Trina Solar

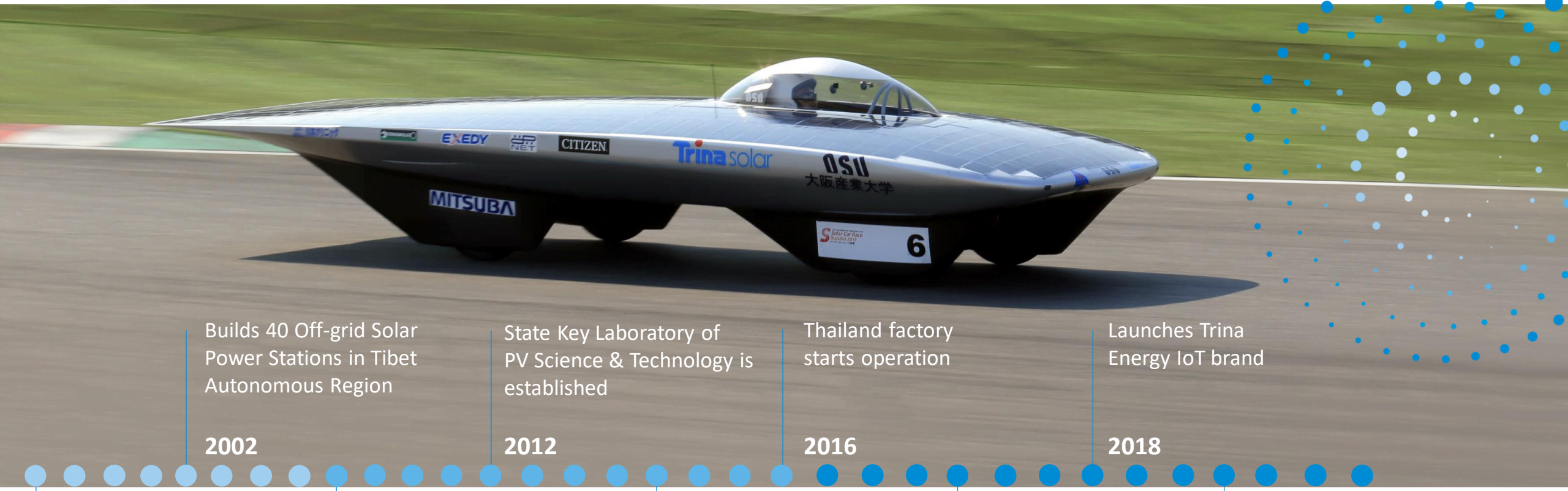
Vertex Series

Apr 2021

天赋能源 合而为一

Power beyond solar

Milestone



1997

Trina Solar is founded

2002

Builds 40 Off-grid Solar Power Stations in Tibet Autonomous Region

2006

Lists on the NYSE

2012

State Key Laboratory of PV Science & Technology is established

2014

Global Module Shipments No.1

2016

Thailand factory starts operation

2017

Launches Trina's Million-Roof Plan

2018

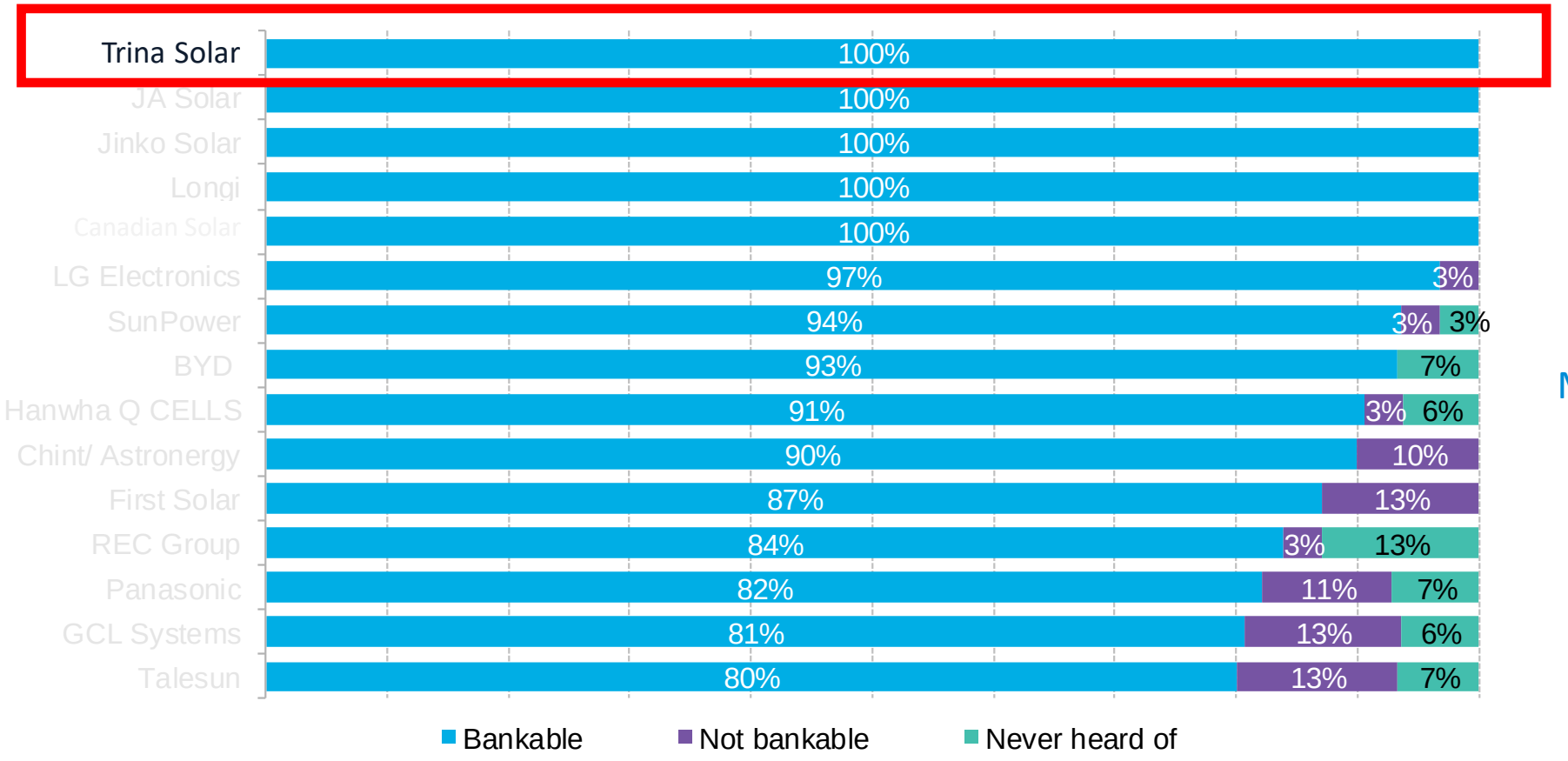
Launches Trina Energy IoT brand

2020

Issued first A-Shares on Shanghai Sci-Tech Innovation Board

Reliable Brand

BloombergNEF's PV module bankability results



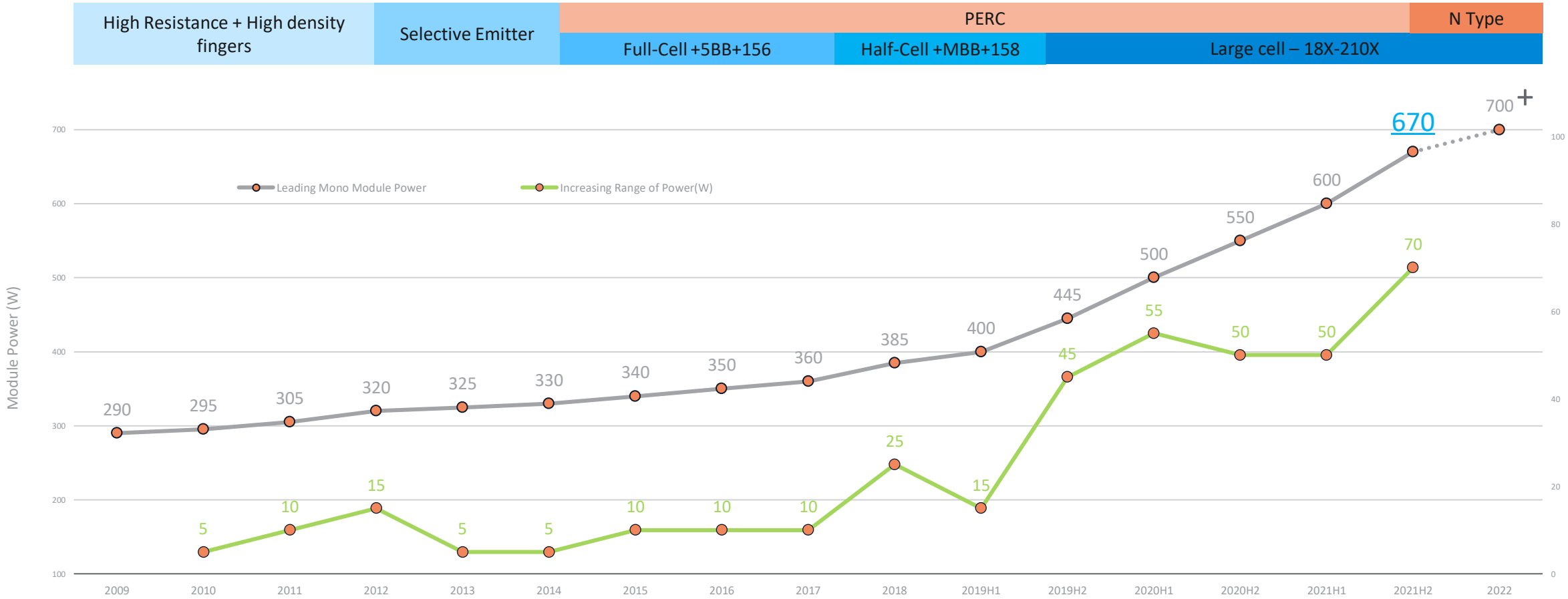
Source：BloombergNEF Aug 2020

"Top Bankable Module Supplier"
2016 -- 2020

Five times in a row

MODULE POWER TREND
LEADING THE ERA OF PV 6.0

Industrialization of 670W Vertex modules begin from today onwards.



Key Elements of LCOE

1. Module cost
2. BOS→Module power, Module efficiency

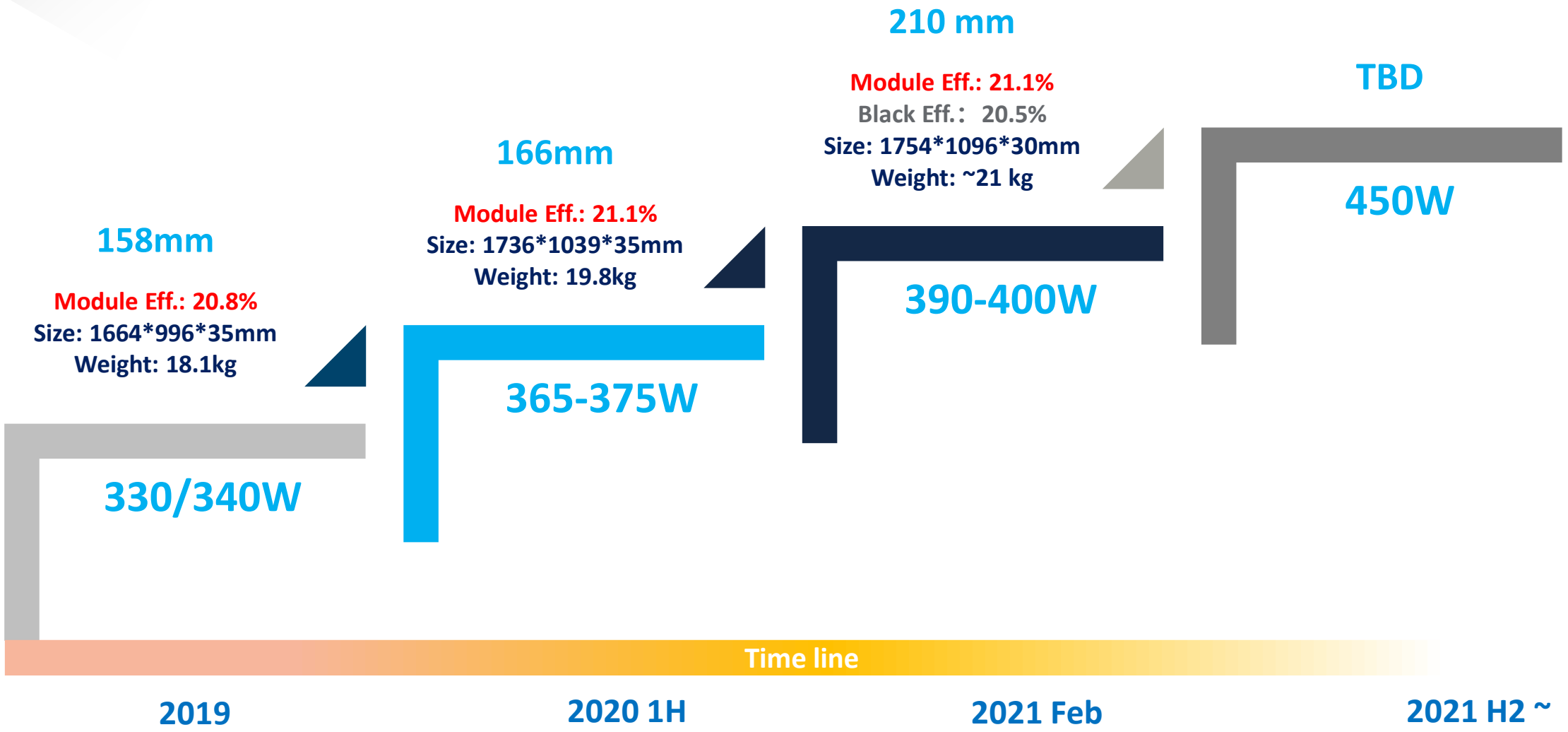
$$LCOE = \frac{\text{Total cost}}{\text{Total power generation}} = \frac{\text{Initial investment} + \text{total O\&M cost} + \text{other costs} - \text{system residual}}{(\text{Uptime}-\text{reliability of System}) + \text{Power generation over lifteime of system}}$$

Module power generation per watt

Trina Product Roadmap Utility / Large Rooftops

* Specs shown is for Bifacial Dual Glass Model

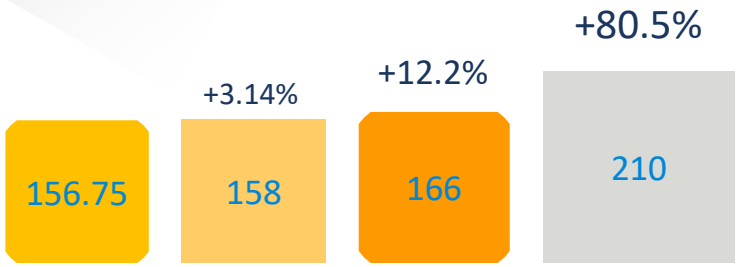
Trina Product Roadmap Residential/ Small C&I



Product Models List

