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Trina Solar

18 December 2023

2:00 pm – 3:00 pm | CET, Berlin, Madrid

5:00 pm – 6:00 pm | GST, Dubai

10:00 am – 11:00 am | BRT, São Paulo

pv magazine
webinars

The value of standard module formats in the n-type era



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Welcome!

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.

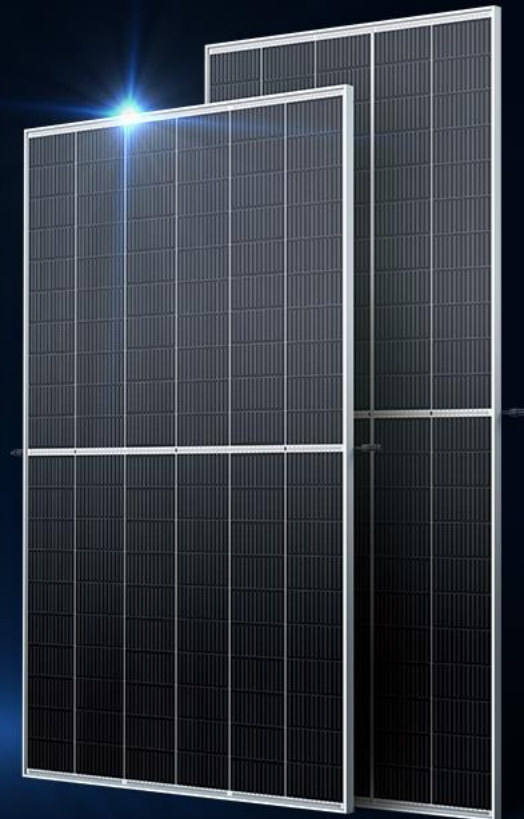
We are recording this webinar today. 

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



N-Type Era – Trend and Value of the Optimum Product Design with Trina Solar Vertex PV Modules

ZHOU YANGYANG, Shirley
Trina Solar · Global Module Product Management



Trina Solar i-TOPCon technology development roadmap

- Innovative Hydrogen passivation technology, The cell efficiency is 0.2% better than that of the product in the same period
- Wafer size 158.75mm×158.75 mm
- Mass production efficiency 23.5%
- 500 MW production line

Tongchuan ‘Top Runner’ technical leader project—2019.12 250MW

Changzhi ‘Top Runner’ technical leader project— 2019.6.30 250MW

- Wafer size 210mm×210mm+ 18BB
- Average mass production cell efficiency 24.5%
- Cell efficiency 25.15% (ISFH certificate)
- 500 MW TOPCon Pilot Line




Vertex S in Europe

Yellow River hydropower in Qinghai
2020.9.30 137MW

- Selective emitter, backside micro-structure reflector, high doping and low composite TOPCon structure. Cell efficiency: 26.2%
- Wafer size: 210,210R
- Mass production efficiency 25.5%
- Full-scale mass production, Production Capacity 40GW+
- Comprehensive product portfolio!



2015~2019

Module power up to 430W

i-TOPCon

In 2015, Base on Trina Solar’s State Key Laboratory of Photovoltaic Science and Technology (PVST), i-TOPCon Lab was established.

2020~2022

Module power up to 680W

i-TOPCon PLUS

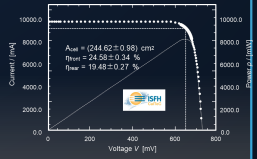
In 2019, the first TOPCon Cell World Record in China, 24.58% (ISFH certification)

2023~2024

Module power up to 710W

i-TOPCon ADVANCED

- Cell efficiency record
- 25.25% (2022/2, ISFH certificate)
 - 25.42% (2022/3, ISFH certificate)
 - 25.5% (2022/3, China National Metrology Institute certificate)



2025+

735W | 785W

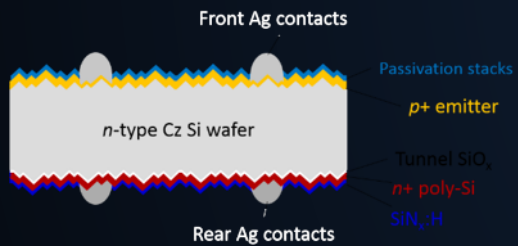
i-TOPCon ULTRA | TANDEM

- i-TOPCon + Full frontal passivation contact cell technology : Efficiency >27%
- i-TOPCon + tandem cell Technology: Cell Efficiency >30%

PCE (%)	Voc (V)	FF (%)	Jsc (mA/cm2)
28.5	1.84	75.9	20.4

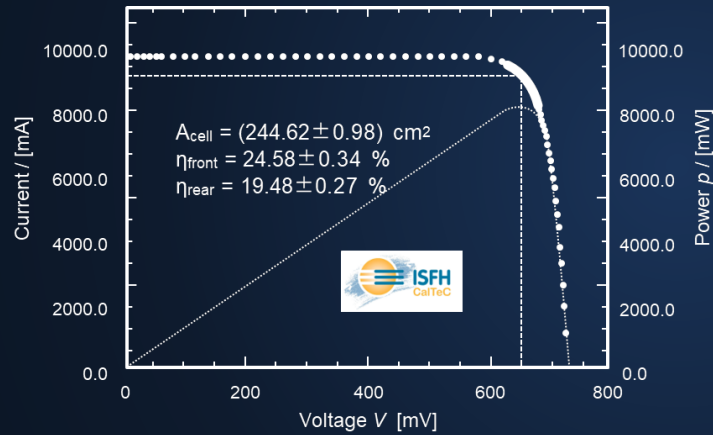
2019-2020, Trina Solar i-TOPCon: Mass production cell efficiency 23.5% (innovative hydrogen passivation technology)

Industrial tunnel oxide passivated contact cell (i-TOPCon)



In 2019, the i-TOPCon structure and technical route were first proposed

24.58% Lab cell



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The first TOPCon battery world record in China, the first mass production exceeded 23.5%(2019)

Conventional Contact

Passivation Contact

Interface recombination rate is 2 orders lower

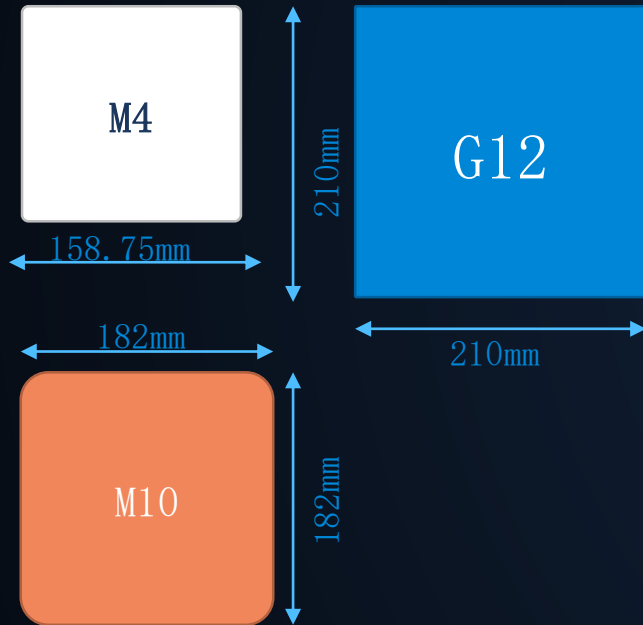
The paper is published in Nature Energy



The first “Top Runner” technical leader project in China (Changzhi in Shanxi and Tongchuan in Shaanxi, 10% power generation gain)

2021-2022, Trina Solar i-TOPCon plus: Mass production capacity 24.5% (210mm solar cell, 18BB)

G12

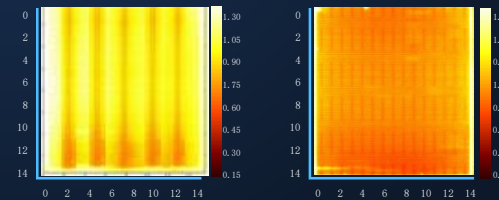


SMBB (18BB)

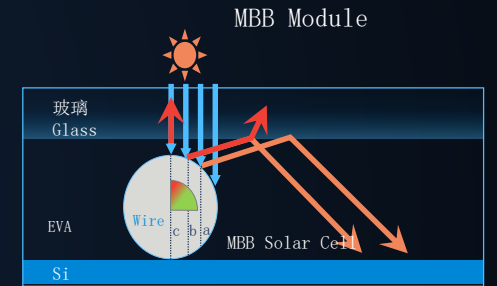
Optical performance:
Increase extra 1%~1.5% optical absorb.



