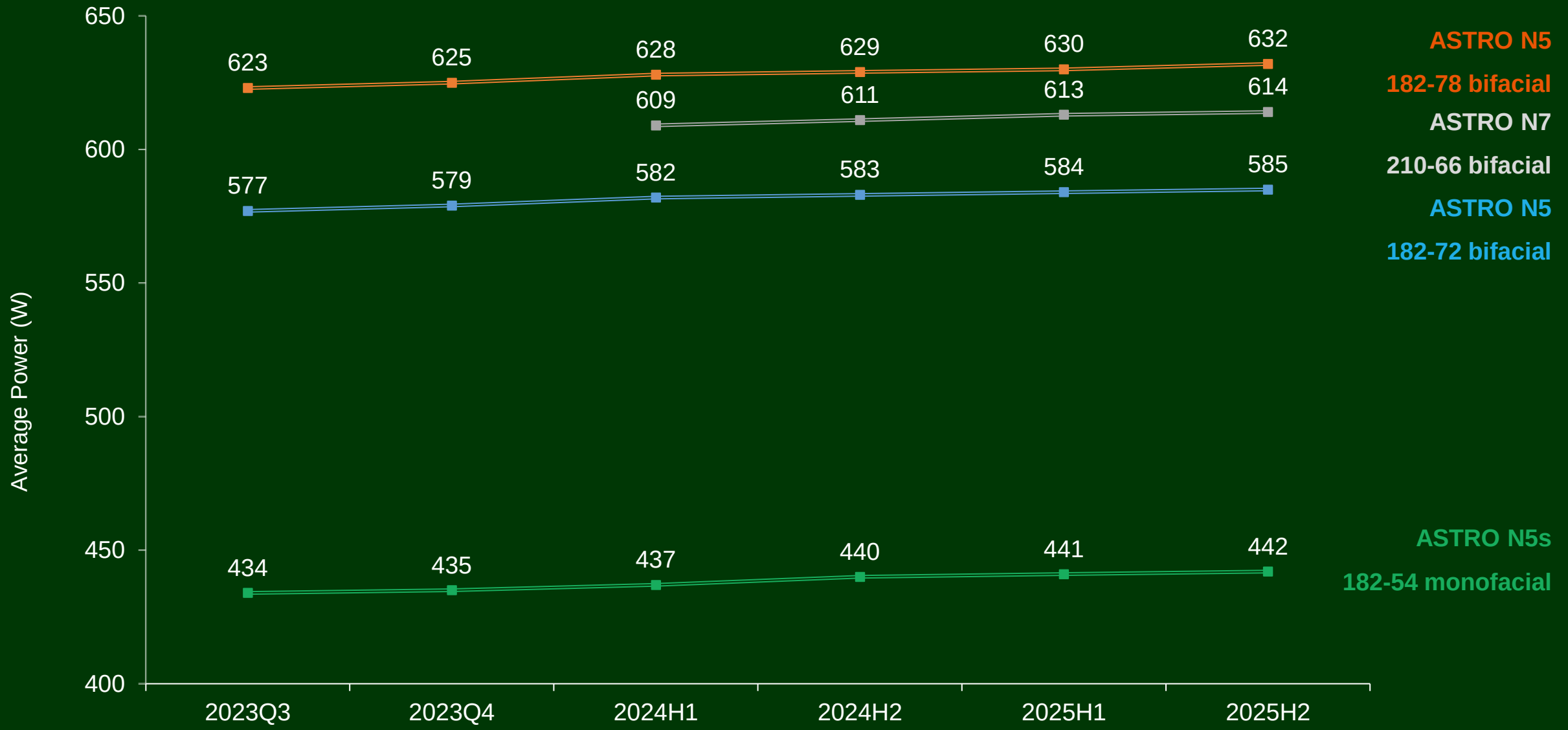
30

Power warranty

12/15

Workmanship warranty

Module Power Forecast – N Type



CONTENT

INTELLIGENT MANUFACTURING

ASTRONERGY

The Thinking Factories

- Supported by Big Data
- AI Quality Inspection
- The 1st to Achieve AI Automatic Detection of EL Defects
- Automatic Monitoring of the Entire Process
- Fully Automated Production
- Automatic Batching by Unmanned Vehicles
- Localization of Production Equipment

Top Level of Intelligent Manufacturing

2016: Sino-German Intelligent Manufacturing Demonstration Base

2020: Intelligent Photovoltaic Pilot Demonstration Enterprise

The World's First PV "Internet + Transparent Factory"


Scribing Machine


Automatic Glass Laminating Machine

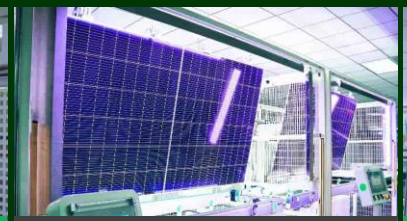

Intelligent Assembly Line


Automatic Feeding and Bar Code Sticking Machine


Series Welding Machine

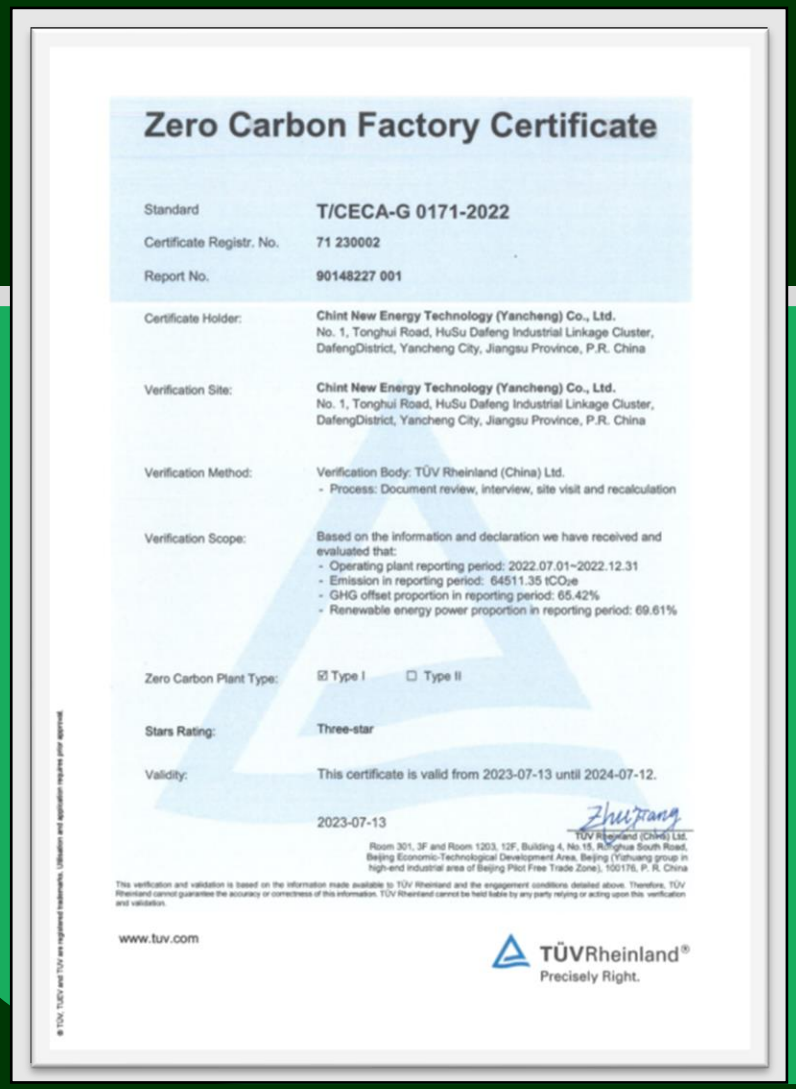

Banding Machine


Laminating Machine


90 Degree Flip Inspection


Group Box All-in-one Machine

Zero Carbon Factory



Zero Carbon Factory Certificate

Standard	T/CECA-G 0171-2022
Certificate Registr. No.	71 230002
Report No.	90148227 001
Certificate Holder:	**Chint New Energy Technology (Yancheng) Co., Ltd.** No. 1, Tonghui Road, HuSu Dafeng Industrial Linkage Cluster, DafengDistrict, Yancheng City, Jiangsu Province, P.R. China
Verification Site:	**Chint New Energy Technology (Yancheng) Co., Ltd.** No. 1, Tonghui Road, HuSu Dafeng Industrial Linkage Cluster, DafengDistrict, Yancheng City, Jiangsu Province, P.R. China
Verification Method:	Verification Body: TÜV Rheinland (China) Ltd. - Process: Document review, interview, site visit and recalculation
Verification Scope:	Based on the information and declaration we have received and evaluated that: - Operating plant reporting period: 2022.07.01~2022.12.31 - Emission in reporting period: 64511.35 tCO_2e - GHG offset proportion in reporting period: 65.42% - Renewable energy power proportion in reporting period: 69.61%
Zero Carbon Plant Type:	☑ Type I ☐ Type II
Stars Rating:	Three-star
Validity:	This certificate is valid from 2023-07-13 until 2024-07-12.

