PVTECH TECHTalk

Trinasolar

Fraunhofer ISE

WEBINAR

The importance of product reliability and system value of a 600W+ module in achieving the lowest LCOE

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Editor in Chief
Solar Media

2 SEPTEMBER 2021

The 600W+ solar module market, ecology system construction and industrialization

Dr. Franck Zhang
Head of Global Product Strategy and Marketing
2 Sep, 2021

OUTLINES

1. Progress of 600W+ ecology system construction
2. 210 modules predicted to become mainstream
3. Global product capacity of Trina Solar in 2021

2009-2021 PV module mass production power trend

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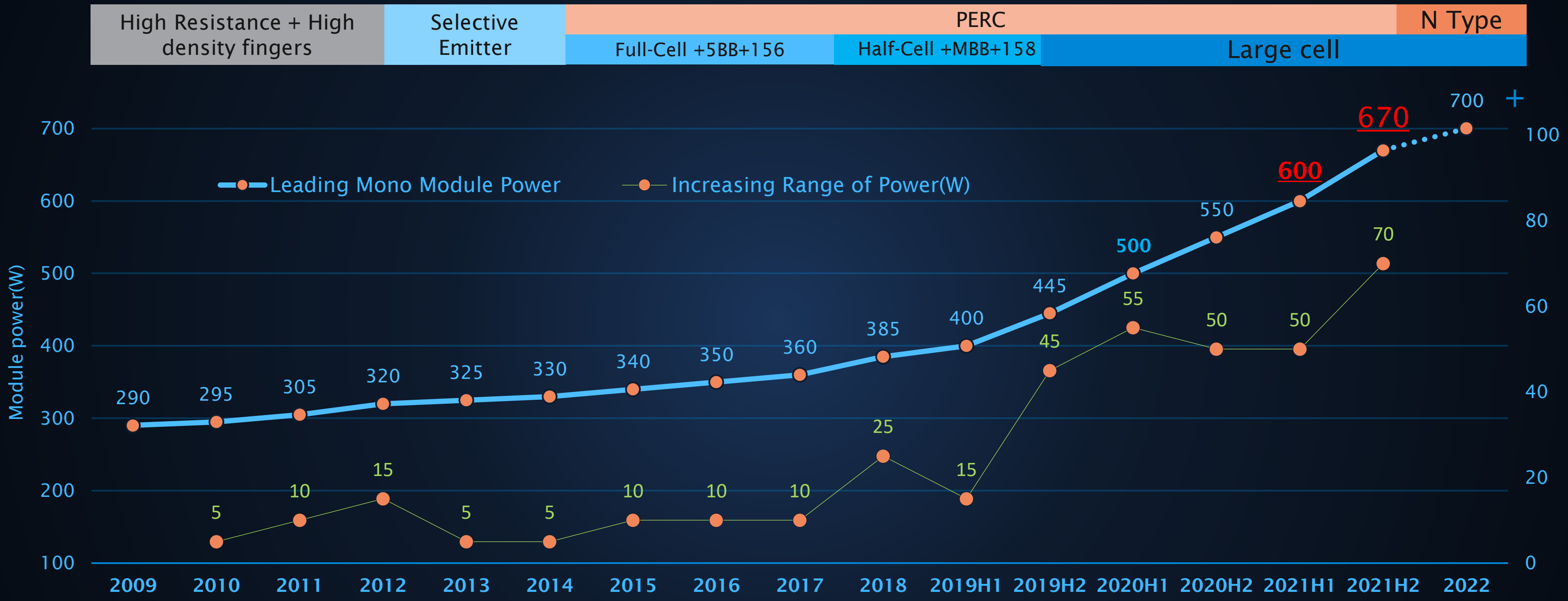

- 600W+ Vertex module was launched in June 2020;
- 670W Vertex module was launched in Mar, 2021.

Trina Solar family of high-efficiency Vertex modules

- Diversified module design, providing customers with solutions for all scenarios

- Vertex series can be applied to various scenarios, such as residential, industrial & commercial rooftops, agriculture, fishery, water, petrol stations, carparks and large utilities.
- Compared to competitors, 210 modules achieve a power increase of 35-90W, delivering more value to customers, saving 0.5~1.6 c USD/W in BOS costs .