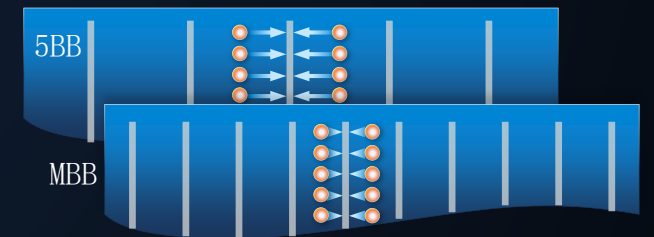
Electrical performance:
Increase extra 1%~1.5% power



Distribution of resistance on PI (photoluminescence) test



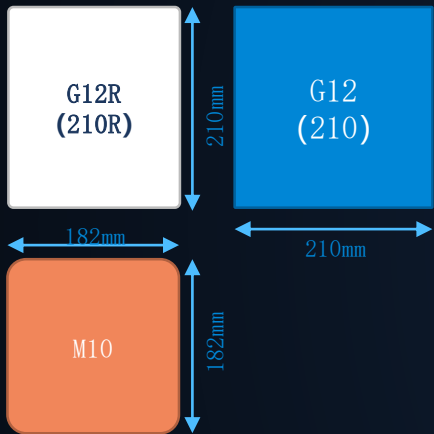
- ▶ Shading reduction
- ▶ Light trapping effect



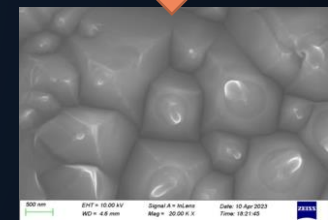
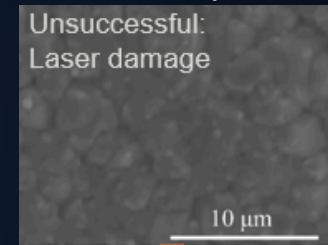
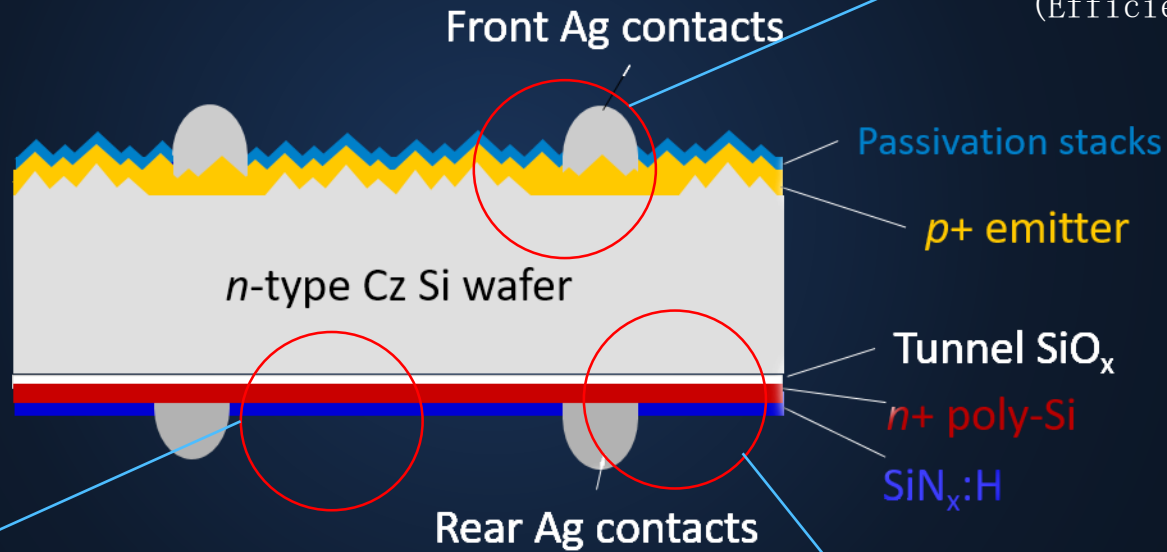
- ▶ Shorten current path 50%
- ▶ cell passivation

i-TOPCon advanced: Cell efficiency up to 26.2% (210R rectangle cell, selective emitter, back side micro-structure reflector, high doping and low composite TOPCon structure.)

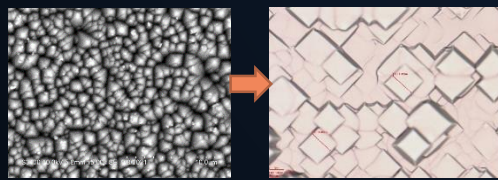
1) The industry-leading innovative **210 cell size**



2) Large area boron doped by **laser**, selective emitter technology (Efficiency increase by 0.2-0.3%)



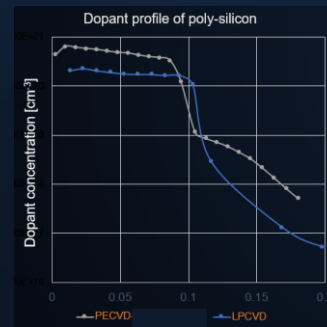
3) Backside **micro-structure** reflector (Inner back reflectivity increased by 25%)



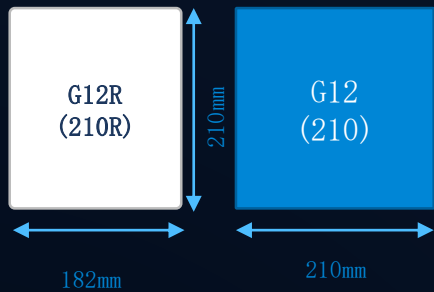
Reflectivity

32%

42%



4) High doping and low composite TOPCon structure. (Adopt **PECVD** route for tunnel oxide and poly-Si, doped density up to $6 \times 10^{20} \text{ cm}^{-3}$, 2-3 times higher than normal LPCVD)- allows thinner layer for lower optical loss



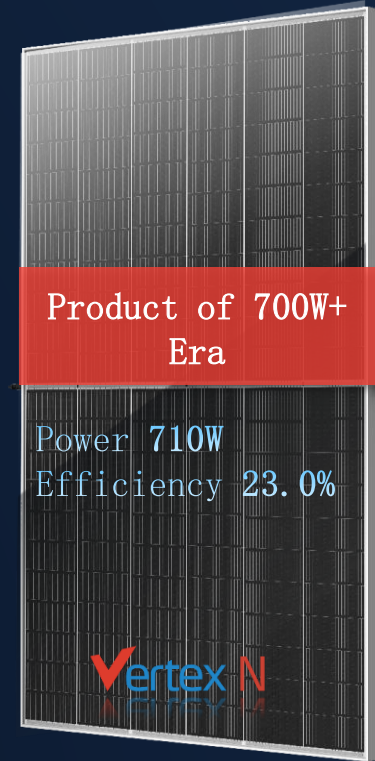
G12 R 48pcs
NEG9R. 28

UP to 450W



G12 R 66pcs
NEG19RC. 20

UP to 620W



G12 66pcs
NEG21C. 20

UP to 710W

Industry average level



Trina solar N-iTOPCon Vertex high efficiency series solar modules ,fit all kinds of application scenarios.