2023-07-13

TÜV Rheinland (China) Ltd.

Room 301, 3F and Room 1203, 12F, Building 4, No.15, Ronghua South Road, Beijing Economic-Technological Development Area, Beijing (Yizhuang group in high-end industrial area of Beijing Pilot Free Trade Zone), 100176, P. R. China

This verification and validation is based on the information made available to TÜV Rheinland and the engagement conditions detailed above. Therefore, TÜV Rheinland cannot guarantee the accuracy or correctness of this information. TÜV Rheinland cannot be held liable by any party relying or acting upon this verification and validation.

www.tuv.com

TÜVRheinland®
Precisely Right.

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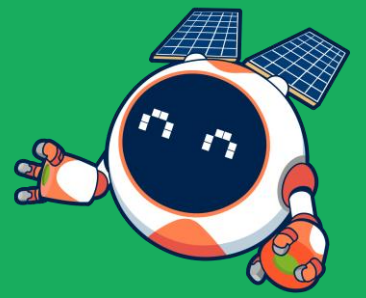
Astronergy - First Zero Carbon Factory In The World Certified by TÜV Rheinland

"A zero-carbon factory" refers to a manufacturing facility that achieves a comprehensive zero carbon emission performance through technological energy-saving and carbon elimination measures during the production process. Our Yancheng base has achieved outstanding results with a greenhouse gas offset percentage of 65.42% and a renewable energy electricity percentage of 69.61%, earning the TÜV Rheinland Zero-Carbon Factory Certification.



INTELLIGENT QUALITY CONTROL

Process Control

MES
(Manufacturing Execution System)

- Collects, feedback and verifies statistics for the control of manufacturing abnormality.

SPC
(Statistical Process Control)

- Monitors key quality control points, ensure process stability, timely alarm and avoid unqualified.

Quality Control App

- Digital documents for statistic reserve and timely control.

AI Quality Detection

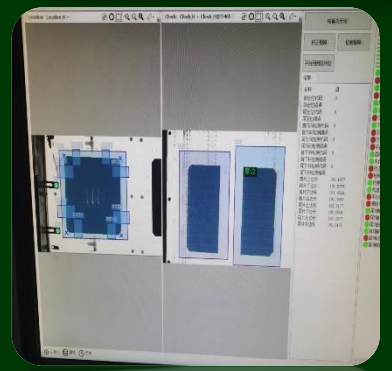
- Intercepts and reports defects in production process to improve products quality.

INTELLIGENT AI DETECTION

ASTRONERGY

Key Process Detection

- CCD Detection
- Serial AI Detection



Semi-finished Product Detection

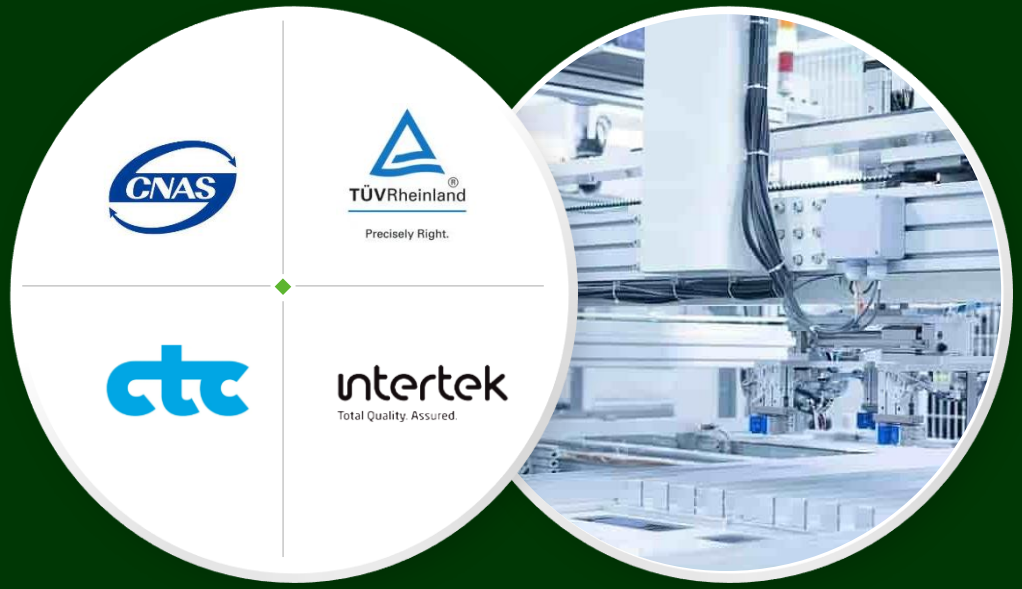
- Pre-lamination EL & VI Detection
- Post-lamination Detection

Finished Product Detection

- Post-lamination EL Detection & Final Detection

HIGH RELIABILITY & HIGH QUALITY

- 25-30 Years Power Warranty
- Systemized Quality Control Measures
- Rigorous Testing Procedures
- Certificates with ISO9001, ISO14001 and OHSAS18001…
- World-class suppliers and partners



With strong testing capabilities, Astronergy has obtained the qualifications of **CNAS Laboratory, CSA Witness Laboratory, TÜV Rheinland Witness Laboratory, Intertek "Satellite Program" Laboratory** and other qualifications, and **conducts more than 30 rigorous tests internally for PV modules**.

LEADING TECHNOLOGY LEADS TO HIGH PERFORMANCE

ASTRONERGY

1st **Tier 1**

Mono-PERC cell efficiency is **23.4%,** leading in PV industry

The average efficiency of **n-type TOPCon cells** reaches **25.7%***,

and the average optimal efficiency of **n-type TOPCon** produced from pilot line hits **26.46%*.** (*Data as of Oct. 23, 2023)

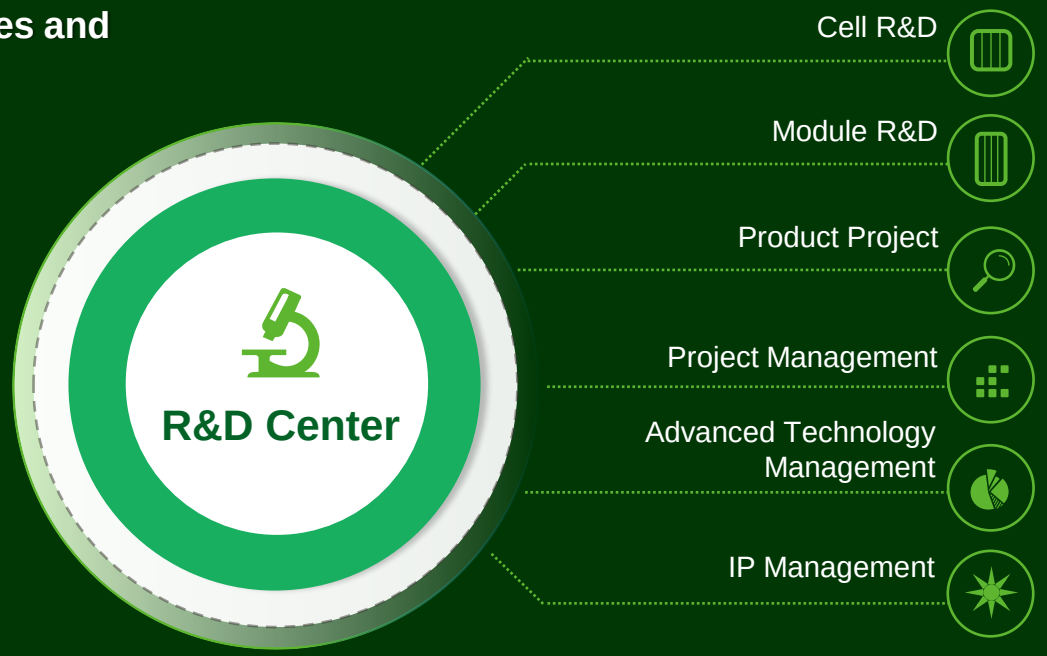
20 %

The number of R&D personnel **with intermediate titles and above** at the national level accounts for **over 20%**

311

(as of Aug., 2023)

311 Patents: **232** Utility Model Patents
72 Invention Patents
7 Appearance Design Patents



To create a sustainable and net-zero carbon world with solar power

GLOBAL R&D COOPERATION

Explore the "industry university research" integration mode with Shanghai Jiao Tong University, Zhejiang University, Zhejiang University of Technology, Hangzhou University of Electronic Science and Technology, New South Wales, Chinese Academy of Sciences Ningbo Institute of Materials and other universities and research institutions, integrate global innovation resources, and promote enterprise R&D innovation and talent training. Deeply cooperate with domestic and foreign frontline equipment and material manufacturers, carry out collaborative innovation in the industrial chain, and promote industry material innovation and industrialization.