600W+ PV Open Innovation Ecological Alliance

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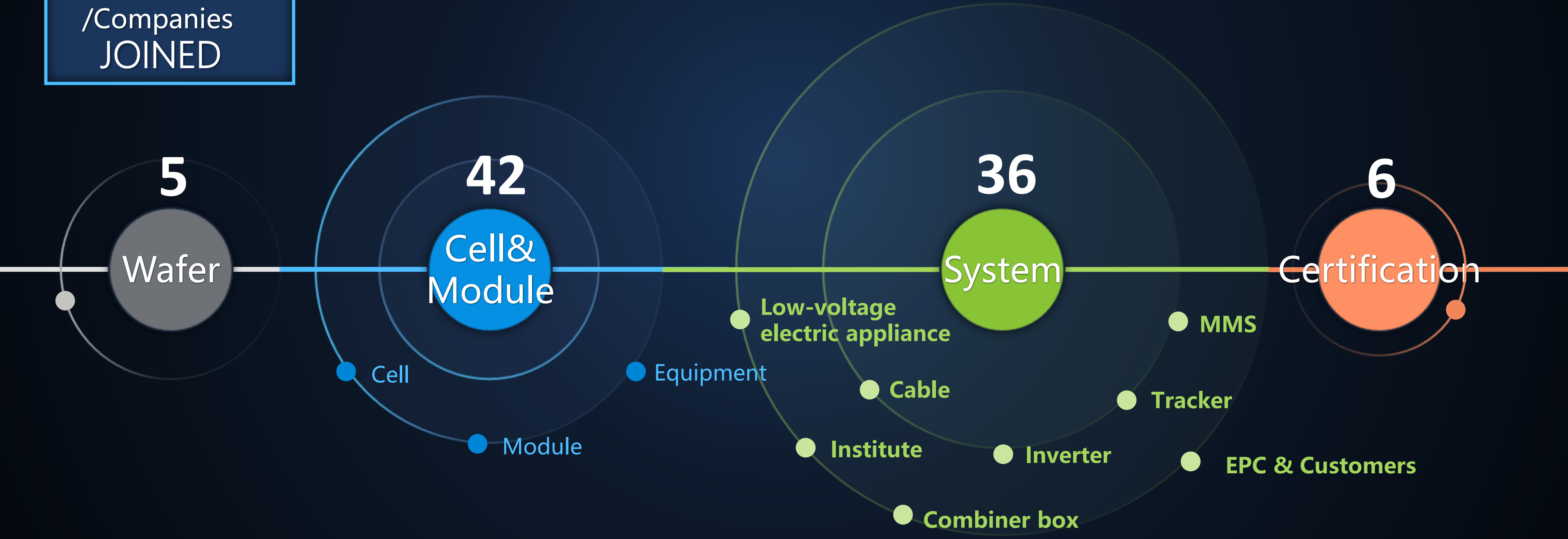
600W+
Photovoltaic Open Innovation Ecologica lAlliance

89
Institutes /Companies JOINED

- The core concept of openness, innovation and ecology of the Alliance accelerates the technological advances and industrialization of 600W+.
- Driving technological innovation and harnessing the strengths of each segment



210 Vertex modules compatible with inverters from leading manufacturers across multiple scenarios

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- HUAWEI
- SUNGROW – Clean power for all
- GOODWE – YOUR SOLAR ENGINE
- SINENG
- Growatt – powering tomorrow
- SMA
- KEHUA TECH
- solis
- Ingeteam
- Fronius
- KACO new energy.
- AiSWEI
- SOFAR SOLAR
- FIMER
- KSTAR 科士达
- TBEA

17th Mar, Huawei launched the inverts compatible with the large-sized-wafer modules.

210 Vertex modules compatible with inverters from leading manufacturers across multiple scenarios

Trinasolar

invertertool.trinasolar.com

210 Vertex Module Inverter Matching Tool

Trinasolar 天合光能

CN|中文

Tool Version:1.1 Data Version:202108 Reference ambient temperature：-10℃

Module Power 670 **Application Scenarios** Please Select **Inverter Brand** Please Select **Inverter Model** Please enter model

Maximum System Voltage Please Select Search

Brand	Scenario	Model	MPPT channel...	MPPT current	MaxVoltage	Module pow...	AC output voltage
华为(HUAWEI)	电站(Utili...	SUN2000-315KTL-H0	8/32	60A*8	1500V	670	
华为(HUAWEI)	电站(Utili...	SUN2000-196KTL-H3	3/14	100A*3	1500V	670	
阳光电源(SUNGROW)	电站(Utili...	SG320HX（40A*12）	12/24	40A*12	1500V	670	
上能(SINENG)	电站(Utili...	SP-320K-H	12/32	45A*12	1500V	670	
上能(SINENG)	电站(Utili...	SP-250K-H	12/24	40A*12	1500V	670	
固德威(GOODWE)	电站(Utili...	GW225KN-HT	6/18	60A*6	1500V	670	
锦浪(GINLONG)	电站(Utili...	G6-GU320K-EHV	12/24	45A*12	1500V	670	
锦浪(GINLONG)	电站(Utili...	GCI-230K-EHV-5G	14/28	26A*14	1500V	670	
科华(KELONG)	电站(Utili...	SPI350K-B-H	12/24	40A*12	1500V	670	

Trina Solar has released a white paper on inverter matching, containing a comprehensive inverter matching database and the world's first quick matching tool.