Higher customer value →

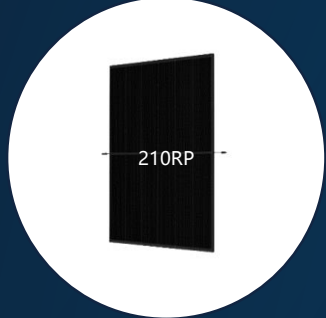
210N mass production with i-Topcon Plus



Jan 2022

Vertex S+ 415W
Light Weight Dual Glass Design
Longer Warranty 25+30Y

Innovative 210R rectangle cell Platform Release



April 2022

+20~30W Higher power
Shipping capacity +5%
Good compatibility
Lower system capex

210RN i-TOPCon Advanced Module Release



Jan 2023

Vertex S+ power up to 450W
Vertex N power up to 620W
Reduced BOS and LCOE
Design concept of innovative 210R platform publish.

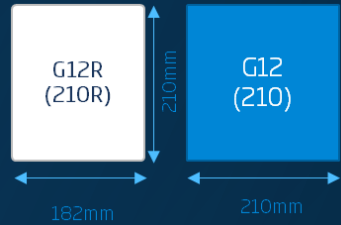
Vertex N Module Mass Production



June 2023

Product mass production

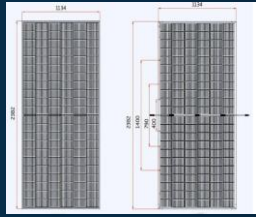
Trina Solar i-TOPCon Technical Roadmap Disclosed



May 2023

Vertex S+ 450
Vertex N 620
Vertex N 710
Full product portfolio

Medium Module Size Standardization



July 2023

Nine of leading Chinese PV manufacturers jointly release uniform mechanical module size @2382*1134mm.

N Type Module Mass Production Capacity Up to 70GW



Q4 2023 ~ 2024

By end of 2023, Overall module capacity 95GW+, cell capacity 75GW+

N-Topcon+ Rectangle wafer based standard size module

关于矩形硅片组件尺寸标准化的倡议

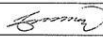
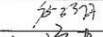
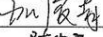
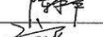
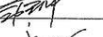
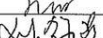

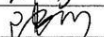
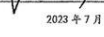
新一代矩形硅片可以提升组件功率，最大化利用封装箱，并降低系统成本，成为行业发展的一个重要技术方向。为降低因矩形硅片组件尺寸的差异导致的产业链供应困难、材料浪费及客户系统设计的应用困扰，推进矩形硅片组件尺寸的标准化势在必行。

阿特斯、东方日升、晶澳、晶科、隆基、天合、通威、一道、正泰9家组件企业代表经过充分及深入地沟通，对新一代矩形硅片中版型2382mm*1134mm组件标准化尺寸达成了如下共识：

组件尺寸：2382mm*1134mm
组件长边纵向孔位距：400mm/790mm/1400mm

同时，我们倡议行业现行的以及未来的182系列组件与210系列组件尺寸设计应遵循中国光伏行业协会标准《T/CPIA 0003-2022 地面用晶硅光伏组件外形尺寸及安装技术要求》（中国光伏行业协会 CPIA (chinapv.org.cn)）中的规定以及行业现有的尺寸。在这些尺寸种类范围内，各厂家根据自己的情况进行采用，以满足不同客户的需求。

9家企业共同倡导和推动上述标准化尺寸方案为行业内更多的企业所接受，并将各矩形硅片组件标准化尺寸纳入中国光伏行业协会的标准。此外，9家企业决定共同成立“光伏组件尺寸标准化研讨组”，形成定期沟通及协同机制，推进新一代矩形硅片其它版型组件尺寸的标准化，以促进光伏行业健康发展。

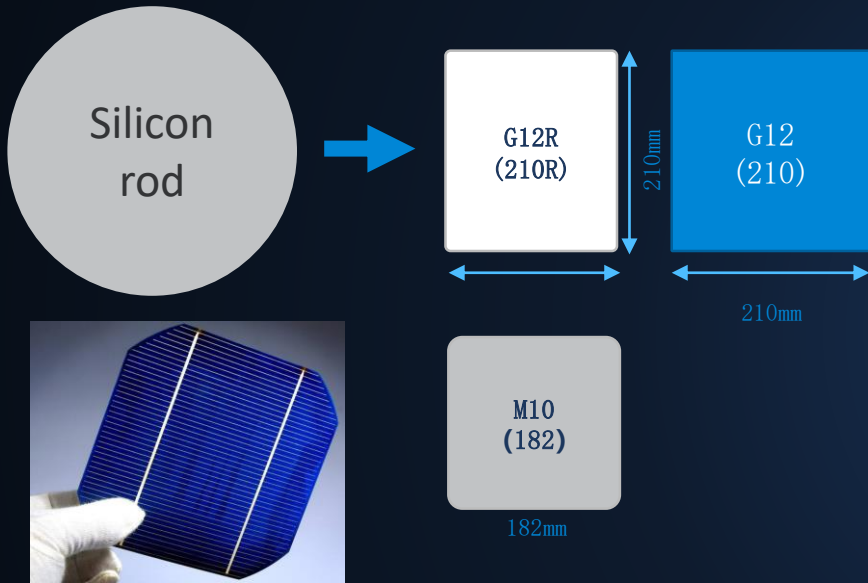
序号	公司名称	签字栏
1	阿特斯阳光电力集团股份有限公司	
2	东方日升新能源股份有限公司	
3	晶澳太阳能科技股份有限公司	
4	晶科能源股份有限公司	
5	隆基绿能科技股份有限公司	
6	天合光能股份有限公司	
7	通威股份有限公司	
8	一道新能源科技股份有限公司	
9	正泰新能科技有限公司	

2023年7月7日

Vendor	Progress	Standard Medium-Size Module Design
Trina	Founder of rectangle 210R Cell and medium size module. First launch of 210R medium size module in 2021. First launch 210RN in 2023. Total shipment is over 15GW. Capacity >30GW	210x182 - 66
Jxkx	Coordinator of module size standardization. New product size is 2382x1134	210x182 -66
Jx	Based on 199 wafer, 2382x1134, 1762x1134, 2333x1134, 2465x1134 product.	Wafer: 199x182 210x182 -66
Cxnt	New product size is 2382x1134	210x182 -66
x斯	Based on Rectangular wafer size, released 2382x1134 products which have been exhibited on domestic and international trade shows	210x182 -66 or 191x182 -72
x升		
x威		
x基		
x道		

Medium size module: 2382 x1134, 210x182
Signed by 9 leading module manufacturers' CEO in 7th July 2023

Wafer & Cell



- 210R wafer area, cell power increase about 15.7%, G12 increased 33.6% compare to 182
- The advantage of large-scale production is obvious