Series Name	Cell size	Type	No. cells	Model	Power	Dimensions	Eff	Applications
Honey M	166mm	Mono Perc ½ cut 9BB	120 (1/2)	DE08M(II)	355-375	1763× 1040 × 35 20kg	19.4-20.5	Resi / C&I Rooftop
Duomax Twin Bifacial			120 (1/2)	DEG8MC.20(II)	350-375	1773 × 1046 × 30 25kg	18.9-20.2	Resi / C&I Rooftop
TallmaxM			144(1/2)	DE17M(II)	435-455	2102 ×1040× 35 24kg	19.9-20.8	C&I Rooftop / Utility
Duomax Twin Bifacial			144(1/2)	DEG17MC.20(II)	430-450	2111×1046×30 28.6kg	19.5-20.4	C&I Rooftop / Utility
Series Name	**Cell size**	**Type**	**No. cells**	**Model**	**Power**	**Dimensions**	**Eff**	**Applications**
Vertex S BS	210mm	Mono Perc 1/3 cut 10BB	120 (1/3)	DE09 / DE09.08	390-405	1754×1096×30 21kg	20.3-21.1	Resi / C&I Rooftop
Vertex S BS All Black			120 (1/3)	DE09.05	380-395		19.8-20.4	Resi / C&I Rooftop
Vertex Bifacial			150 (1/3)	DEG18MC.20(II)	485-505	2187×1102×35 30.1kg	20.1-21.0	C&I Rooftop / Utility
Vertex BS			150 (1/3)	DE18M(II)	480-510	2187×1102×35 26.5kg	20.1-21.2	C&I Rooftop / Utility
Vertex Bifacial	210mm	Mono Perc ½ cut 12BB	110(1/2)	DEG19C.20	530-550	2384×1096×35 32.6kg	20.3-21.0	C&I Rooftop / Utility
Vertex BS			110(1/2)	DE19	535-555	2384×1096×35 28.6kg	20.5-21.2	C&I Rooftop / Utility
Vertex Bifacial			120(1/2)	DEG20C.20	580-600	2172x1303×35 35.3kg	20.5-21.2	Utility
Vertex BS			120(1/2)	DE20	585-605	2172x1303×35 30.9kg	20.7-21.4	Utility
Vertex Bifacial			132(1/2)	DEG21C.20	630-670	2384×1303×35 38.7kg	20.4-21.6	Utility
Vertex BS			132(1/2)	DE21	635-670	2384×1303×35 33.9kg	20.4-21.6	Utility