Hangzhou Dianzi University

High-efficiency Monocrystalline PERC Cell Technology

Shanghai Jiao Tong University

New Tunnel Passivated High-efficiency Solar Cell & Module Technology

Zhejiang University

Key Technologies of Low-cost and High-efficiency Solar Cells

UNSW SYDNEY

Hydrogen Passivation Project

Zhejiang University of Technology

n-type Passivated Contact High-efficiency Bifacial Crystalline Silicon Solar Cells

R&D ROADMAP

ASTRONERGY

2025

Cell: **Perovskite Cell, Tandem Cell,** HBC

Technology: High sheet-resistance and dense fingers

2024

Cell: TOPCon+, **TBC+, HJT**

Technology: **electroplating, efficient texturing**

2023

Cell: PERC、TOPCon

Technology: SMBB, polysilicon deposition,

Boron selective emitter

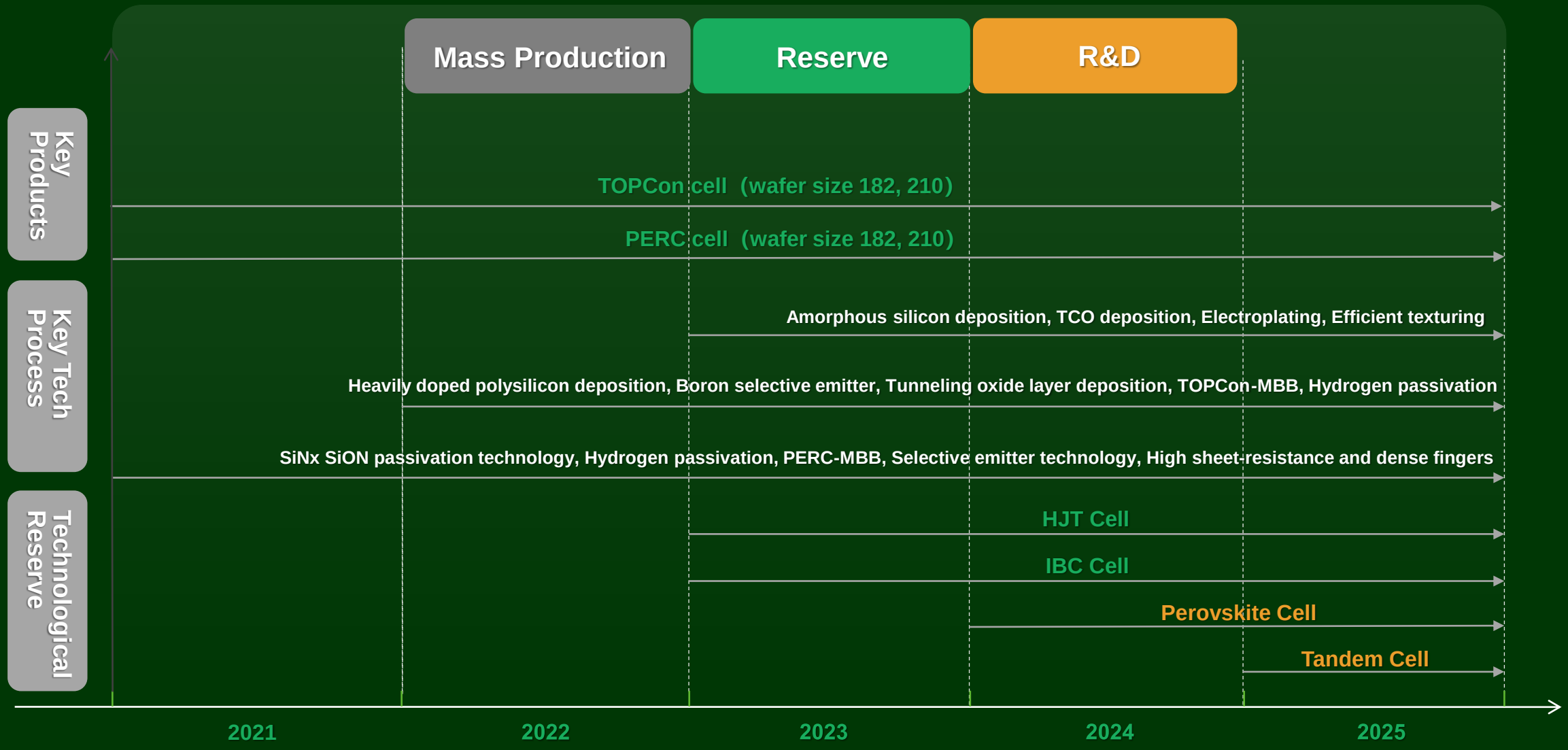
2022

TOPCon & PERC 182/210

54/72/78 format

R&D ROADMAP

ASTRONERGY



FINANCIAL SUPPORT

ASTRONERGY

Actively involved in the financial investment sector, the company has established investment and financing companies such as Zhejiang Civil Investment Bank, Wenzhou Civil and Commercial Bank, Zheshang Insurance, and CHINT Finance, and has been investing in new energy, electrical and many other fields.

We have established comprehensive cooperation with major domestic and foreign financial institutions such as China Credit Insurance, China Development Bank, Export Bank, ICBC, IFC, Standard Bank, Shinhan Bank, SCB, CITI, etc., with financing ratio and financing cost leading in the industry.

GLOBAL PARTNERS

ASTRONERGY

CORPORATE SOCIAL RESPONSIBILITY

In May 2023, Astronergy globally published its 2022 Environmental, Social and Governance (ESG) Reports (hereinafter referred to as "the ESG Report"), delivering on its actions and results on promoting sustainable and stable development and practicing UN SDGs and UNGC 10 Principles to all stakeholders.

Corporate Governance
Sustainable Management

Goal 8
Decent Work and Economic Growth

Goal 9
Industry, Innovation and Infrastructure

Goal 16
Peace, Justice and Strong Institutions

R&D investment over than RMB:

250 million

Conduct due diligence and environmental assessment dimension screening in terms of supplier's social impact:

92.89

Legal proceedings related to corruption and unfair competition:

0

Customer satisfaction score:

100 %

Astronergy ESG Report download: https://www.astronergy.com/index.php/?s=esg&search_type=3

CORPORATE SOCIAL RESPONSIBILITY

ASTRONERGY

In May 2023, Astronergy globally published its 2022 Environmental, Social and Governance (ESG) Reports (hereinafter referred to as "the ESG Report"), delivering on its actions and results on promoting sustainable and stable development and practicing UN SDGs and UNGC 10 Principles to all stakeholders.

Climate Change
Environment-friendly

Goal 6
Clean Water and Sanitation

Goal 7
Affordable and Clean Energy

Goal 13
Climate Action

Scope I+II emission intensity:

30.49 tCO2e/MW

Energy intensity:

0.46

tons of standard coal/MW

Environmental violations:

0

Achieved

3 %

reduction in overall energy consumption

Astronergy ESG Report download: https://www.astronergy.com/index.php/?s=esg&search_type=3

CORPORATE SOCIAL RESPONSIBILITY

Support **1,000** Employees to Complete Continuing Education and Enhance Their Academic Qualifications

Support **100** Ecological Power Plant Projects in Total

90% Product Recycling Rate

40% Proportion of Female Employees

30% Proportion of Female in the Management Team

30% Proportion of Female Technicians

100% Proportion of Core Suppliers Certified by ISO 14001/45001

Help **10,000** Farmers Increase Their Income

Operational Carbon Neutrality

100% Proportion of Renewable Energy Sources

2050

ZERO BY 2050 Carbon Neutrality

2035

Zero Landfill of Waste

All Members of the Management Team Have Their Compensation Linked to Esg

100% Core Suppliers Are Subject to Due Diligence Audits and Social Environmental Standard Assessments

8 Zero Carbon Factories

2028

Astronergy **ESG Report**

French ECS Certification

The First Zero Carbon Factory

2023

Corporate social responsibility

Joined the United Nations Global Compact (UNGC)

Appear on the official website of the United Nations, which endorses the CHINT brand and brings the following benefits:

- Share experience and learn from each other with consensus companies and organizations.
- Expand CHINT's resources for overseas public welfare activities.
- Obtain the most authoritative sustainable development policy information and connection.
- Establish partnerships with United Nations agencies, including the International Labor Organization, the office of the United Nations High Commissioner for human rights, the United Nations Environment Program and the United Nations Development Program.
- Improve the ECO VADIS corporate social responsibility score of 10 +, so as to maximize business opportunities.

Corporate social responsibility

ASTRONERGY

Charity Activities in China

- CHINT Group has always been devoted to building an extraordinary CSR management system and improving social responsibility performance throughout all aspects of business operation.
- CHINT Group has donated more than 54 million dollars to social welfare such as precise poverty alleviation, school donation, epidemic relief, industry promotion and ecological protection.

Promote photovoltaic projects in the countryside to increase farmers' family income and protect environment.