210 Vertex modules compatible with solutions from top tracker manufacturers

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Arctech Solar

Skyline / Skysmart II

nextracker
A Flex Company

Nextracker products

ARRAY TECHNOLOGIES

DuraTrack HZ v3

PVH

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

GAMECHANGE SOLAR
REPOWERING THE PLANET

GENIUS TRACKER™ 1P/ GENIUS TRACKER™ 2P

Soltec

SF7 & SF8

IDEEMATEC

H4PLUS ™

TrinaTracker

TrinaTracker (Vanguard™/Agile™)

210 Vertex module milestones

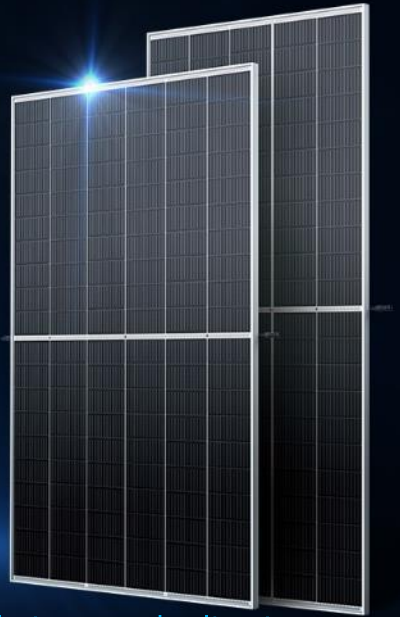
2021.5.26

Standardization of 210 module dimensions & mounting

Holes

Milestones

Companies	L1	K1	A1	A2	C1	C2	T1	R	G1	STP	ZT	TH	HQ
156 @ 380	2.004	1.987	2.000		2.000		2.000		1.986	1.988			1.994
158 @ 400	2.020	2.008	2.031		2.132		2.024	2.015	2.010	2.016	2.018	2.015	2.080
166 @ 450	2.115		2.104		2.108		2.100	2.108	2.116		2.108	2.092	
182 @ 540	2.256	2.274	2.279	2.285	2.261	2.266					2.279	2.471	
210 @ 550							2.384						
210 @ 600							2.172						
210 @ 670							2.384						



- **Downstream**: Unified module size and mounting holes benefit tracker selection and installation standardization; this ensures the convenience of supply and use of module.
- **Upstream**: Unified size can reduce inventory, improve production efficiency, and greatly reduce related costs.

Standardization of 210 module dimensions & mounting holes

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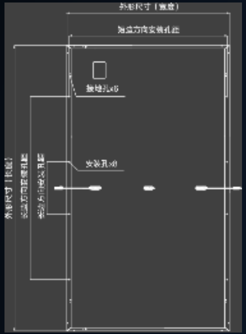


Shape of mounting hole

600W
210-60pcs

670W
210-66pcs

Key dimension: Shape dimension	Module type	Cell amount	Module length [mm]	Module width [mm]	Cell amount	Module length [mm]	Module width [mm]
	Backsheet	120	2172±2	1303±2	132	2384±2	1303±2
	Dual glass	120	2172±2	1303±2	132	2384±2	1303±2
Mounting hole location	**Module type**	**Cell amount**	**Long side mounting distance [mm]**	**Short side mounting distance [mm]**	**Cell amount**	**Long side mounting distance [mm]**	**Short side mounting distance [mm]**
	Backsheet	120	400/1400±1	(1259±2)~(1269±2)	132	400/1400±1	(1259±2)~(1269±2)
	Dual glass	120	400/1400±1	(1259±2)~(1269±2)	132	400/1400±1	(1259±2)~(1269±2)
Mounting hole dimension	**mounting hole gap**	**W[mm]**	**L[mm]**	**R[mm]**	**W[mm]**	**L[mm]**	**R[mm]**
	1400	9	14	4.5	9	14	4.5
	400	7	10	3.5	7	10	3.5