Integration of Innovative Technologies



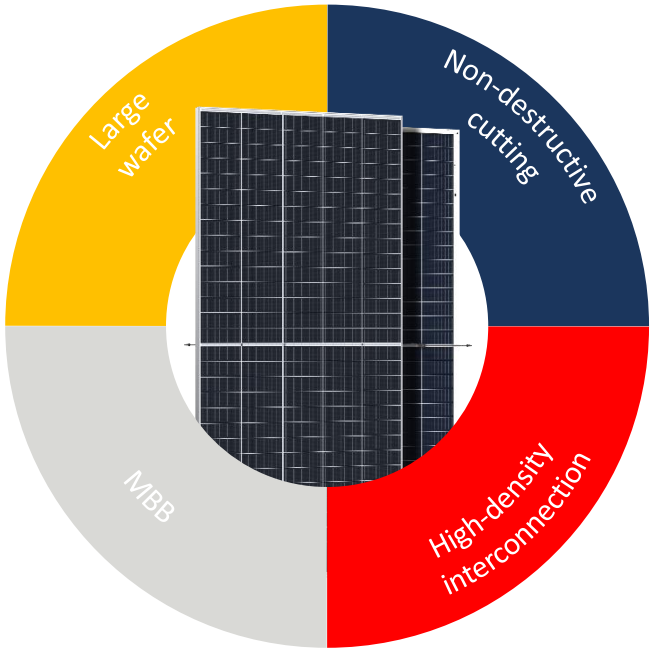
The largest size of wafer:

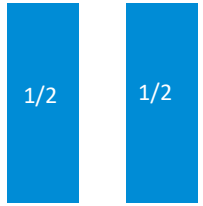
Largest silicon ingot technology from semiconductor industry

MBB(Multi-Bus bar):

Multiple bus bar match large size wafer perfectly

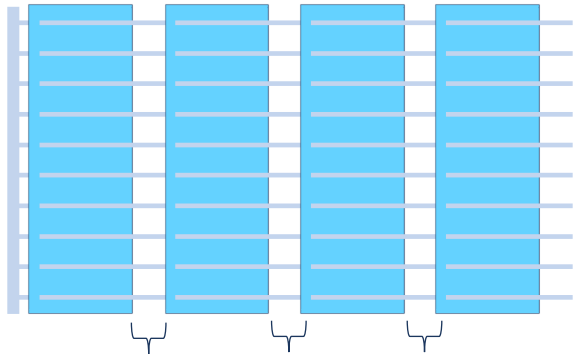
210mm ->1/3 cut – 10BB , ½ cut 12BB





Non-destructive cutting

Low Temperature laser – similar mechanical loading capabilities as full cell

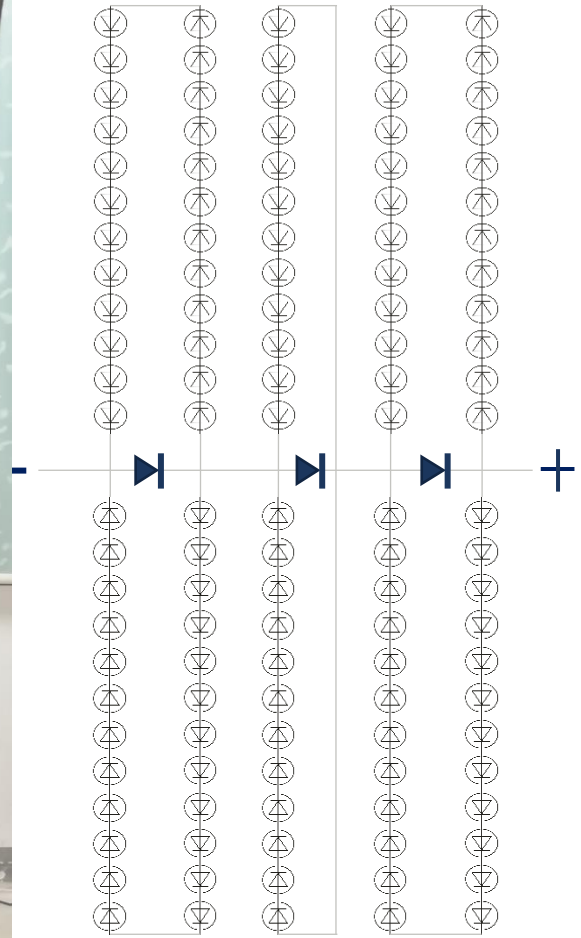


High-density Interconnection technology:

Minimized Space between Cell to Cell to Improve module Efficiency 0.2-0.3%

210mm – Vertex S

Vertex S Product information



Max. Power

400W+

- 210mm cell
- Multi-busbar
- Non-destructive cutting
- High-density interconnection
- 5*12*2 layout – 120 cells
- 1/3 cut

Max. Eff.

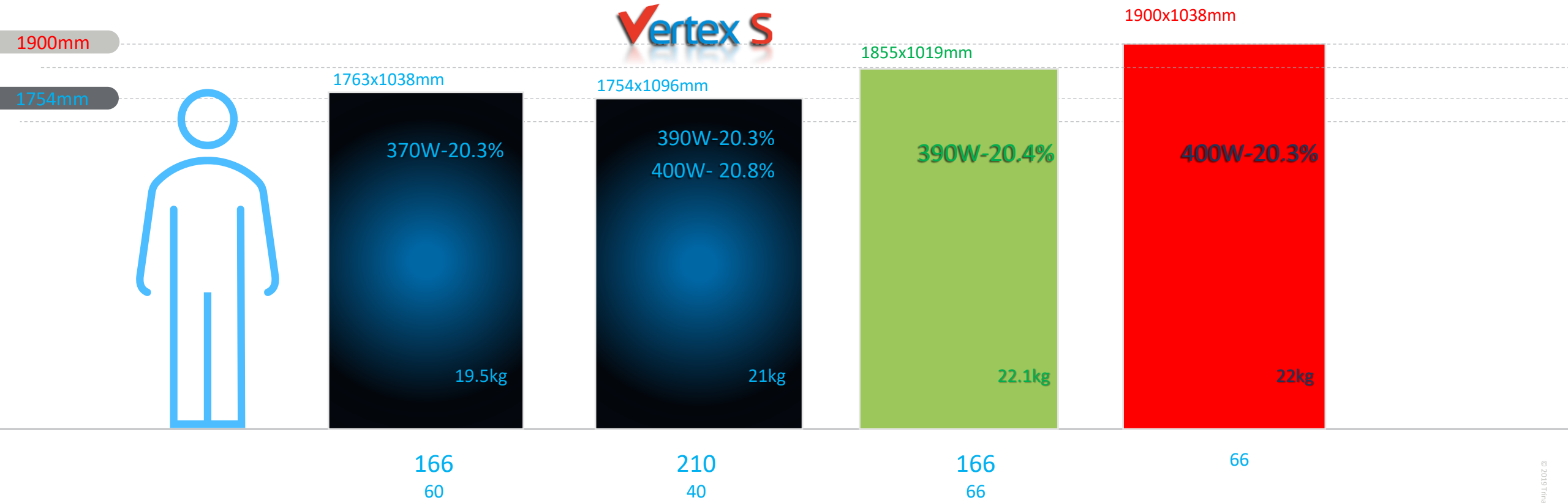
20.8%+

- Size: 1754x1096x30mm
- Weight: 21.3kg
- Temp Coeff: -0.34%/ ℃
- Degradation: Y1 2% , Annual 0.55%
- Power Warranty: 25 years
- Product Warranty: 15 years for black frame and all black