Provide scholarship of 20 million dollars so far for educational institutions to help students in need and reward excellent students

Set up innovation award of more than 1 million dollars to encourage talents and promote development of the electric-power industry

Donated 1.5 million dollars of emergency supplies to the rescue operations in Henan flood

Collaborate with China Society for Promotion of the Guangcai Program and actively participate in targeted poverty alleviation

Corporate social responsibility

Overseas Charity Activities

Donated over 1,000 boxes of food and necessary living materials to more than 1,000 families in need in 40 underdeveloped areas in Egypt in April 2021.

"CHINT, Let Love Shine" continues to bring clean energy experiences to schools, hospitals and welfare institution around the world

CHINT associated with Foundation Frenó Al Icus, launching the "Pedal against stroke" virtual low-carbon challenge to draw attention to the problem of stroke and improve people's awareness and vigilance.

Global relay to fight the pandemic together. Donated overseas more than 200k masks ,10k protective clothes and 50 respirators.

Helped Rebuild Homes in the Earthquake Areas of Turkey by providing urgently needed materials

Launched an initiative to combat the devastation that caused by the storm Philomena: that is, donated 5 % of the amount of CHINT surge protections sold online to the tree recovery.

CONTENT

APPLIED CASES

Utility-scale Power Stations

- Benban Solar Park Project in Egypt, 165MW
- Agriculture-Solar Hybrid PV Power Station in Wenzhou, 150MW
- Forest-Solar Hybrid Power Station in Jiangshan Quzhou, 200MW
- Utility-scale Project in Zhangjiakou, Hebei Province, 70MW
- Goonumbla Project in Australia, 89MW
- Barreiras Project in Brazil, 50MW
- Insua Power Station in Portugal, 48.5MW
- Utility-scale Project in Yongchang, Gansu Province, 200MW
- Utility-scale Project in Qiongjie, Tibet, 10MW
- Top Runner Project in Baicheng, Jilin Province, 100MW

……

ASTRONERGY

Midden-Groningen Solar Park, one of The Largest Power plant in the Netherlands
103MW | The Netherlands

China's First Sand-Solar Power Station
310MW | Kubuqi, Inner Mongolia, China

The Largest Fishing-Solar Hybrid Project in Asia
550MW | Wenzhou, Zhejiang Province, China

Claresholm Solar Farm, one of the Largest Solar Power Plant in Canada
132MW | Southern Alberta, Canada

APPLIED CASES

Distributed PV Rooftop

C&I PV Rooftop

- Logistics Warehouses Rooftop Solar Projects in Serbia, 10MW
- Hikvision Rooftop Project in Hangzhou, Zhejiang Province, 10MW
- Jintian Copper BIPV Power Station in Ningbo, Zhejiang Province, 30MW
- C&U Group Rooftop Project in Wenzhou, Zhejiang Province, 23MW
- Roof Project in Changxing Economic Zone, Huzhou, Zhejiang Province, 20MW
- Geely Automobile PV Rooftop Project in Linhai, Zhejiang Province, 10.3MW

……

Residential PV Rooftop

- Residential Project in Kecheng District, Quzhou, Zhejiang Province, 30MW

……

Roof Photovoltaic Power Station of Hangzhou East Railway Station
10MW | Hangzhou, Zhejiang Province, China

Hangzhou Civic Center Podium Roof Photovoltaic Power Station
1.2MW | Hangzhou, Zhejiang Province, China

Hervey Bay Rooftop
16 kW | Australia

Project "Million Rooftops for Zhixi"
4MW | Quzhou, Zhejiang Province, China

Global Cases

ASTRONERGY

Yajiang,Ganzi
Kela Power Station

Location:
Ganzi, Sichuan

Installed Capacity:
523.1MW

CO_2 Prevented:
1.6 Million t

Global Cases

ASTRONERGY

Shougang Park,Beijing
McDonald

Location:
Beijing

Installed Capacity:
0.4MW

CO_2 Prevented:
200 t

Global Cases

ASTRONERGY

Qilian Mt National Park

Location:
Qinghai & Gansu

Install Capacity:
43KW

CO_2 Prevented:
53 t

Global Cases

ASTRONERGY

Almax Aluminium

Location:
Queensland, Australia

Installed Capacity:
0.8MW

Power Generation:
1.20 Million kWh

Global Cases

ASTRONERGY

Döllen Power Station Brandenburg

Location:
Brandenburg, German

Installed Capacity:
154.4MW

Power Generation:
150 Million kWh

Global Cases

ASTRONERGY

Singapore F1

Location:
Singapore

Installed Capacity:
0.76MW

Power Generation:
800,000 kWh

Global Cases

ASTRONERGY

Project "Million Rooftops for Zhixi"

Location:
Quzhou, Zhejiang

Installed Capacity:
4MW

CO_2 Prevented:
3,100t

Global Cases

ASTRONERGY

Hangzhou East Railway Station Project

Location:
Hangzhou, Zhejiang

Installed Capacity:
10MW

CO_2 Prevented:
9,970t

Global Cases

ASTRONERGY

Taihan, Wenzhou Project "Complementary Fishery and Lighting"

Location:
Wenzhou, Zhejiang

Installed Capacity:
550MW

CO_2 Prevented:
648,000t

Global Cases

Wenzhou, Zhejiang
Ground Power Stations with Complementary Agriculture and Lighting