Module

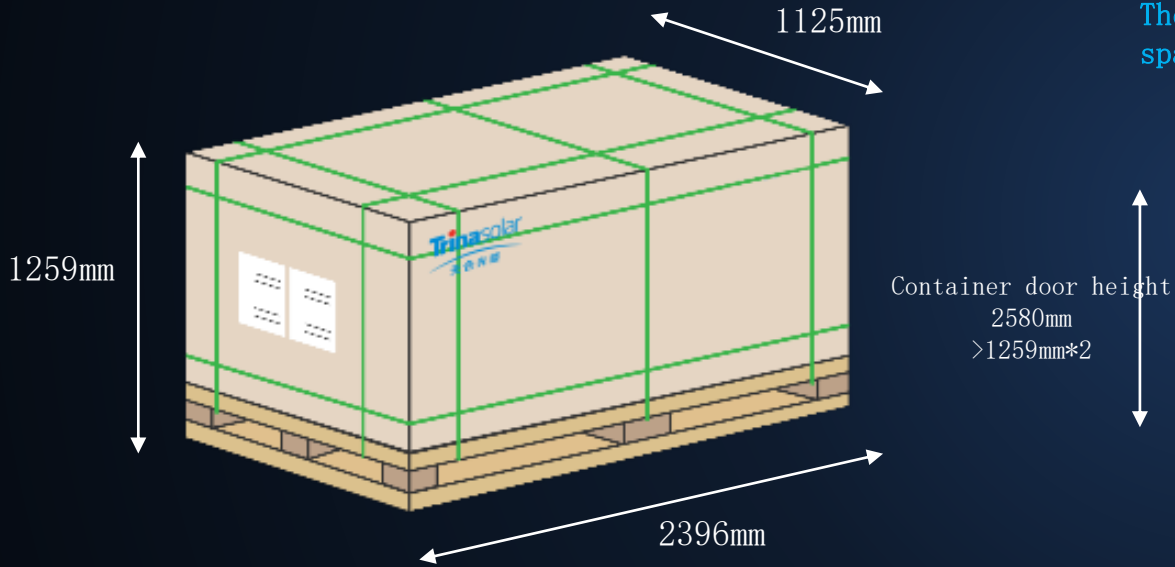
Product	Vertex RN	182-72pcs N
Design	210Rx66 half-cut	182x72 half-cut
Dimension	2382x1134x30mm	2278x1134x30mm
Weight	33.7kg	31kg
Technology	i-TOPCon advanced	182 TOPCon
Max Power	610W (+30W)	580W (BL)
Module Efficiency	22.6% (+0.1%)	22.5%
Voc	49.0V (-6.7%)	52.5V
Imp	14.96A	13.22A
Container capacity	720	720
Container power	439.2kw (+5%)	417.6
Container utilization rate	98.5%	94.5%

- Medium size module's power increase 30W with 10.6cm* longer size.
- 210R-66 design, module open-circuit voltage is 6.7% lower
- Container utilization is 4% higher, reach to 98.5%. Lower carbon emission during transportation.

Modules with standard medium size (represented by 210R) are more competitive

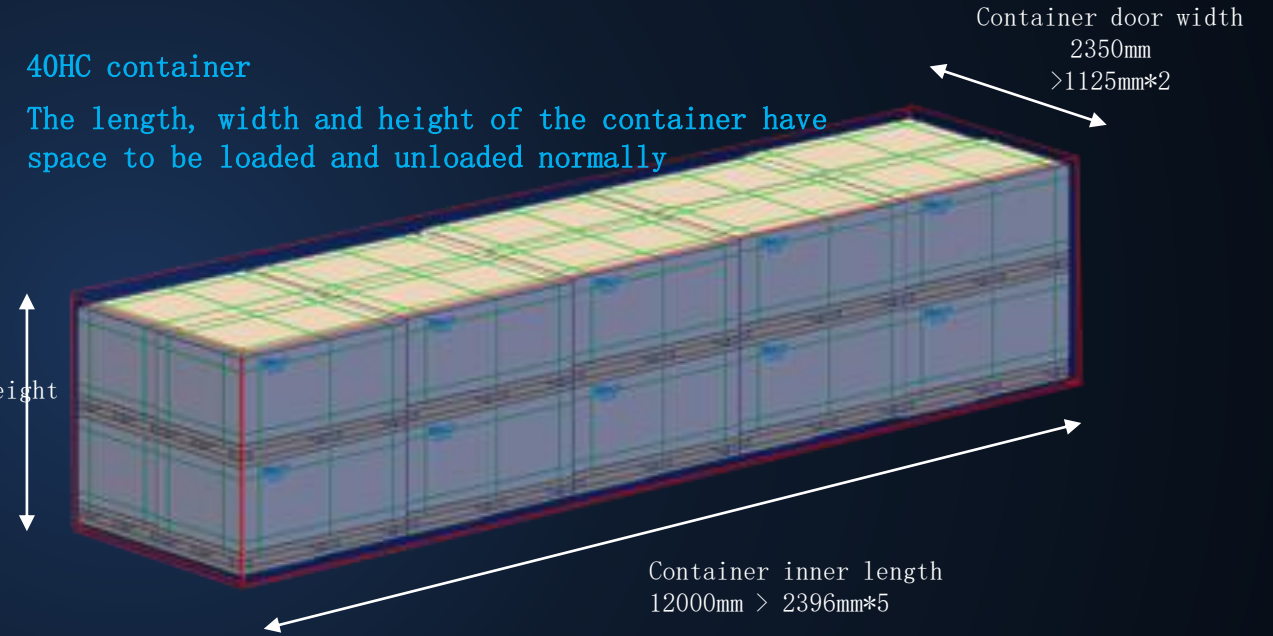
210R -66pcs Golden size:2382*1134mm , Maximize the use of container space

210R module package size (pallet included)



40HC container

The length, width and height of the container have space to be loaded and unloaded normally



	Module power	Pieces per pallet	Pallets per container	Container space utilization	Power total per container	
182-N	580W	36	20	94.5%	417, 600W	BL
210R-N	610W	36	20	98.5%	439, 200W	+24, 200W (+5%)

String: High Power, Low Voc

210RN
605Wp



Product Name	Vertex RN
Module Power	610W (+30W)
Voc	49.0V (-6.7%)
Imp	14.96A

Design
Advantages

- 210RN 605W **Voc 3.5V lower**
- According to 1500V system, each string length around 29 pieces, string power is 17.7kW.**
- Each string increases 2 more modules, with +13% increase in string power.**

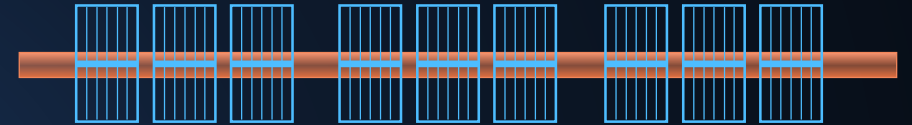
Reference
182N 575Wp



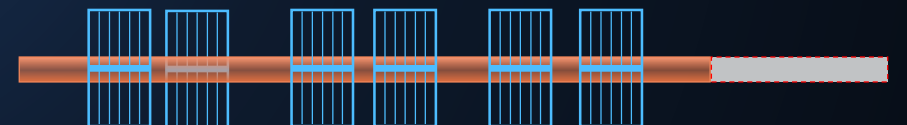
Product Name	182-72pcs N
Module Power	580W (BL)
Voc	52.5V
Imp	13.22A

- 182-72 module power is 30W lower
- 1500V system voltage, 27 modules/ string, string power about 15.7kW

System: The Best Partner for Tracking System



- 1P Tracker: 3 Strings on 1 tracker, Length tracker: ~ 101.0m
- Tracker power: 53.1 kW/Tracker, total power increase **+13%**
- Total quantity of strings & module: reduced **-13%**
- Installation load, quantity of DC cable, MC4 connector reduced by 5~8%



- 1P Tracker: 3 Strings on 1 tracker, Length tracker: ~94.2m
- Tracker power: 47.1 kW/Tracker

Vertex N is optimized designed product which is pushing for a lower LCOE!