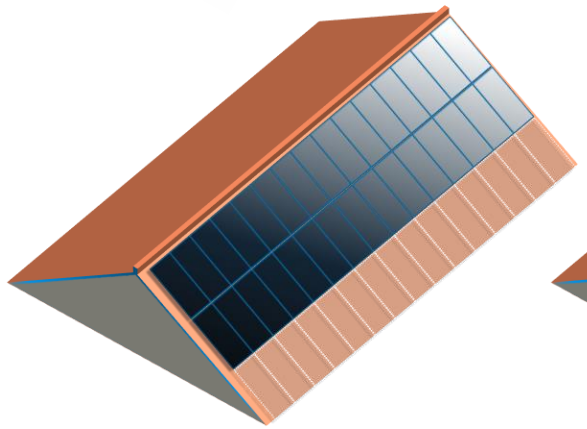
Voc：41.2V　　Isc：12.28A

Vertex S –optimized dimensions

Length less than 1.8m offers more flexibility in residential rooftop installation and reduce overhang risks



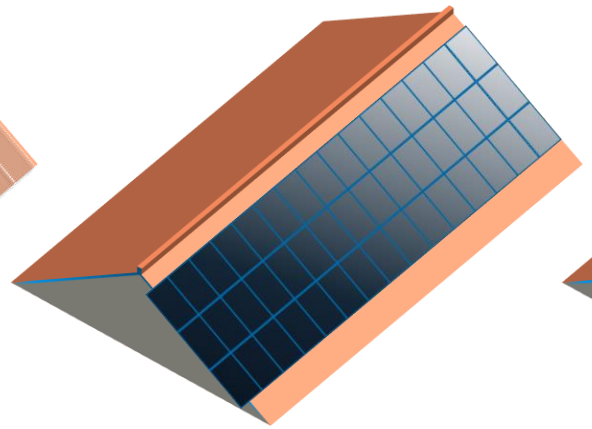
More Productivity from Same Size Roof



158(72) 405W

32pcs(2*16)

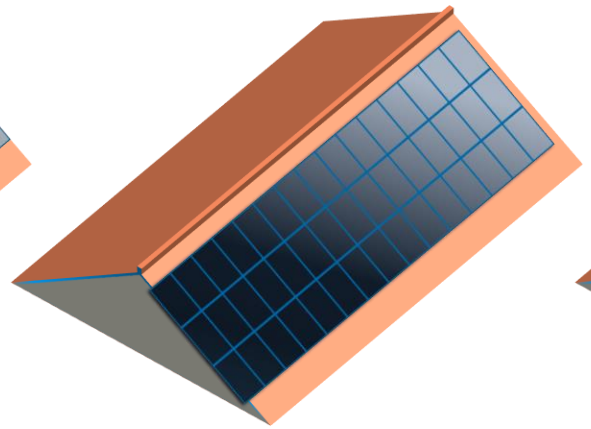
12.96kW



158(60) 340W

48pcs(3*16)

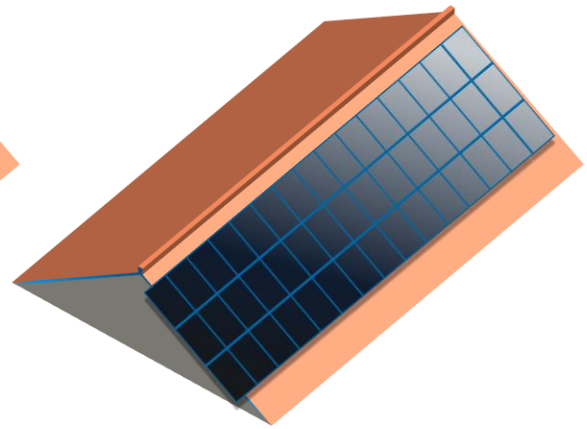
16.32kW



166(60) 370W

45pcs (3*15)

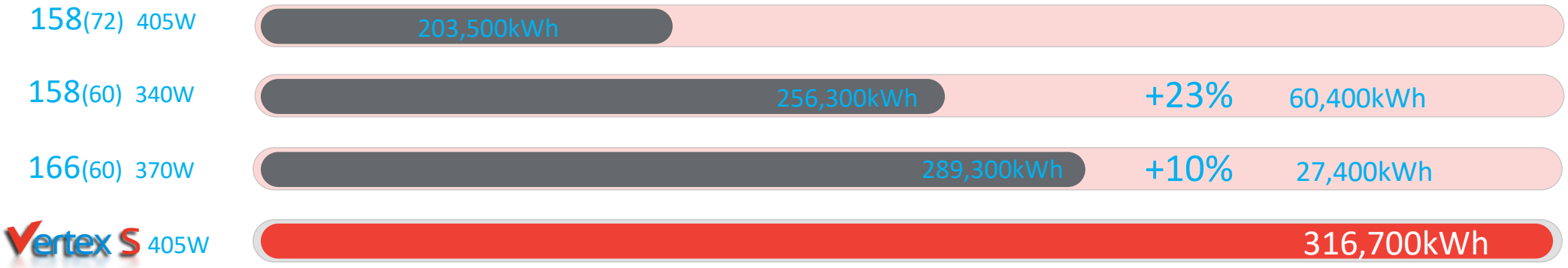
16.65kW



Vertex S 405W

45pcs(3*15)

18.23kW



Example project, electricity generation in 25 years

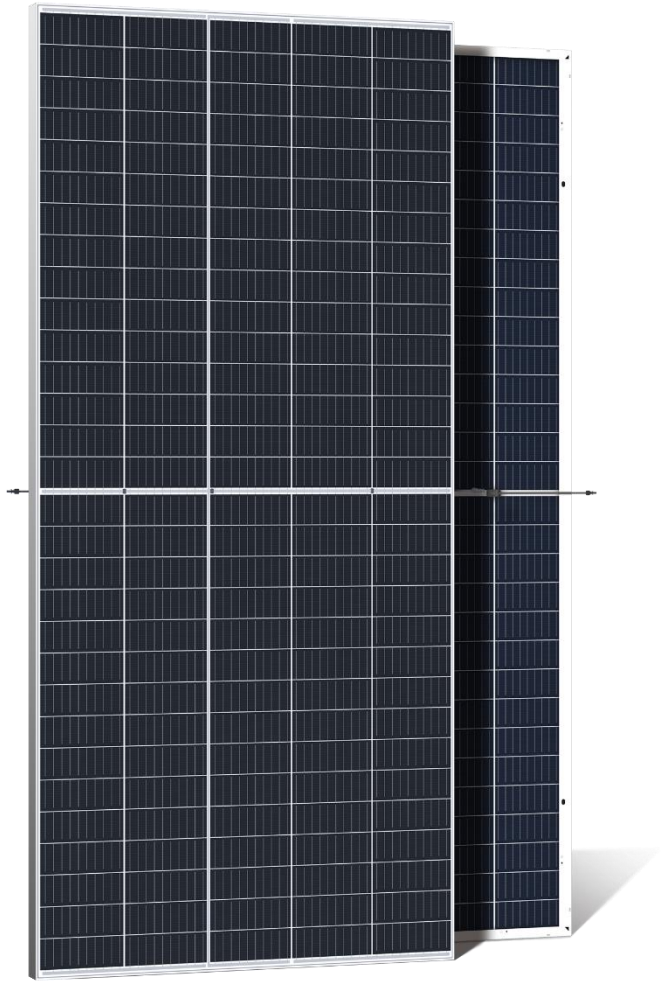
210mm - Vertex Bifacial and Mono Facial

Higher Power

Maximum expected power：
550W+/600W+/670W+.

High Efficiency

Benefit from square mono cells and high-density technology， the efficiency of Vertex can reach up to 21%.



High Reliability

lower first & yearly degradation.