Location:
Wenzhou, Zhejiang

Installed Capacity:
150MW

CO_2 Prevented:
134,000t

Global Cases

ASTRONERGY

Kubuqi, Inner Mongolia Power Stations with Complementary Sand and Lighting

Location:
Kubuqi, Inner Mongolia

Installed Capacity:
310MW

CO_2 Prevented:
550,000t

Global Cases

ASTRONERGY

Midden Groningen Solar Park

Location:
The Netherlands

Installed Capacity:
103MW

CO_2 Prevented:
1.64 Million t

Global Cases

ASTRONERGY

Benban Solar Park

Location:
Egypt

Installed Capacity:
165.5MW

CO_2 Prevented:
156,000t

Global Cases

ASTRONERGY

Goonumbla

Location:
Australia

Installed Capacity:
89MW

CO_2 Prevented:
140,000t

Global Cases

ASTRONERGY

Brazil Barreiras

Location:
Brazil

Installed Capacity:
50MW

CO_2 Prevented:
21,535t

Global Cases

ASTRONERGY

Claresholm Solar Park

Location:
Canada

Installed Capacity:
132MW

CO_2 Prevented:
149,000t

Global Cases

ASTRONERGY

Baywa Yatpool Solar Park

Location:
Austrlia

Installed Capacity:
106MW

CO_2 Prevented:
105,841t

Global Cases

ASTRONERGY

Ínsua Solar Park

Location:
Portugal

Installed Capacity:
48.5MW

Power Generation:
94 million kWh

Global Cases

ASTRONERGY

DaMi Floating Solar Park

Location:
Vietnam

Installed Capacity:
47.5MW

Power Generation:
70 million kWh

THANKS FOR WATCHING

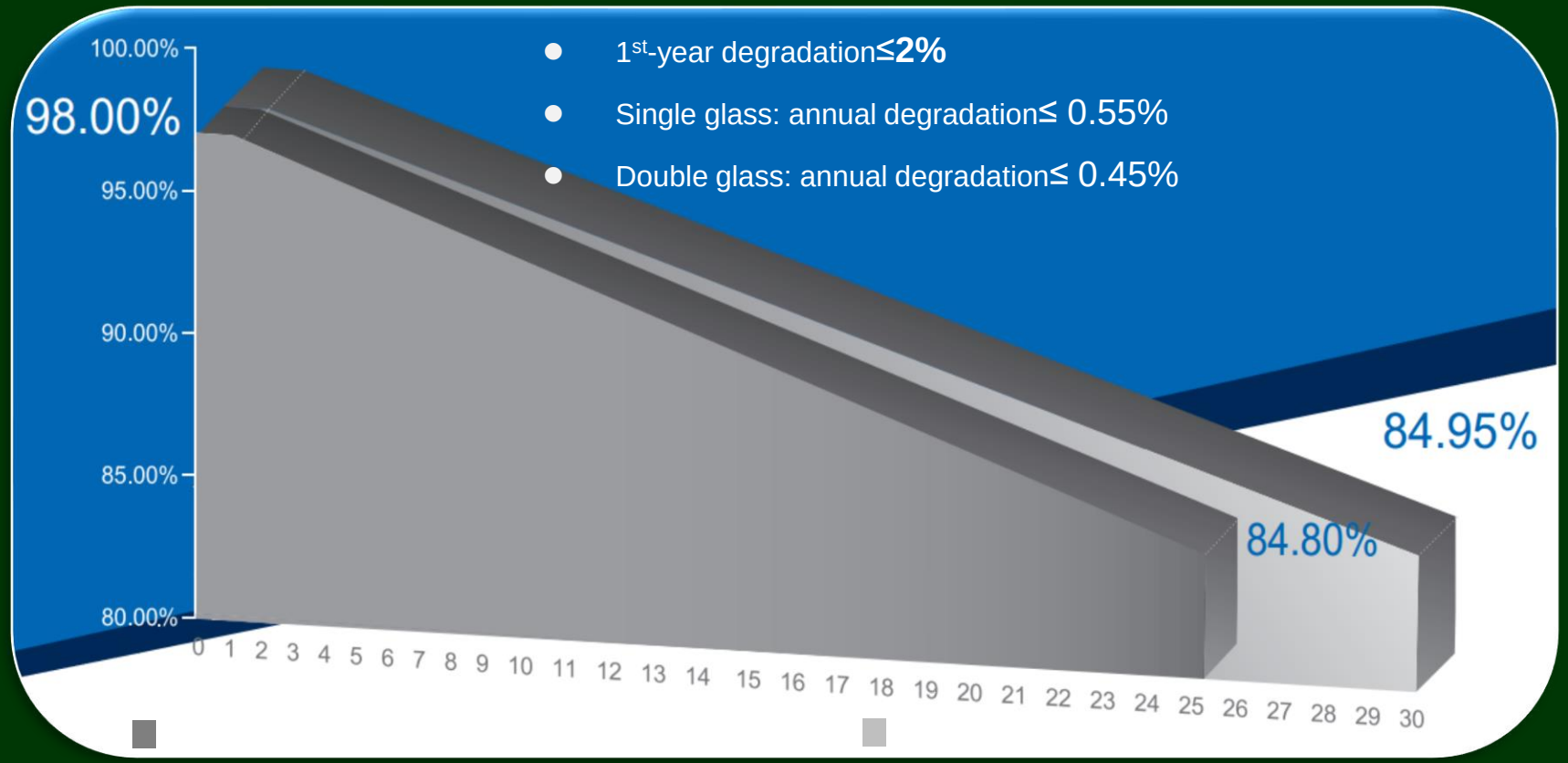
Astronergy
WeChat Channel

Linkedin YouTube Twitter Facebook

Welcome to visit
www.astro-energy.com

ASTRO

Warranty – ASTRO series



- 1st-year degradation≤**2%**
- Single glass: annual degradation≤ 0.55%
- Double glass: annual degradation≤ 0.45%