High Power Generation:

a) Lower Temperature Coefficient

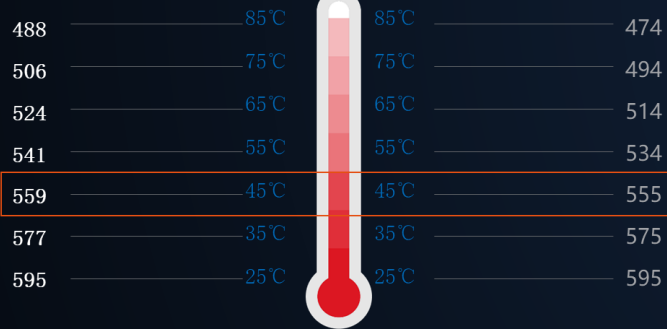
Module Working Temperature

N type
Power Output

-0.30%/°C
Temp Coefficient

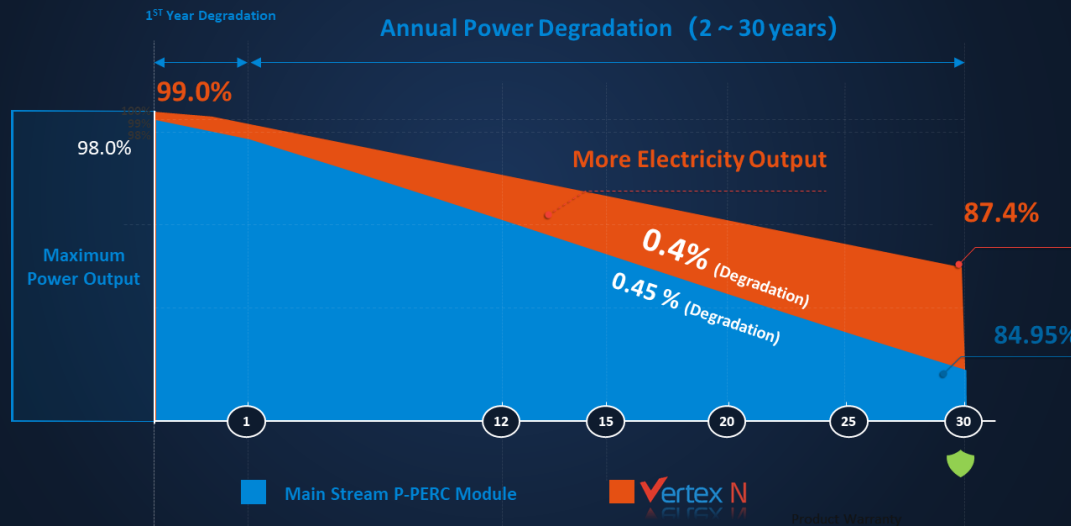
P type
Power Output

-0.34%/°C
Temp Coefficient



N type module can help reduce the power loss by 0.8% compared with P type when cell temperature is 45 °C

b) Lower Degradation



Higher power generation during 30 year lifecycle

c) Higher Bifaciality

Ground Condition	PERC 70% (±5%)	N Topcon 80% (±5%)
Grass Land Albedo=0.2	BL	+3.34%
Sand Albedo=0.4	BL	+4.40%
White Paint Albedo=0.7	BL	+5.42%

Benefiting on the extra power gain from the rear side

Trina Solar Vertex N Products Design Concept • 4

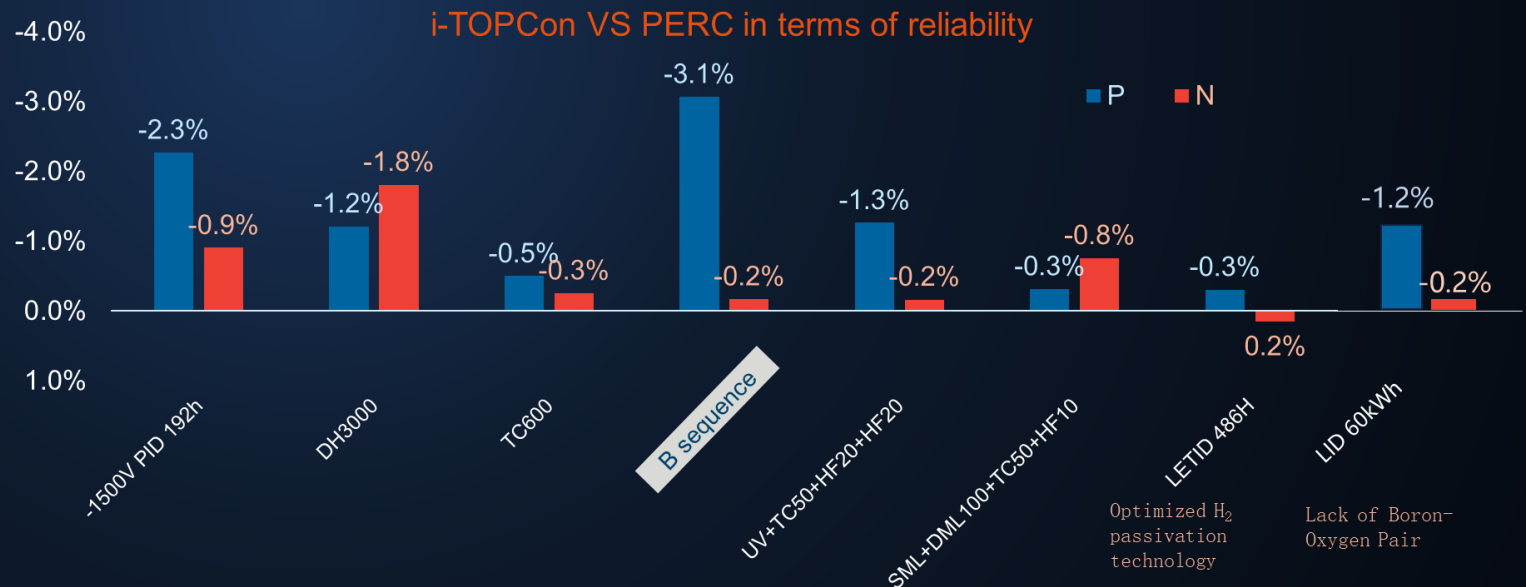
Higher Reliability:

5 Rigorous Tests - Mechanical

1. **Non-uniform snow-load test**
Withstand uneven snow load of 2.8m
2. **Extreme low-temperature**
Safe and Reliable under -40 °C Extreme temperature
3. **Hail test**
Withstand 35mm Hail Impact, no damage
4. **DML test**
Pass ±1500Pa Dynamic Load Test @ 20000 times
5. **Extreme wind tunnel test**
Pass 17 Hurricane Wind Test

Aging Tests

- The reliability of i-TOPCon modules is generally better than PERC
- Low post-test degradation% leads to higher power generation during the lifecycle