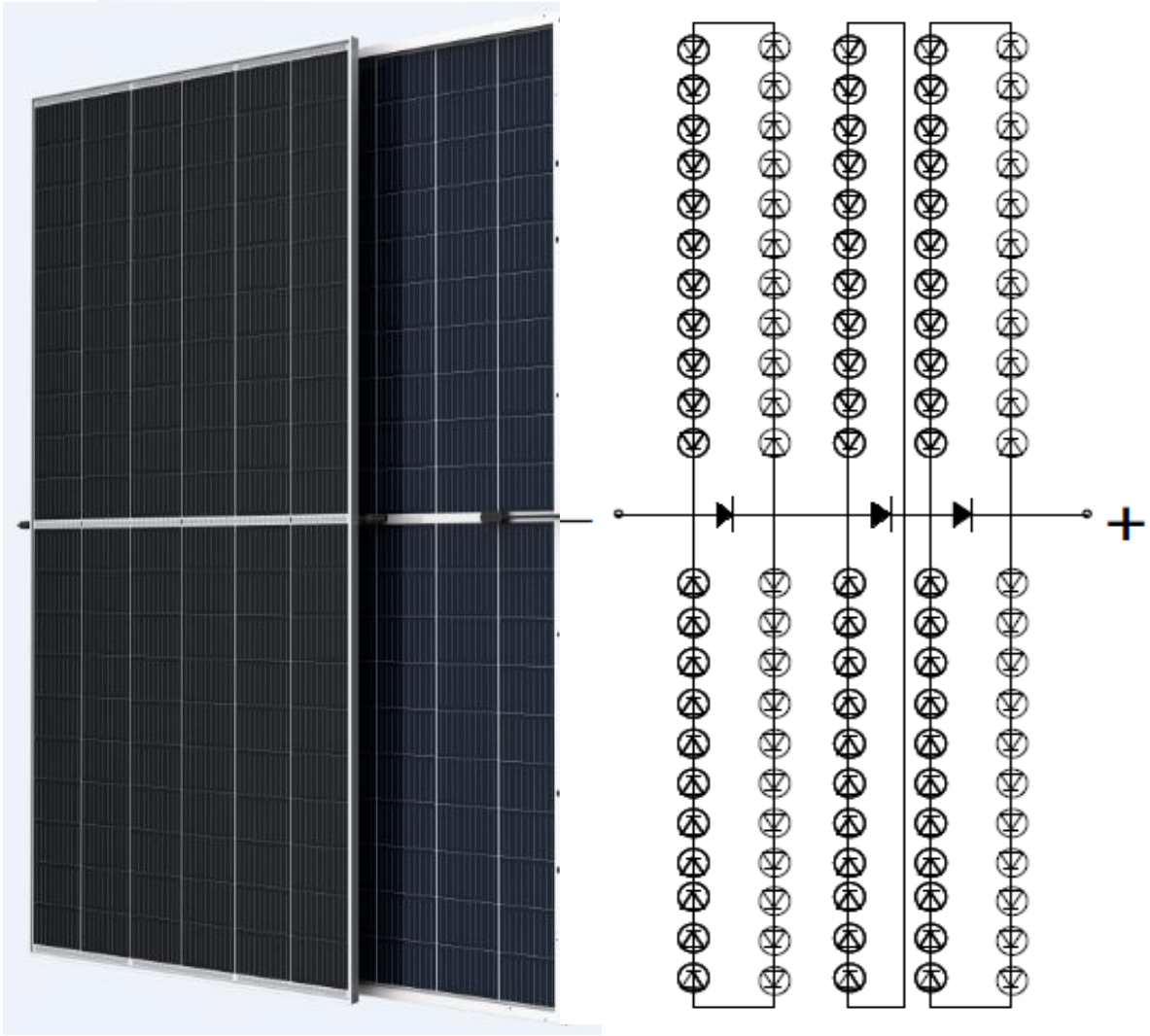
30 years of power warranty for bifacial

High Power Generation

Excellent temperature coefficient and low irradiation performance.

5% - 30% of additional power generation brought by the backside.

Vertex 550W Product information



Max. Power

550W+

- 210mm cell bifacial
- Multi-busbar
- Non-destructive cutting
- High-density interconnection
- 5*11 layout
- Half-cut

Max. Eff.

21.0%+

- Size: 2384x1096x35mm
- Weight: 32.6kg
- Temp Coeff: -0.34%/ ℃
- Degradation: Y1 2% , Annual 0.45%
- Power Warranty: 30 years
- DEG19C.20

Low voltage, high current

Voc：38.1V　　Isc：18.39A

Higher Power per string – 550W Vertex

35.8% more per string

Comparison Module Quantity per String & Power

Module	Module Quantity/String	Per Module Power	Total Power per String
210	36	550W	19800W
182	27	540W	14580W

Conditions: ***-10 degrees , 1500 V system***

Per string power is the critical factor that impacts the cost of Balance of System(BOS)

Evaluation by 3rd party DNVGL - 1P Tracker scenario

LCOE comparison results

- **Overall EPC cost decrease for 545 W**
- **Higher power bin uses less module number, less installation to do**
- **Low Voltage design uses less strings, less DC cable and wiring work**
- **High string power**
- **Less total weight of tracker**

	Euro €/Wp			USD $/Wp		
	450 W	535 W	545 W	450 W	535 W	545 W
Tracker & mounting	0.1000	0.0896	0.0885	0.126	0.1124	0.1115
EPC cost	0.5268	0.5079	0.5052	0.9533	0.9222	0.9132
Development	0.1137	0.1138	0.1138		0.1567	
CAPEX	0.6406	0.6217	0.619	1.1099	1.0788	1.0699
CAPEX compare 450 W		-2.9%	-3.4%		-2.80%	-3.60%
Land	0.0017	0.0016	0.0017	0.0034	0.0033	0.0033
O&M fee		0.015			0.0082	
Asset management		0.002			0.0015	
OPEX		0.0187			0.0130	
	Euro €/kWh			USD $/kWh		
LCOE	0.0366	0.0357	0.0356	0.0451	0.0437	0.0435
LCOE compare 450 W		-2.5%	-2.8%		-3.0%	-3.5%

Key Takeaways

- the LCOE cost for 545 W modules lower than 535 W.
- LCOE could be even lower when trackers optimized to fit 3 strings per tracker
- This calculation assumes inverters can have higher string input 20A.

1 Cost estimations based on similar projects in Spain and USA. Tracker costs provided by supplier based on estimated tracker dimension changes for similar 545 W modules
2 Results comparable to industry reports system pricing. Wood Mackenzie, U.S. Solar PV System Cost Model, H1 2020

Assessment interpretation

Table 3-3 CAPEX results (€) – Spain

Item	410Wp Bifacial	450Wp Bifacial	500Wp Bifacial	535Wp Bifacial	545Wp Bifacial
Module	0.1932	0.1932	0.1932	0.1932	0.1932
Inverter	0.0257	0.0257	0.0257	0.0257	0.0257
Tracker with piles	0.1098	0.1000	0.0935	0.0896	0.0885
Cabling DC	0.0055	0.0049	0.0047	0.0040	0.0027
Cabling AC LV	0.0017	0.0016	0.0015	0.0014	0.0017
Cabling AC MV	0.0024	0.0024	0.0023	0.0023	0.0025
Cabling DC mounting	0.0044	0.0039	0.0037	0.0032	0.0021
Cabling AC LV mounting	0.0012	0.0012	0.0011	0.0011	0.0013
Cabling AC MV mounting	0.0011	0.0011	0.0011	0.0010	0.0011
Fencing	0.0005	0.0005	0.0005	0.0005	0.0004
Tracker and module mounting	0.0260	0.0237	0.0213	0.0199	0.0195
Trenches	0.0046	0.0044	0.0042	0.0039	0.0044
Drainage system	0.0014	0.0014	0.0013	0.0013	0.0014
Roads	0.0017	0.0017	0.0017	0.0016	0.0017
Land adequation	0.0026	0.0025	0.0025	0.0025	0.0025
Transport tracker	0.0012	0.0011	0.0010	0.0009	0.0009
Transport modules	0.0128	0.0117	0.0105	0.0098	0.0096
Other BOS such as transformers, CCTV, monitoring, substation and containers, EPC profit and contingency	0.1460	0.1460	0.1460	0.1460	0.1460
EPC cost	0.5418	0.5268	0.5159	0.5079	0.5052
BOS	0.3485	0.3336	0.3226	0.3147	0.3119
BOS reduction	0.0000	-0.0429	-0.0743	-9.71%	-10.50%
Development and others	0.1138	0.1137	0.1138	0.1138	0.1138
CAPEX	0.6555	0.6406	0.6297	0.6217	0.6190
CAPEX 410 as baseline(%)	0.00%	-2.28%	-3.94%	-5.16%	-5.58%