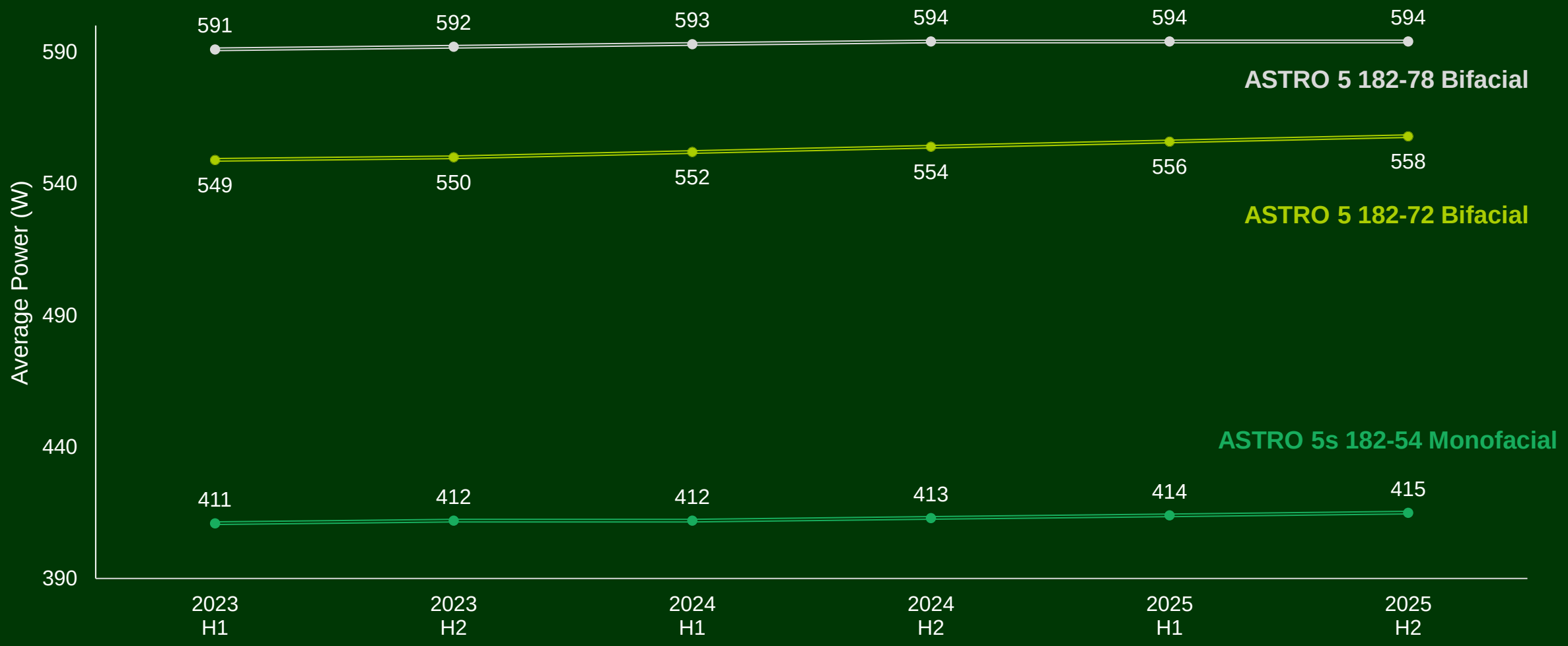
25/30

Power warranty

12/15

Workmanship warranty

Module Power Forecast – P Type



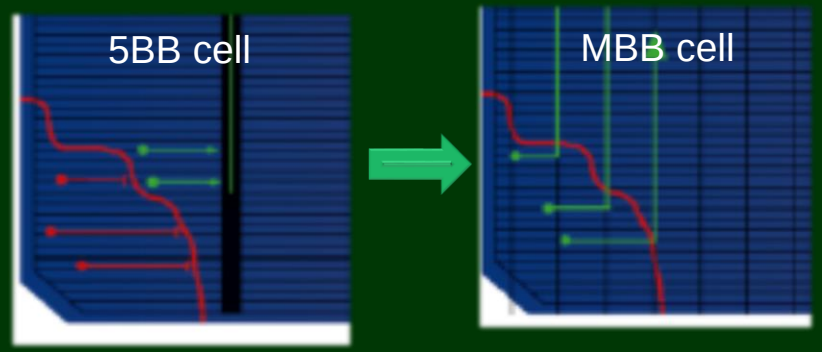
Multi-busbar

ASTRONERGY

ASTRO adopts 11BB design

Power ↑

Performance ↑



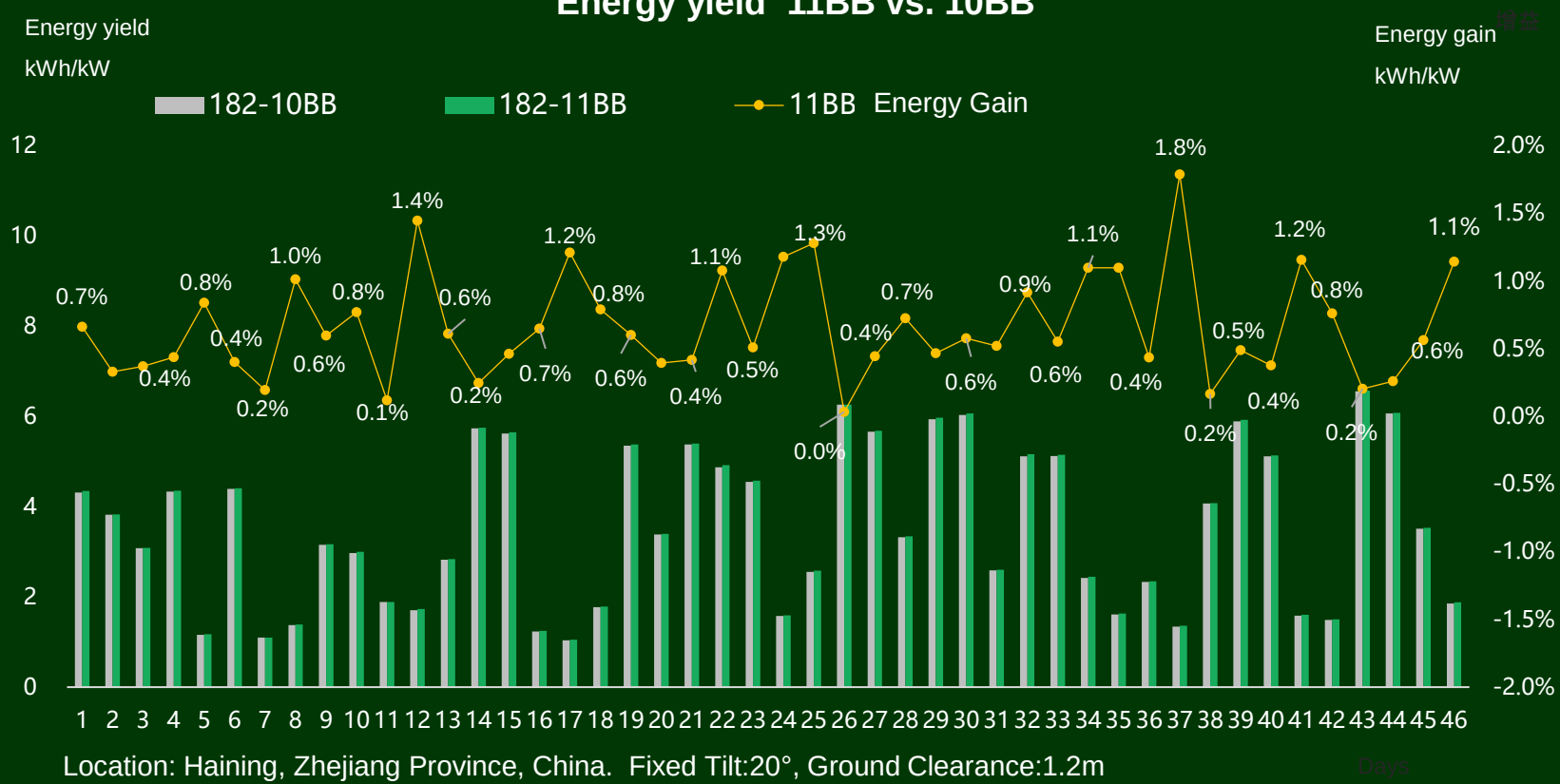
Improving light absorption

Improving tolerance to cracks

11BB vs. 10BB Energy Generation

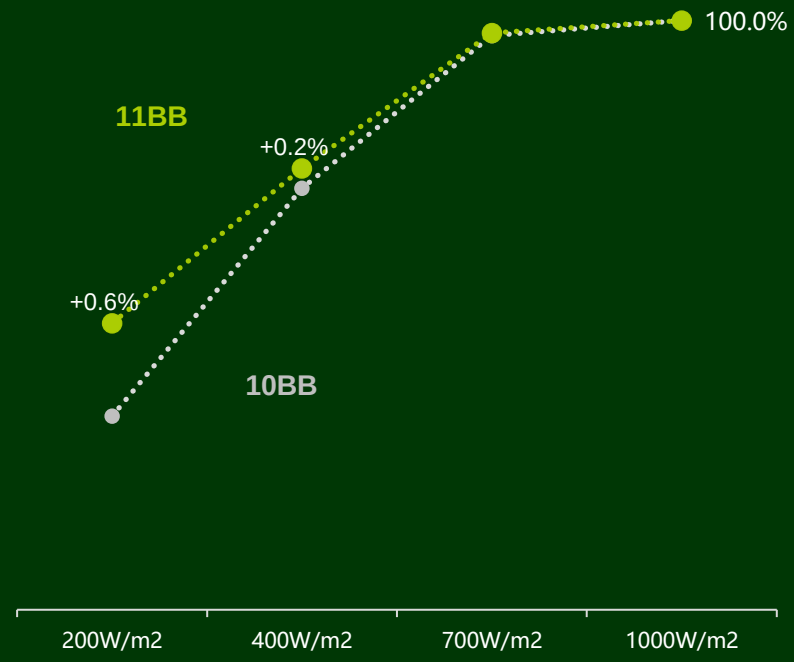
ASTRONERGY

Energy yield 11BB vs. 10BB



Location: Haining, Zhejiang Province, China. Fixed Tilt:20°, Ground Clearance:1.2m

Relative efficiency 11BB vs. 10BB



182-11BB performs 0.6% higher specific energy yield than 182-10BB.

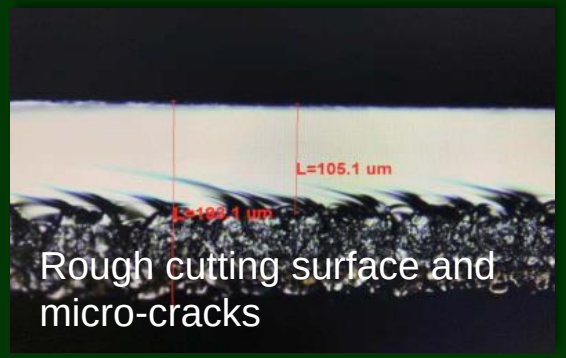
11BB has better low-light performance (0.6% higher relative efficiency at 200W/m2).

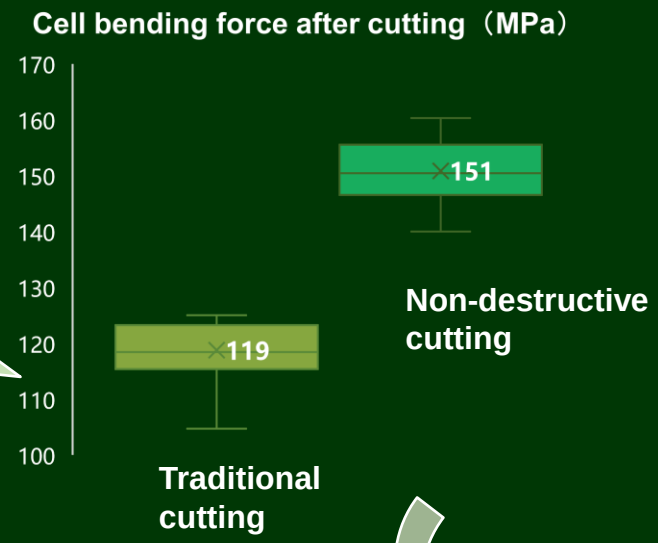
11BB has higher efficiency, hence lower operation temperature.

Non-destructive Cutting

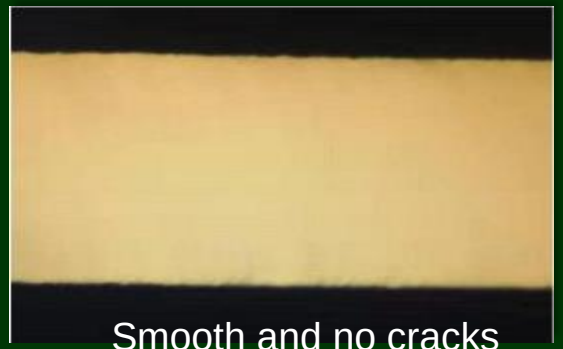
Non-destructive cutting: smooth cutting surface and no cracks, improving **the bending strength of cells and the mechanical properties of modules**

Traditional cutting





Non-destructive cutting



Improved mechanical properties

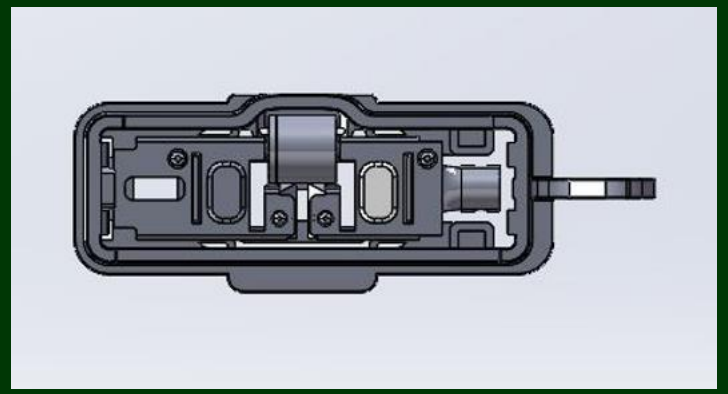
Junction Box with Advanced Design

ASTRONERGY

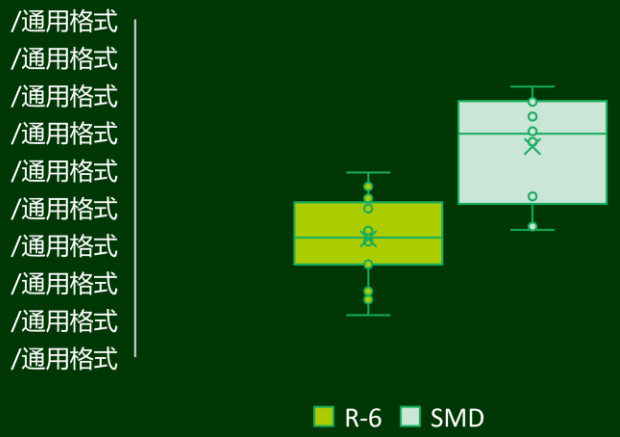
✓ Electric resistance welding type

✓ Red copper substrate

✓ Advanced electrical design



Different bypass diode thermal test



Current of test : 30A

Faster heat dissipation

Higher current

Higher reliability

Max. 28A

at thermal runaway

IEC62979-2020 certificate

CERTIFICATE of Conformity

TÜVRheinland

Registration No.: AK 50542886 0001

Report No.: CN22U4L5 001

Holder: Chint New Energy Technology Co., Ltd.
No. 1 Jisheng Road,
Jianshan New Zone
Haining
314415 Zhejiang
P.R. China

Product: diode
(Photovoltaic modules - Bypass diode - Thermal runaway test)

Identification:

Type Designation	: CHS3xyz (Chint New Energy (LOGO)) (x=1 or 2; y=1 or 2 or 3; z=1 or 2)
Diode	: 25SQ045 for y=1; 30SQ045-SL for y=2; 40SQ045 for y=3
Forward current	: 19A for 25SQ045; 24A for 30SQ045-SL; 28A for 40SQ045
Reverse bias voltage	: 17VDC for 25SQ045 and 30SQ045-SL; 16VDC for 40SQ045
Ambient Temperature	: 75°C

Tested acc. to: IEC 62979:2017

The certificate of conformity refers to the above mentioned product. This is to certify that the specimen is in conformity with the assessment requirement mentioned above. This certificate does not imply assessment of the production of the product and does not permit the use of a TÜV Rheinland mark of conformity.