Inverters Compatible With Vertex N Suitable for All Kinds of Applications



Commercial and Industry Roof
610W or 710W Vertex + String Inverter



Hundreds MW Utility
710W Vertex N + Central Inverter



Mountain and Hilly Land Utility
Medium size 610W Vertex + String Inverter



Trinasolar

Power Beyond Solar



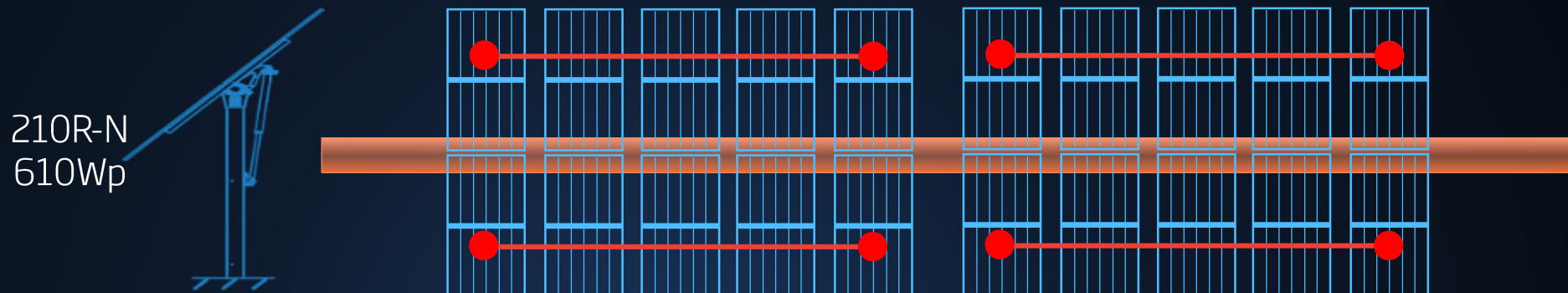
Trinasolar

天合光能

Trina Tracker N-Type Module Solution



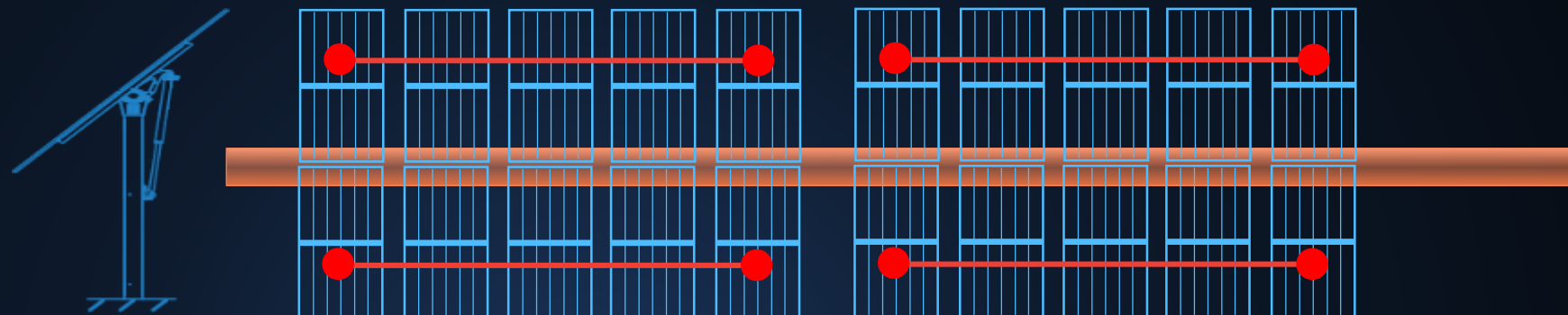
Compatibility of N-type Module with 2P tracker



Module	Size (mm)	String No.	Module No.	Tracker length	Capacity/set
182.20-72 P	2278*1134	√ (4 string)	√ (4*27)	√ (62.32m)	√ (61.56kw)
182.20-72 N	2278*1134	√ (4 string)	√ (4*26)	√ (60.00m)	√ (60.84kw)
210-66 RN	2382*1134	√ (4 string)	√ (4*28)	√ (64.61m)	√ (66.08kw)

28/string . 2P tracker length: 1 set power increase **+8.6%**

Compatibility of N-type Module with 2P tracker



Tracker Length		Module type	Power (W)	Actual length(m)	Tracker cost	Cable cost	BOS cost
70m	4 string	182P-72	61.81	62.32	BL	BL	BL
	4 string	210RN-66	66.08	64.61	+0.00138	-0.0284	-0.027

0.385cent

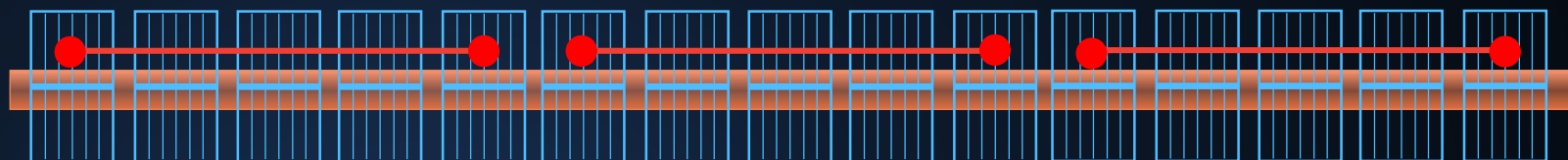
Tracker Length		Module type	Power (W)	Actual length(m)	Tracker cost	Cable cost	BOS cost
70m	3 string	210P-66	59.24	59.42	BL	BL	BL
	4 string	210RN-66	66.08	64.61	-0.00416	-0.0244	-0.03574

0.51cent

Compatibility of N-type Module with 1P tracker



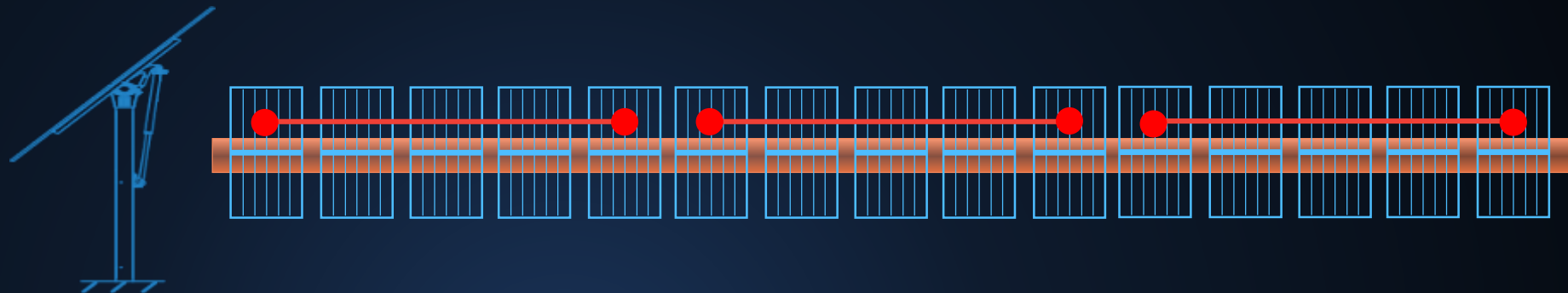
210R-N
605Wp



Module	Size (mm)	String No.	Module No.	Tracker length	Capacity/set
182.20-72 P	2278*1134	√ (3string)	√ (3*27)	√ (96.40m)	√ (48.69)
182.20-72 N	2278*1134	√ (3string)	√ (3*26)	√ (92.98m)	√ (46.94)
210-66 RN	2382*1134	√ (3string)	√ (3*28)	√ (98.48m)	√ (50.13)

28/string . 1P tracker length: 1 set power increase **+6.8%**

Compatibility of N-type Module with 1P tracker



Tracker Length		Module type	Power (W)	Actual length(m)	Tracker cost	Cable cost	BOS cost
110-120m	3 string	182P-72pcs	44955	94	BL	BL	BL
	3 string	210RN-66pcs	51765	101	-0.0226	-0.0047	-0.0273

0.39cent

Tracker Length		Module type	Power (W)	Actual length(m)	Tracker cost	Cable cost	BOS cost
110-120m	2 string	210P-66pcs	39600	80	BL	BL	BL
	3 string	210RN-66pcs	51765	101	-0.0250	-0.0035	-0.0285