Savings

Savings mainly come from three parts:

Savings	Saving logic against 182
Tracker with piles	We get the price guidance from main stream tracker manufacture The general saving logic is the total length of tracker is shorter than 182 , means less steel and piles. (even though we have more tracker units because we connect 2 strings per tracker)
DC cabling &mounting	Critical advantage . Given the low voltage , high string power feature . Much less string numbers comparing to 182 , which can significant reduce the overall DC cable length , leads to much lower DC cable cost
Labor	1. DC mounting Shorter DC cable leads to lower DC related labor cost. 2. Module mounting . Higher Power bin uses less module quantities leads to lower module mounting labor cost 3. Tracker mounting : Shorter overall tracker length

Simulation Summary – other scenarios

Configuration	BOS			545 VS 450 gap	545 VS 535 gap
	166-450W	182-535W	210-545W		
2P tracker	0.2247	0.2125	0.2093	-5.4%	-6.9%
2P portrait fixed tilt	0.1536	0.1385	0.1339	-9.8%	-12.8%
4V landscape fixed tilt	0.1559	0.1407	0.1387	-9.8%	-11%

Unit：US$/W

Compare with 166-450 and 182-535W， Vertex 545W has lower BOS in different scenarios.

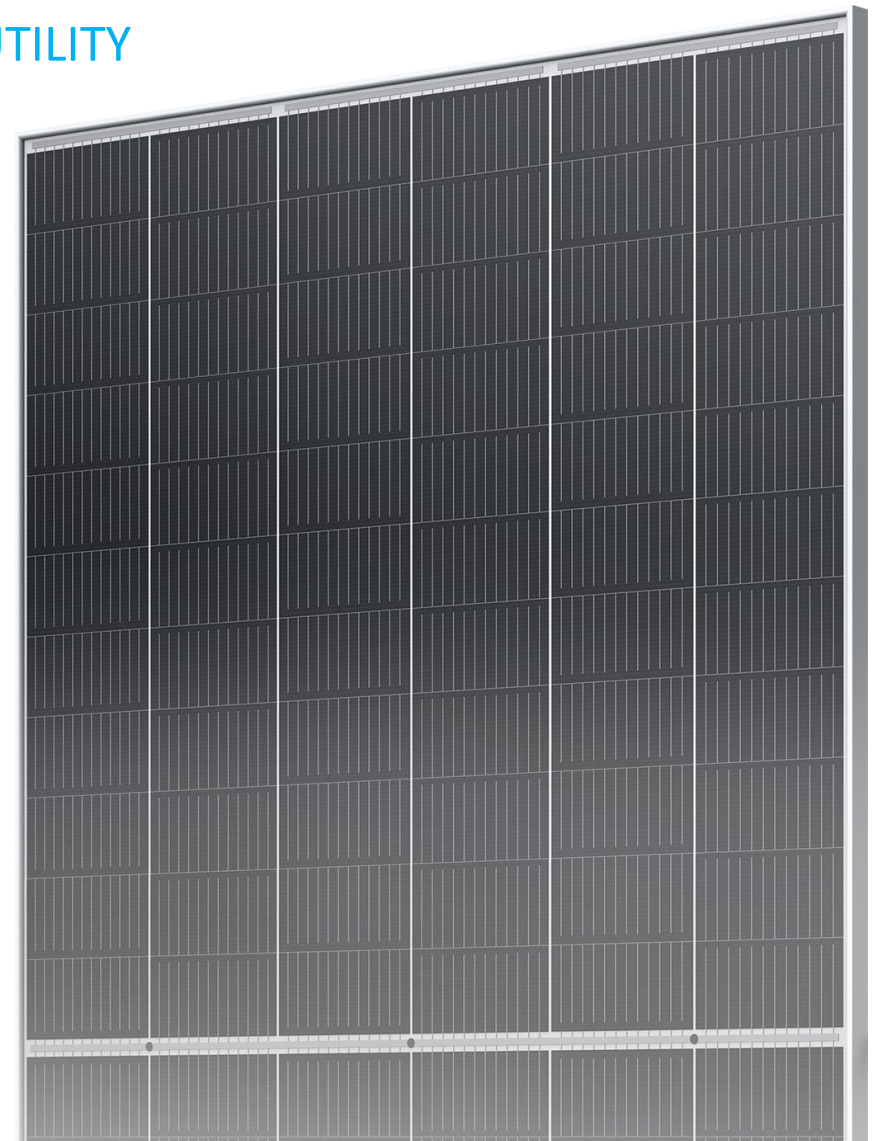
Trina Solar 670W VERTEX

ULTRA-HIGH POWER | HIGH EFFICIENCY | HIGH RELIABILITY

DESIGNED FOR LARGE-SCALE UTILITY

Ultra High Power

670W



High Efficiency

21.6%

Mechanical data

Size: 2384*1303*35mm

Backsheet Weight: 33.9kg

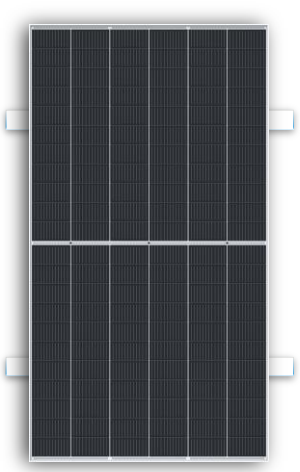
Bifacial Weight: 38.7kg

Electrical Data

Low voltage concept design

V_{oc}: 45.7V I_{sc}: 18.5A

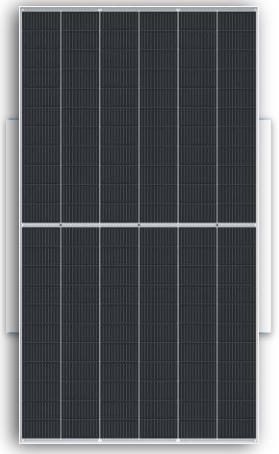
RELIABILITY ASSURANCE



Static loading
+5400Pa/-2400Pa

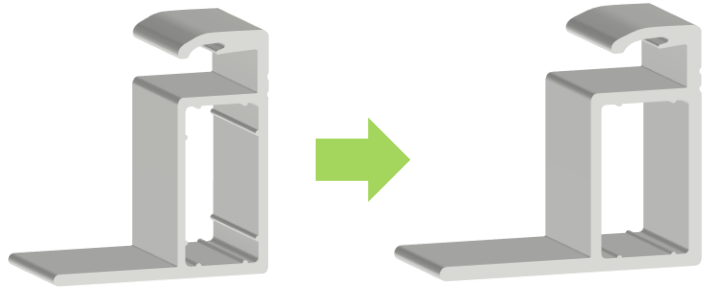
Static loading
+3600Pa/-2400Pa

Fix-tilt



Static loading
+2400Pa/-2400Pa

Tracker



Conventional Module frame

670W Vertex Module frame

Optimal Design:

- Optimized frame profile design;
- Strengthened material ;
- Reinforced supporting bar for backsheet module ;
- Excellent loading performance suits diversified scenarios.