Certification Body

Date 05.05.2022

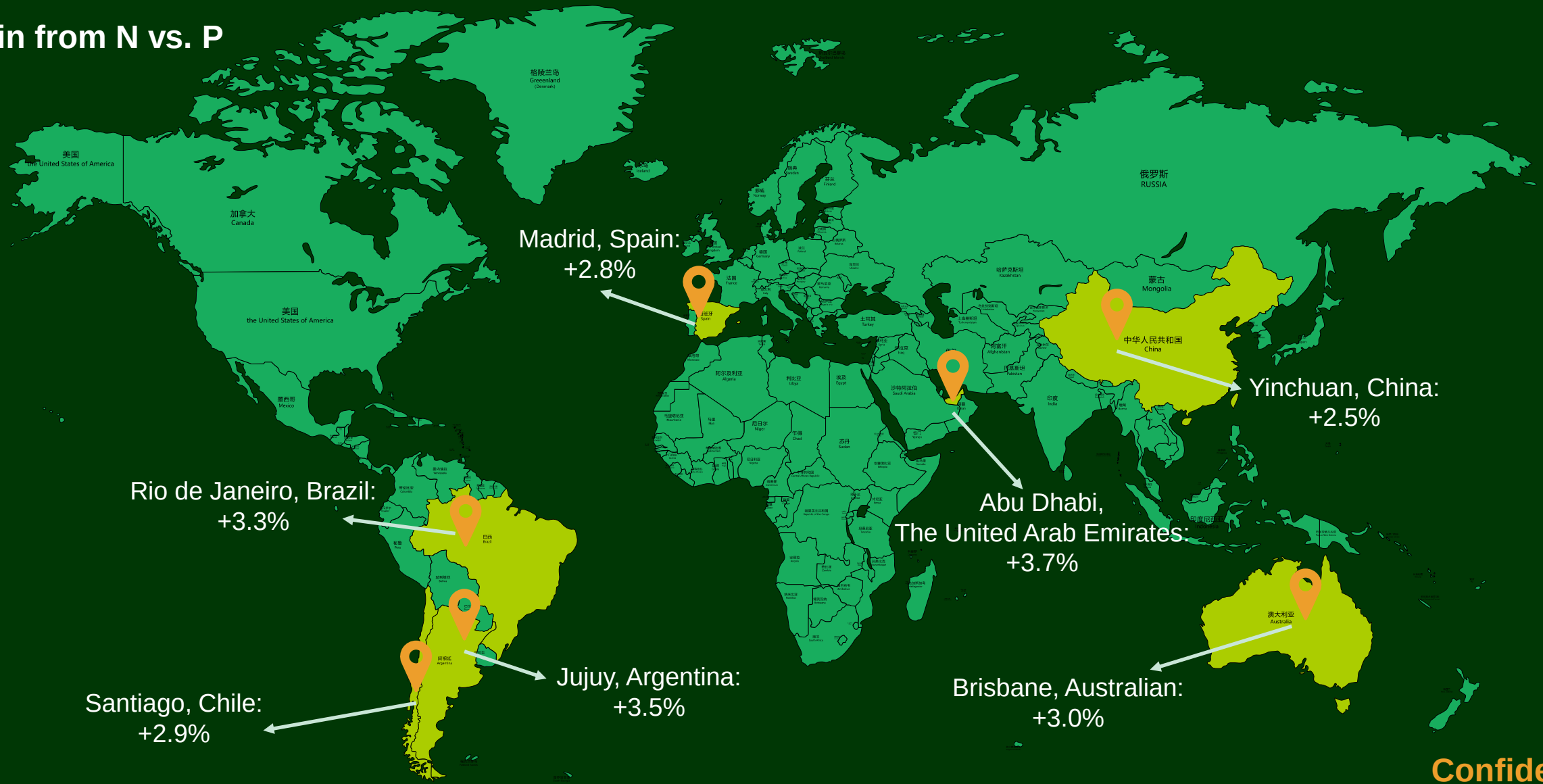
Paulus Hou

TÜV Rheinland LGA Products GmbH - Tillystraße 2 - 90431 Nürnberg

Lifetime energy yield

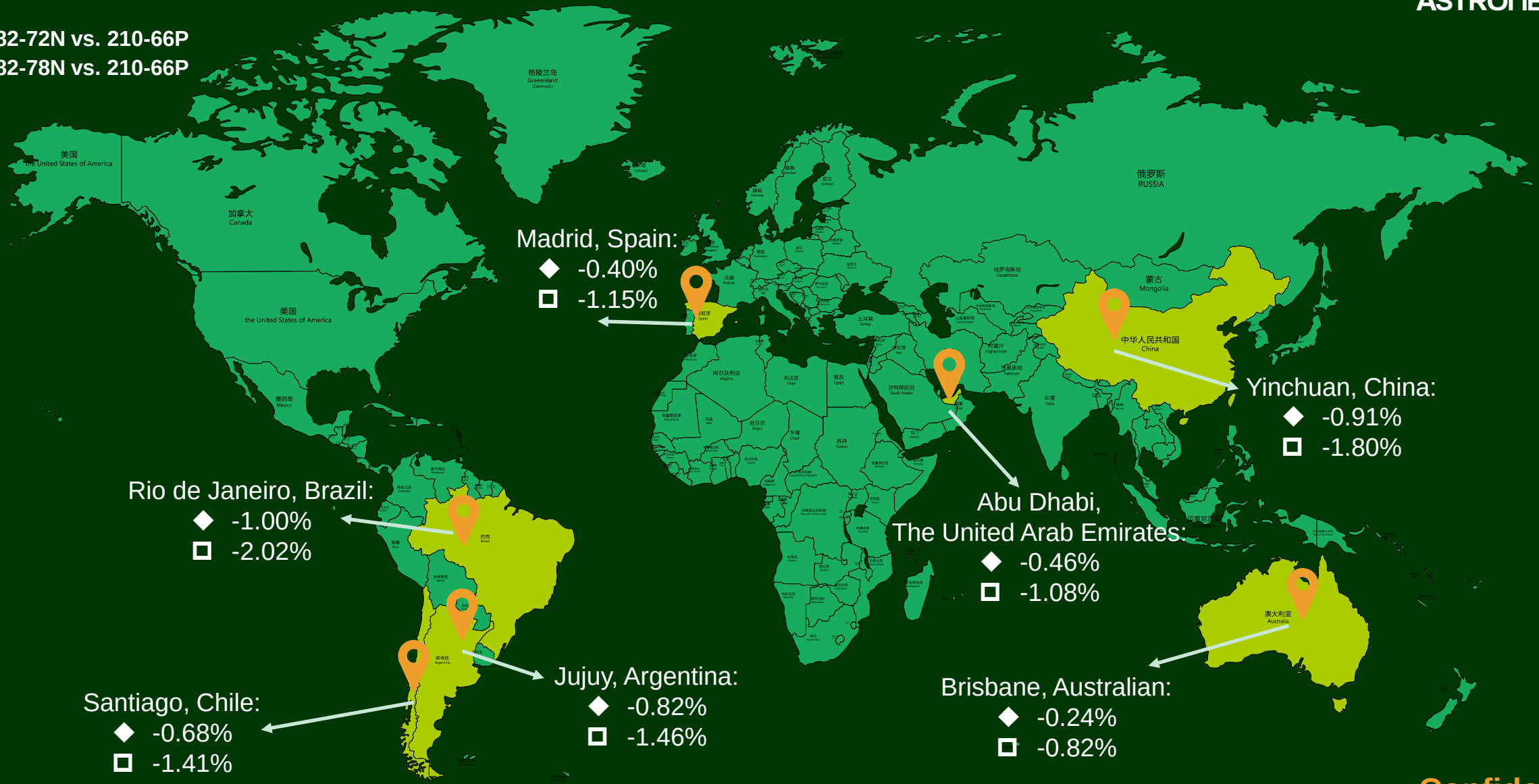
ASTRONERGY

Gain from N vs. P



BOS Cost

◆ 182-72N vs. 210-66P
□ 182-78N vs. 210-66P

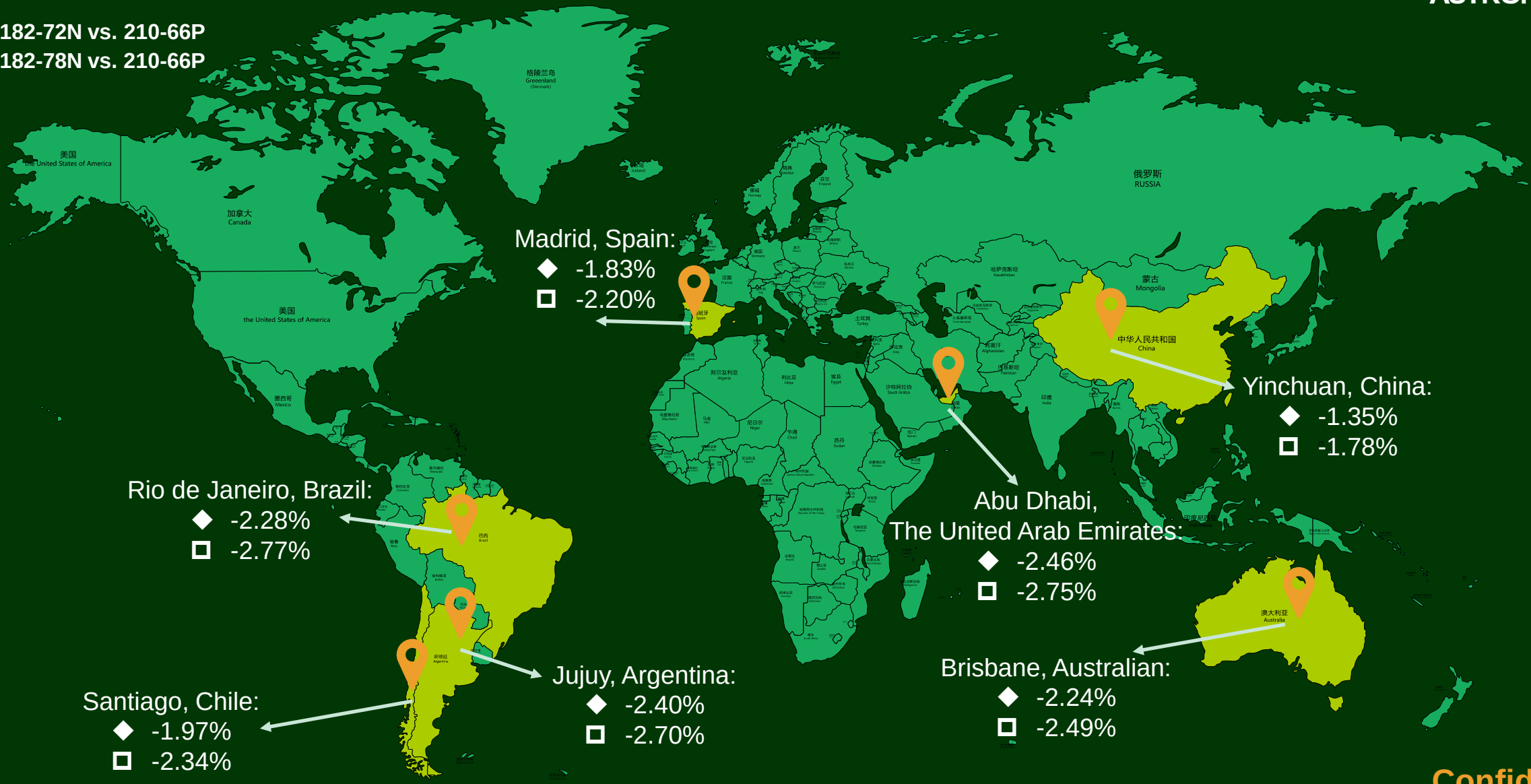


LCOE

Based on the price increase of 1 US cents/W for TOPCon modules

ASTRONERGY

◆ 182-72N vs. 210-66P
□ 182-78N vs. 210-66P



Madrid, Spain:
◆ -1.83%
□ -2.20%

Yinchuan, China:
◆ -1.35%
□ -1.78%

Rio de Janeiro, Brazil:
◆ -2.28%
□ -2.77%

Abu Dhabi,