0.40cent

Challenge

Challenge

Solution

Increasing local content requirements



Planning Factory
Third party Supplier

Falling module make trackers less attractive for some developers



Maximise energy density of project

High labor cost in installation

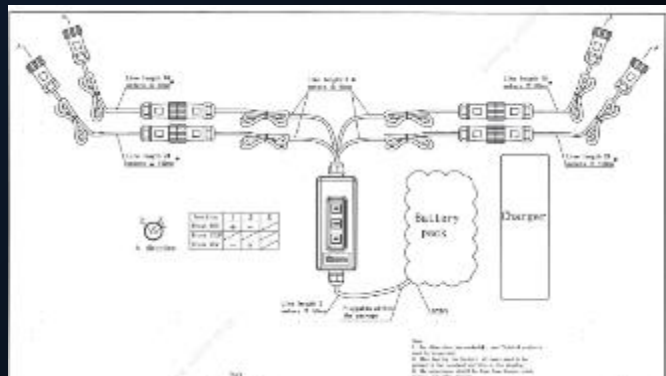
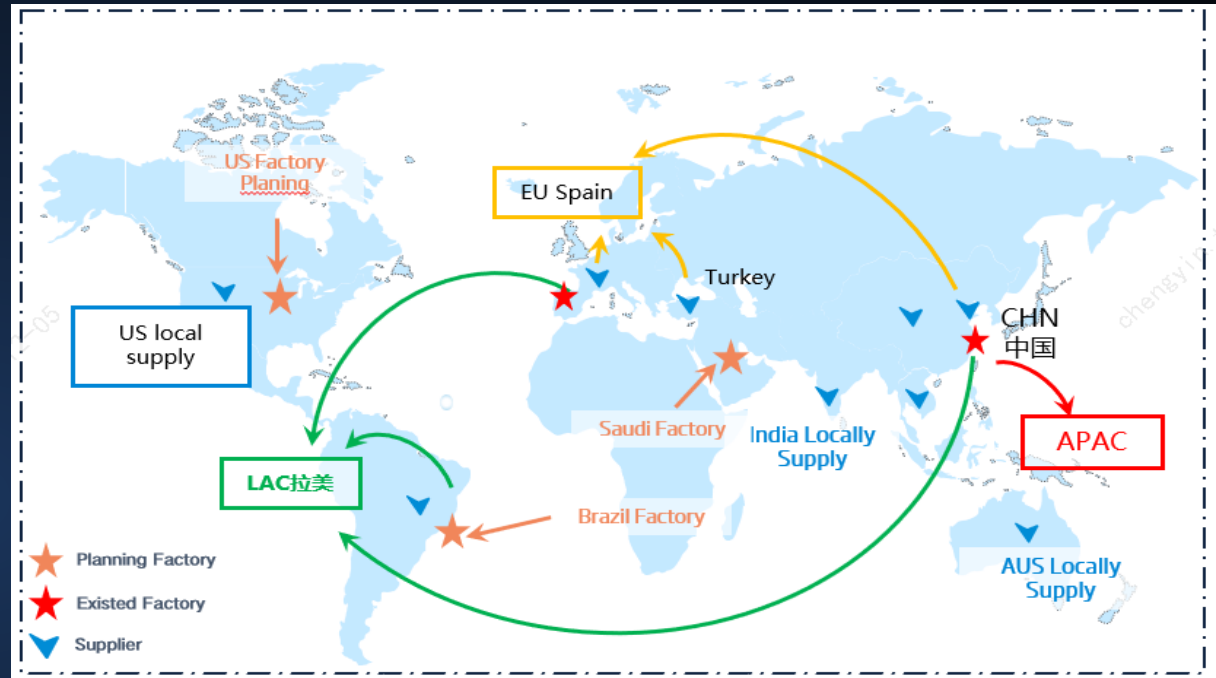


Develop quick installation devices

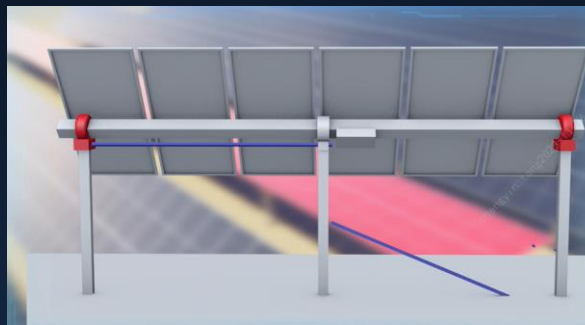
increasing lifetime operational costs



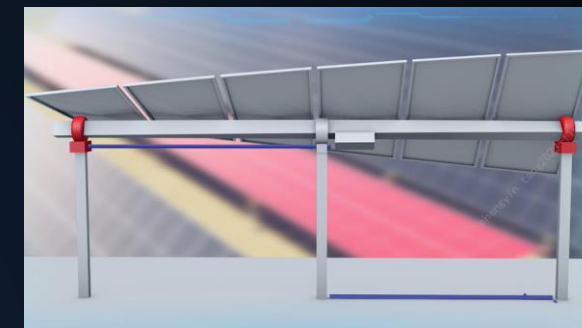
$$LCOE \downarrow = \frac{\text{Initial investment} + \text{O\&M cost} \downarrow}{\text{Life cycle power output}}$$



Multi-motor system reduce O&M cost



Mechanical failure cannot be self-monitored



Tracker twisted,



Advantage: Electrical signal transmission via cable. Trackers will stop operating after 10 seconds of overload, current anomaly, no signal input, etc.

Results: No Tracker torsion occurred, protecting Tracker and Module.



UL Renewable Energy Advisory

Greater China –Honglei Sheng

December 2023

128 Year History of Safety Science Leadership

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UL Research Institutes is a nonprofit research organization dedicated to advancing the Underwriters Laboratories public safety mission through scientific discovery and application. With best-in-class experts, we are the world's premier safety science research organization. We conduct rigorous independent research, analyze safety data and explore at the edges of technology to be the first to uncover and act on emerging risks to human safety.

About UL Standards & Engagement

UL Standards & Engagement is a nonprofit standards development and advocacy organization that translates data from safety science into practical, action-oriented safety standards. We convene experts worldwide and serve as a vital resource for regulators and policymakers. As a part of our public outreach activities, we share knowledge, advance standards-related safety policy partnerships and advocate for standards and regulations that result in positive safety changes.

About UL Solutions

A global leader in applied safety science, UL Solutions transforms safety, security and sustainability challenges into opportunities for customers in more than 100 countries. UL Solutions delivers testing, inspection and certification services, together with software products and advisory offerings, that support our customers' product innovation and business growth. The UL Certification Marks serve as a recognized symbol of trust in our customers' products and reflect an unwavering commitment to advancing our safety mission. We help our customers innovate, launch new products and services, navigate global markets and complex supply chains and grow sustainably and responsibly into the future. Our science is your advantage.





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Standards



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Technology and Service Overview

Mitigate the risks associated with renewable energy project investment



Technical Due Diligence

- Lenders technical advisory.
- Acquisition due diligence.
- Vendor due diligence.
- Construction monitoring.
- Operational monitoring.

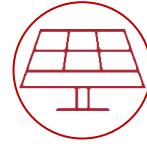
Areas of Expertise

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- Design & Implementation.
- Site Conditions.
- Permitting and Environmental.
- Contracts Review.
- Programme Analysis.
- O&M Strategy.
- Financial Model.





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- Feasibility studies, complex terrain layout and energy assessment
- Owner's Engineer
- Lender Technical Advisor
- Acquisition Due Diligence
- Factory and component inspection
- PV module Bankability Study
- PV module LCOE assessment

Bankability Study

APAC-MEA



Bankability Study Report

- Technical Bankability Study report is a fully comprehensive technology review covering OEM, storage system, Rack and Cells including the QA/QC review and factory review.
- Company Overview + Detailed Technology Description + Design Verification + Operating Experience Issues
- **Best suitable if the client is a buyer, Bankability Study Report helps the client mitigate all equipment (PV module, bracket and tracker and etc.) related concerns.**
- **Detailed supplementary description of the Certification and Test results, and a comprehensive documents for financing.**



Bankability Study Report

Table 2.1 Scope of Work

1.0	Introduction	
2.0	Module Technology Review	
	2.1	Key Specifications
	2.2	Test certificates
	2.3	Reliability and Performance
	2.4	Field Performance Review (optional)
	2.5	LCOE Report Review (optional)
3.0	Company Review	
	3.1	Company History
	3.2	Market Share and Competitiveness
	3.3	Financial Status
	3.4	Manufacturing Capacity
	3.5	IP & Patents
	3.6	Post-Sales Service and Warranty Support
4.0	Manufacturing and QA/QC Review (Cell manufacturing plant + Module assembly plant)	
	4.1	Factory Environment
	4.2	Manufacturing Process Review
	4.3	QA/QC review
5.0	Documentation Review, Project Coordination, and Communication	



Schedule and Deliverables

The work described in Section 2 should be completed in the time schedule defined below. The schedule will begin when the Proposal is fully executed or when all required documentations are made available (“Project Initiation Date”), whichever is later.