IEC 61215

IEC 61730

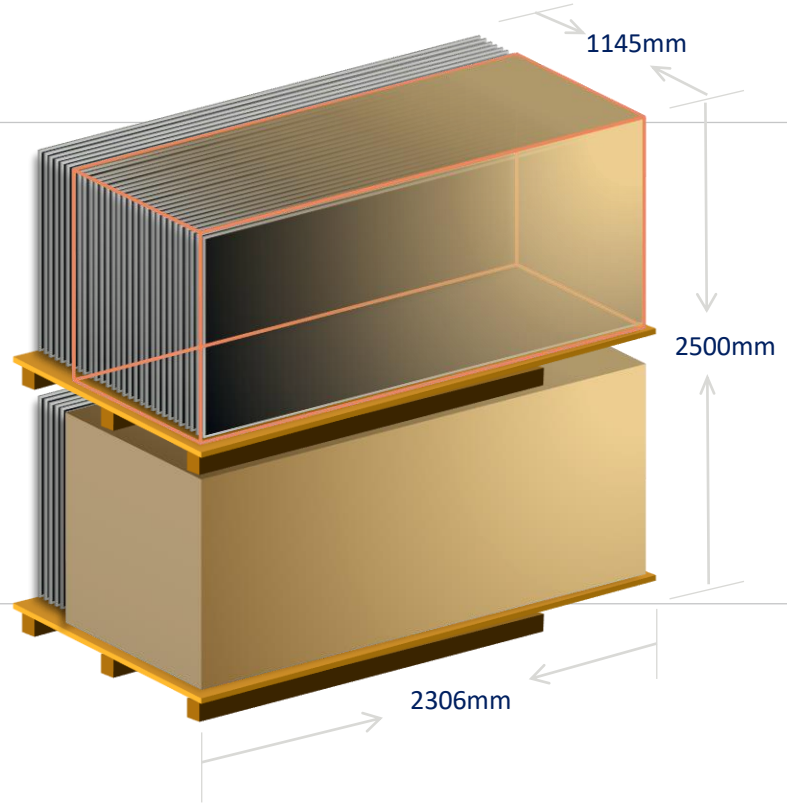
Received certification

Innovative Packaging Arrangement

Maximizing the space utilization of containers, 12% saving in transportation costs comparing to the traditional packing.

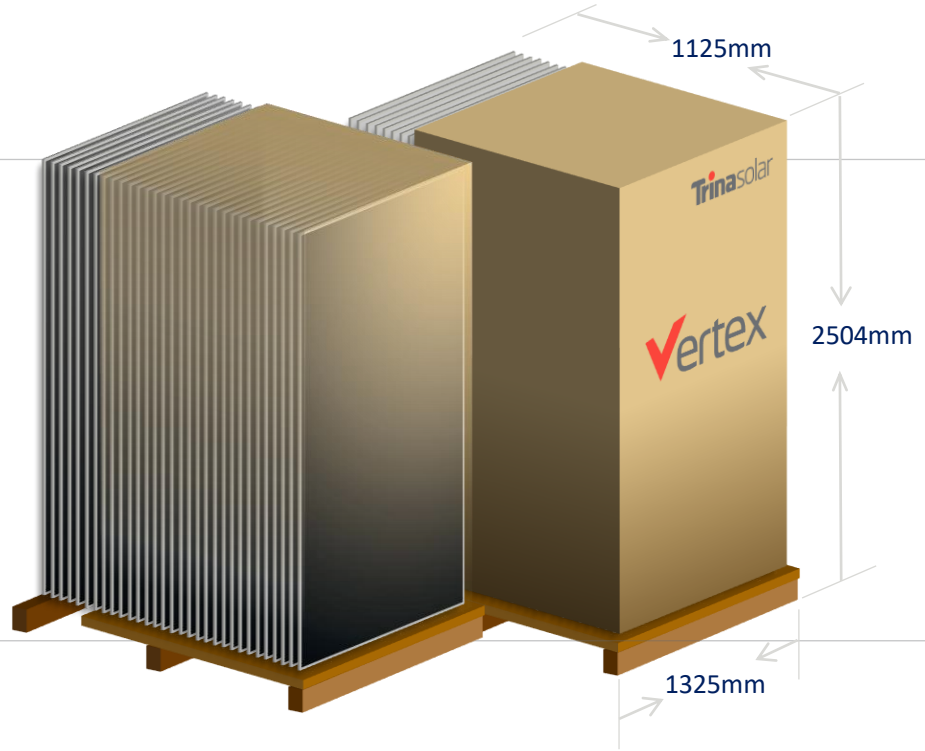
Conventional packing

Horizontal two-tier stack



Innovative packing

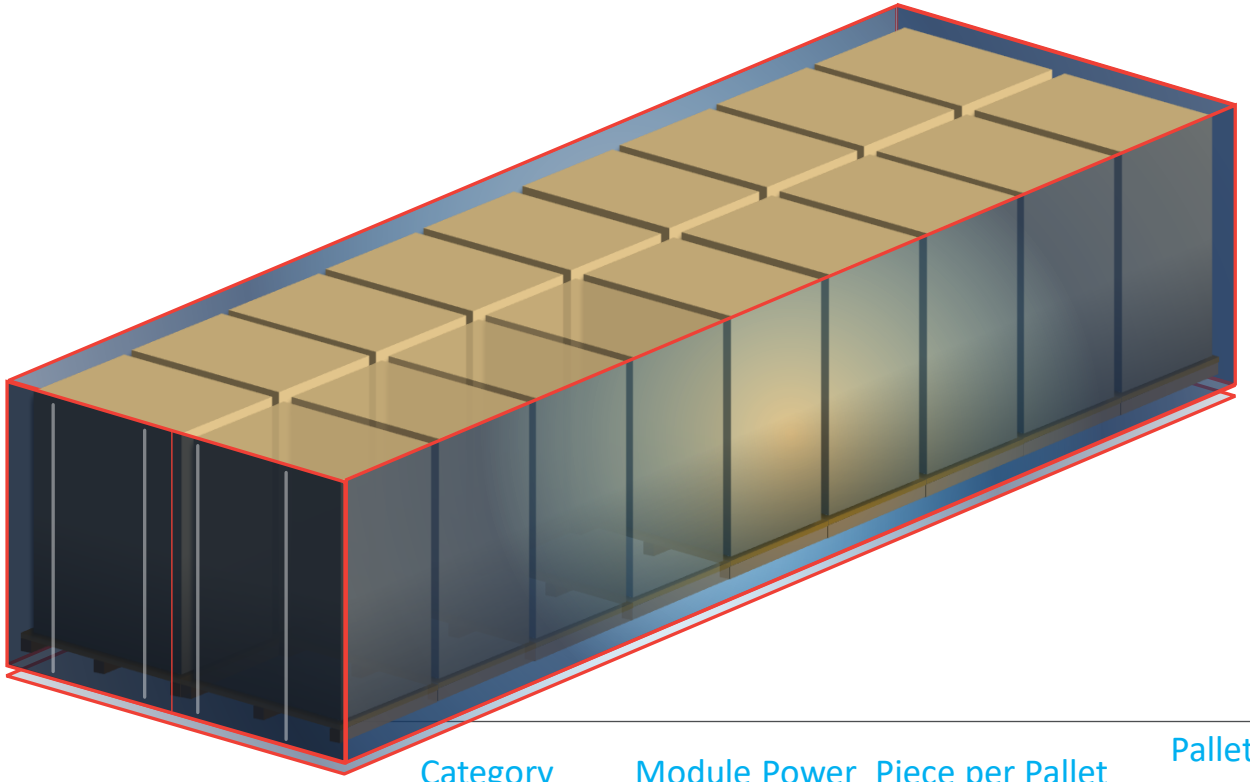
Vertical placement



Innovative Packaging Arrangement

SPACE LOADING CAPACITY PER CONTAINER

+12%

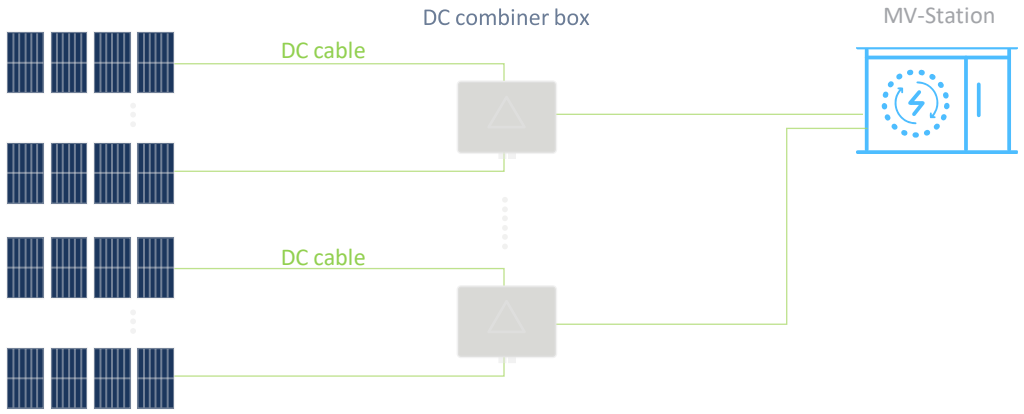


Category	Module Power	Piece per Pallet	Pallet NO. per Container	Power per Container	
Other Module	540W	31	20	334,800W	
Vertex Module	670W	31	18	373,860W	+39060W (+12%)