The United Arab Emirates:
◆ -2.46%
□ -2.75%

Santiago, Chile:
◆ -1.97%
□ -2.34%

Jujuy, Argentina:
◆ -2.40%
□ -2.70%

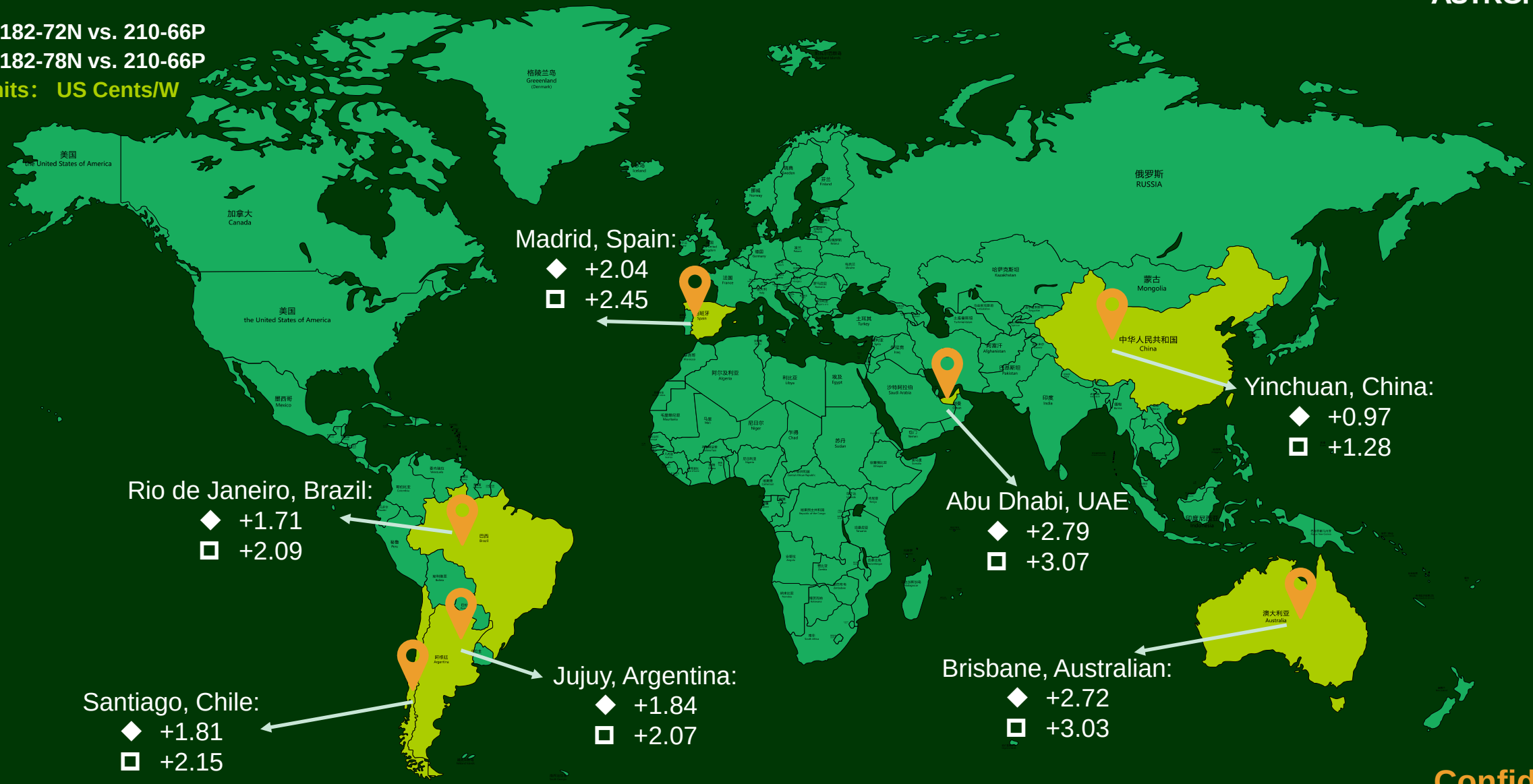
Brisbane, Australian:
◆ -2.24%
□ -2.49%

Module Profit Space

Based on the price increase of 1 US cents/W for TOPCon modules

ASTRONERGY

◆ 182-72N vs. 210-66P
□ 182-78N vs. 210-66P
Units： US Cents/W



Madrid, Spain:
◆ +2.04
□ +2.45

Yinchuan, China:
◆ +0.97
□ +1.28

Rio de Janeiro, Brazil:
◆ +1.71
□ +2.09

Abu Dhabi, UAE
◆ +2.79
□ +3.07

Jujuy, Argentina:
◆ +1.84
□ +2.07

Santiago, Chile:
◆ +1.81
□ +2.15

Brisbane, Australian:
◆ +2.72
□ +3.03