Deliverables	Time to Complete
Draft Report	8 weeks from executed Agreement, receipt of all required documentation, and site visit.
Final Report	2 weeks after Client has provided feedback on the Draft report.



ESS Standard Establishment

- UL 1642 – lithium battery cell;
- UL 2054 – household and commercial battery;
- UL 2580 – electric vehicle battery;
- UL 1973 – battery for light electric rail application and stationary application (commonly adopted for grid-tied ESS standard);
- UL 2272 – electrical system for personal e-mobility devices (PMD) such as e-scooter, e-bike, etc. (adopted in Singapore as market-entry prerequisite for e-scooter);
- UL 9540 – standard of energy storage systems and equipment (which covers a wider range of energy storage including battery, hydrogen, flywheel, thermal-storage, etc., for multiple applications)
- UL 9540A – testing standard for evaluating battery thermal runaway / fire propagation of ESS;
- UL also contributes to the development and international harmonization of industry safety and performance standards, e.g. UN 38.3 – lithium battery testing and transportation, and IEC standards.



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Bankability Study for Trina Solar

APAC-MEA



Trina Solar N-Type Module Bankability Study Report



INDEPENDENT ENGINEERING REPORT

N-Type Module Bankability Study

PREPARED FOR:
TRINA SOLAR CO., LTD.

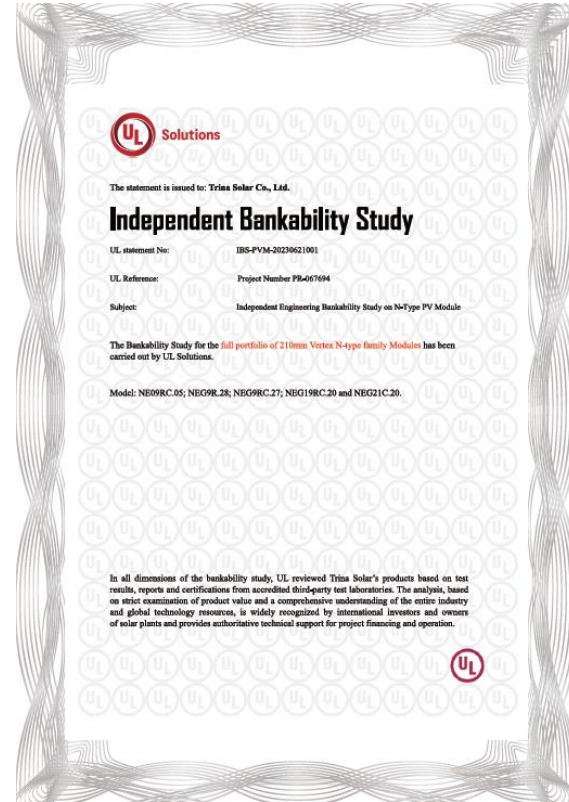
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China

02 November 2023

CLASSIFICATION
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Trina Solar N-Type Module Bankability Study Report

UL STS (“UL Solutions”) is pleased to be engaged by Trina Solar Co. Ltd. (“Trina Solar” or the “Client”) to provide a Bankability Study services (the “Service”) for 5 models of the Client’s solar photovoltaic modules (the “Product”). The list of PV module models is presented in the table below.

Table 1.1: List of modules under review

No.	Type	Peak Power (Wp)
1	TSM-NEG9R.28	450
2	TSM-NEG19RC.20	610
3	TSM-NEG9RC.27	440
4	TSM-NE09RC.05	430
5	TSM-NEG21C.20	700



Trina Solar N-Type Module Bankability Study Report

The following table summarized UL Solution's work and the comments for each of the scope.

Table 2-1: Executive summary

	Subject	Comment
1.	Technology Review	<p>Based on reviewed IEC and UL test certificates and reports, UL Solutions is in the view that the design and operating specifications of the Vertex S and Vertex N products under review are aligned with industry standards.</p> <p>Trina Solar PV modules under review have passed IEC61215 and IEC 61730-1 and -2, which is considered standard qualifications by the solar industry.</p>
2.	Company Review	<p>Trina Solar's cumulative shipments by the first half of 2023 exceeded 150GW out of which the production capacity of 210mm modules accounted for over 95% of the total annual capacity.</p> <p>Trina Solar presented a significant income and profit growth from 2020 to 2022. It is noted that the significant growth in operating income of more than 90% (as compared to 2021) and nearly 190% (as compared to 2020) was recorded in 2022.</p> <p>Trina Solar offers 12 or 15 years of product warranty, and 25 to 30 years of performance warranty across its Vertex S+ and Vertex N series of modules.</p> <p>UL Solutions considers the power performance warranty to be consistent with industry standard in terms of module degradation.</p>
3.	Manufacturing and QA/QC Review	<p>UL visited Trina Solar Suqian cell factory and Huai'an module factory on 9 August 2023 and 4 August 2023, respectively. UL inspected the production line for 210R series PV cell and Vertex S and S+ series PV module and the workshop environment and found that the working environment to be clean, safe and conducive for workers.</p> <p>UL reviewed the manufacturing process and verified the process during the manufacturing facility site visit. UL is in the view that the documented process matches the process observed on site.</p> <p>UL observed that the cell fabrication and module manufacturing facilities have the proper safety procedure and did not identify any major HSE risks during the visit. Based on interviews with operators at the manufacturing facility, UL understands that the operators had proper training and qualification before their job assignments. Proper machine-specific safety warning and instructions were observed to be pasted in prominent places.</p> <p>The automated testing procedures such as EL testing after cell layup and cell stringing were viewed as good practice to identify defects early in the manufacturing process so as to minimize wastage and rework.</p>



Trina Solar N-Type Module Bankability Study Report

Table 3.3: Product certifications and testing

Standard	TSM-NE09RC.05	TSM-NEG9R.28	TSM-NEG9RC.27	TSM-NEG19RC.20	TSM-NEG21C.20
IEC 61215: 2016	✓	✓	✓	✓	✓
IEC 61730: 2016	✓	✓	✓	✓	✓
UL 61730: 2017	✓	-	✓	✓	✓
IEC 62716: 2013	✓	✓	✓	✓	✓
IEC 60701: 2020	✓	✓	✓	✓	✓
IEC 60068-2-68	✓	✓	✓	✓	✓
Hail test – MQT 17 of IEC 61215-2: 2016 ¹	-	✓	✓	✓	✓
PPP 58042B:2015 according to IEC TS 62804-1: 2015	✓	✓	✓	✓	✓



Trina Solar N-Type Module Bankability Study Report

From the figures listed in Table 4.1, Trina Solar presented a significant income and profit growth from 2020 to 2022. It is noted that the significant growth in operating income of more than 90% (as compared to 2021) and nearly 190% (as compared to 2020) was recorded in 2022. Right after and during the global pandemic situation, Trina can still achieve strong financial performance only demonstrates the confidence that the PV market has in Trina Solar.

Trina Solar has also invested in world-class research facilities. Its Ministry of Science and Technology – approved Laboratory for PV Science and Technology was awarded two prestigious state-level accreditations, namely, National Enterprise Technology Center and National Model Enterprise for Intellectual Property. As the competition in the PV module market is expected to be more intense moving forward to 2025, UL Solutions believes it is crucial to continue investing in R&D to improve the products' performance and safety features.



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The value of standard module formats in the n-type era

Q&A



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