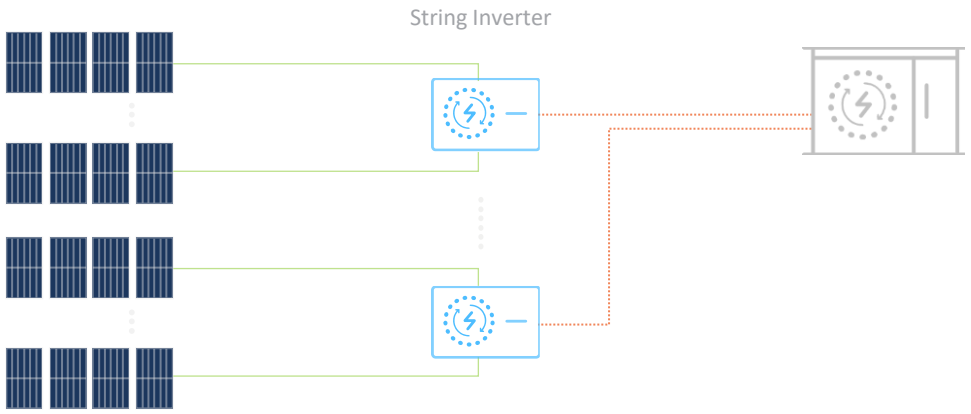
Compatible with major Inverter Suppliers

The world's leading photovoltaic inverter brands have announced the market launch of inverters compatible with the Trina Vertex Modules.

Central Inverter



String Inverter



SUNGROW 阳光电源 · 上能电气 SINENG · SMA

HUAWEI
SUN2000-196KTL-H3

上能电气 SINENG
SP-250K-H

SUNGROW 阳光电源
SG225HX (SG250HX)

SMA
SHP 150
STP 110

Upgrade fuse capacity from 15A to 30A

锦浪科技 GINLONG · 固德威 GOODWE · Growatt · solaredge

Compatible with Top 8 Tracker suppliers

Eight world's leading photovoltaic tracker suppliers have successively issued compatibility approvals for Trina Vertex Modules.

Arctech Solar

Skyline / Skysmart II

ARRAY TECHNOLOGIES

DuraTrack HZ v3

GAMECHANGE SOLAR
REPOWERING THE PLANET

GENIUS TRACKER™ 1P/ GENIUS TRACKER™ 2P

IDEEMATEC

H4PLUS ™

nextracker
A Flex Company

Nextracker products

PVH

Independent row Monoline™
(all its versions 1V, 3H and 2V); Multi-row: Axone™, Axone Duo™)

Soltec

SF7 & SF8

TrinaTracker

TrinaTracker (Vanguard™/Agile™)

210 VERTEX MODULE AND CELL SUPPLY CAPACITY

Module:
~12GW
Cell:
~10GW
SUQIAN
FACTORY

Module:
~17GW
Cell:
~19GW
YANCHENG
FACTORY

Module:
~7GW
CHANGZHOU
FACTORY

Module:
~8GW
YIWU
FACTORY

Module:
~6GW
Cell:
~6GW
OVERSEAS
FACTORY

Cell Capacity in 2021

Module Capacity in 2021

Trina Residential

17 pcs of DE09.05(II)
390W = 6630W

18 pcs of DD08M.08(II) 400W = 7200W

ELECTRICAL DATA (STC)	
Peak Power Watts-PMAX (Wp)*	390
Power Tolerance-PMAX (W)	
Maximum Power Voltage-VMPP (V)	33.8
Maximum Power Current-IMPP (A)	11.54
Open Circuit Voltage-VOC (V)	40.8
Short Circuit Current-ISC (A)	12.14
Module Efficiency ηm (%)	20.3
Module Dimensions	1754×1096×30 mm
Weight	21.3 kg (47.0 lb)

With higher power bin, rooftops space can be maximized

Trina C&I

200 pcs of DE18M(II) 500W = 100KW

ELECTRICAL DATA (STC)

Peak Power Watts-PMAX (Wp)*	500
Power Tolerance-PMAX (W)	
Maximum Power Voltage-VMPP (V)	42.8
Maximum Power Current-IMPP (A)	11.69
Open Circuit Voltage-VOC (V)	51.7
Short Circuit Current-ISC (A)	12.28
Module Efficiency ηm (%)	20.7
Module Dimensions	2187×1102×35 mm
Weight	26.5 kg (58.4 lb)

200 pcs of DE19 550W = 110KW

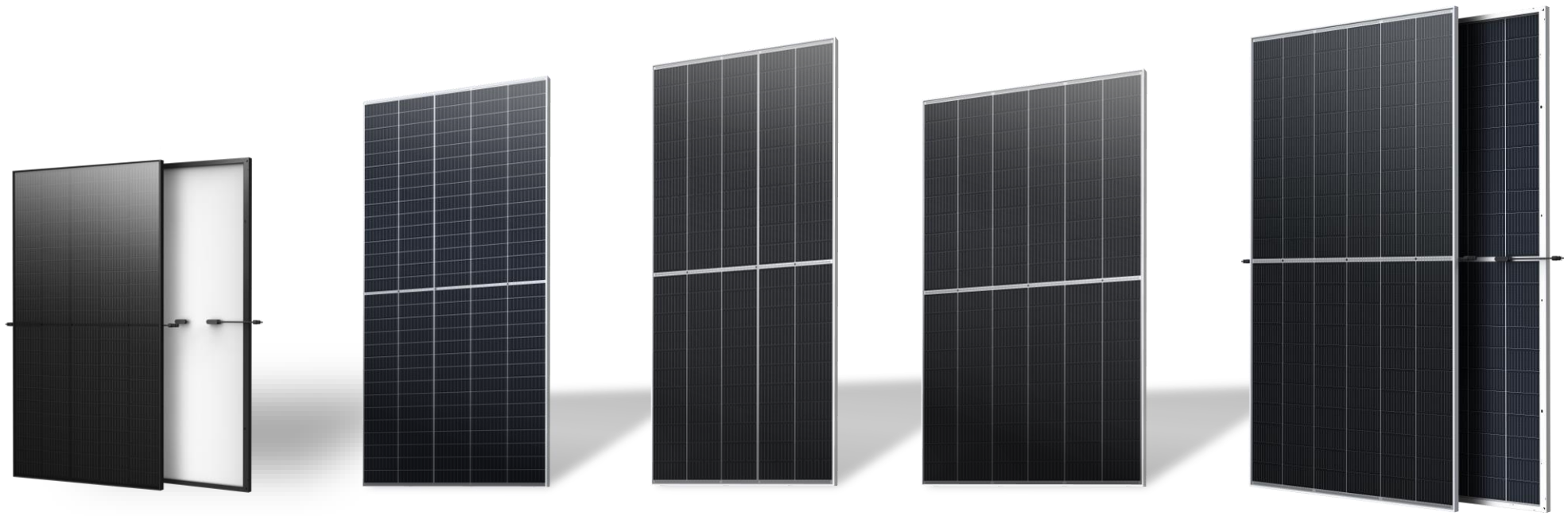
ELECTRICAL DATA (STC)

Peak Power Watts-PMAX (Wp)*	550
Power Tolerance-PMAX (W)	
Maximum Power Voltage-VMPP (V)	31.6
Maximum Power Current-IMPP (A)	17.40
Open Circuit Voltage-VOC (V)	37.9
Short Circuit Current-ISC (A)	18.52
Module Efficiency ηm (%)	21.0
Module Dimensions	2384×1096×35 mm
Weight	28.6 kg (63.1 lb)

Trina Utility

China
50MW DEG19C.20
40MW DEG19, 10MW DE19C.20 – commissioned Jan 2021

Trina Vertex Family
Leading Technology, Exceed Expectation!



Vertex

Vertex S — UP to 405W

18 series(1/3) — UP to 500W

19 series(1/2) — UP to 550W

20 series (1/2) — UP to 600W

21 series (1/2) — UP to 670W

Others

370W | 450W | 540W | 580W | 600W+

Thank you

Trinasolar