2021 SNEC

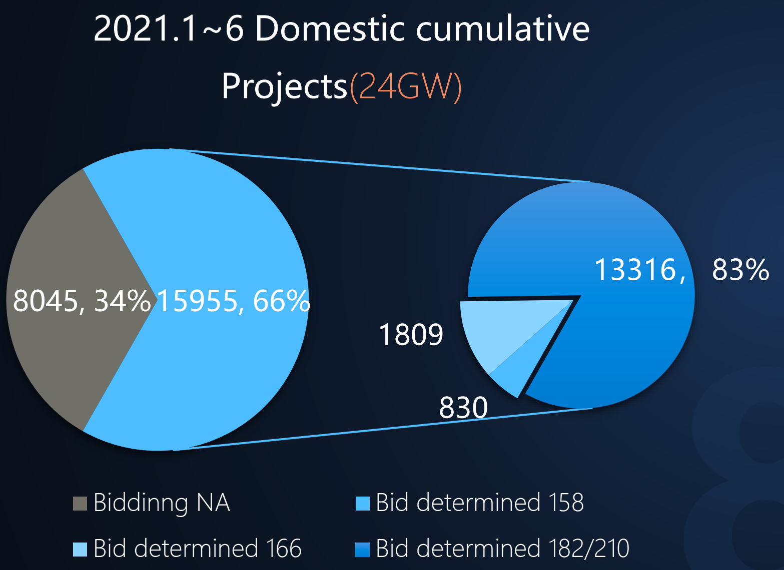
@57% of companies exhibited 210 modules

57%

- 57% (21/37) of companies exhibited 210 Modules with module power 600-700W;
- 35% companies presented 182 Modules with power: 550-570W;

2021.1-6

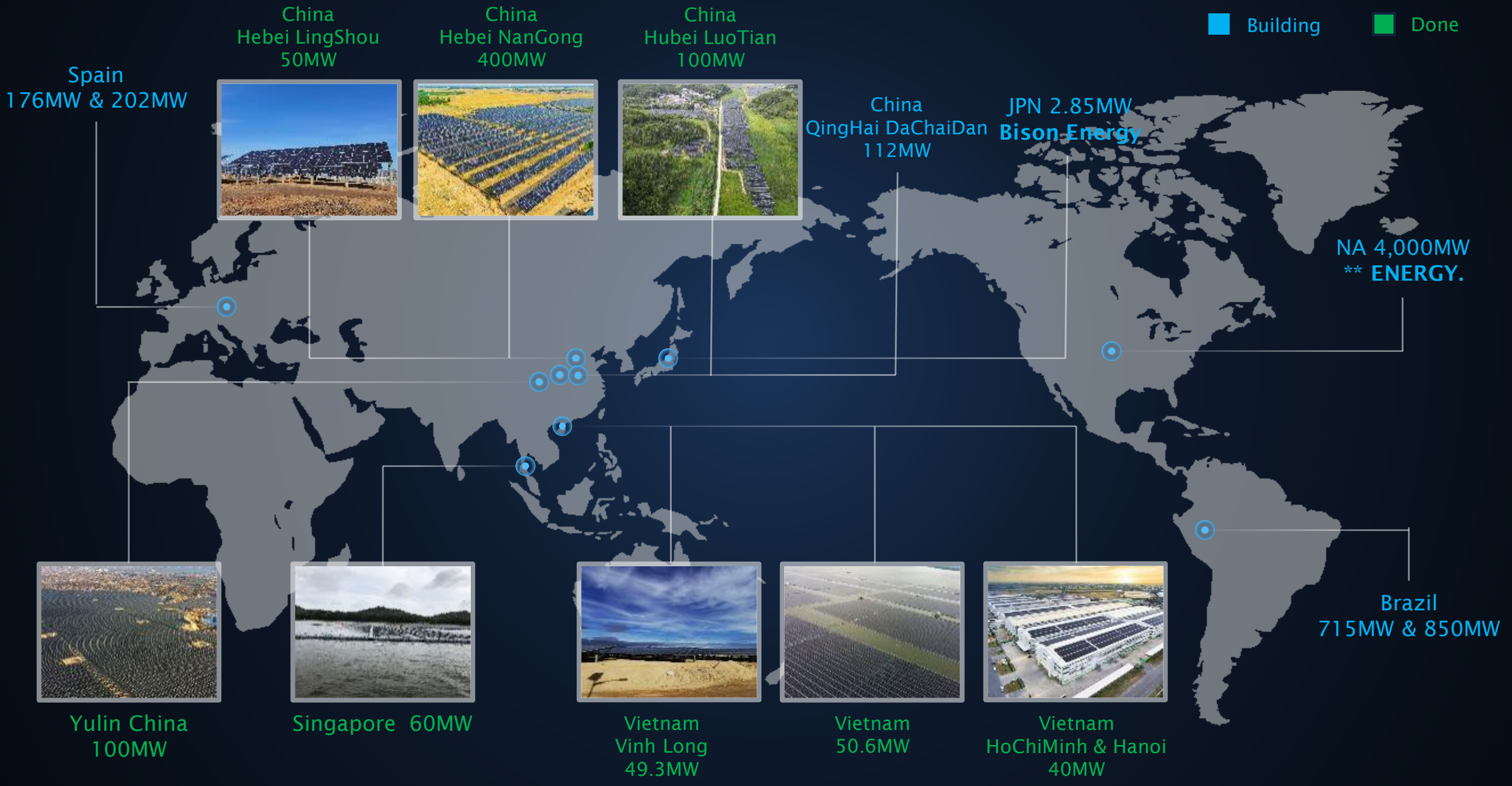
Cumulative bidding projects of Chinese companies - high power modules account for 83%



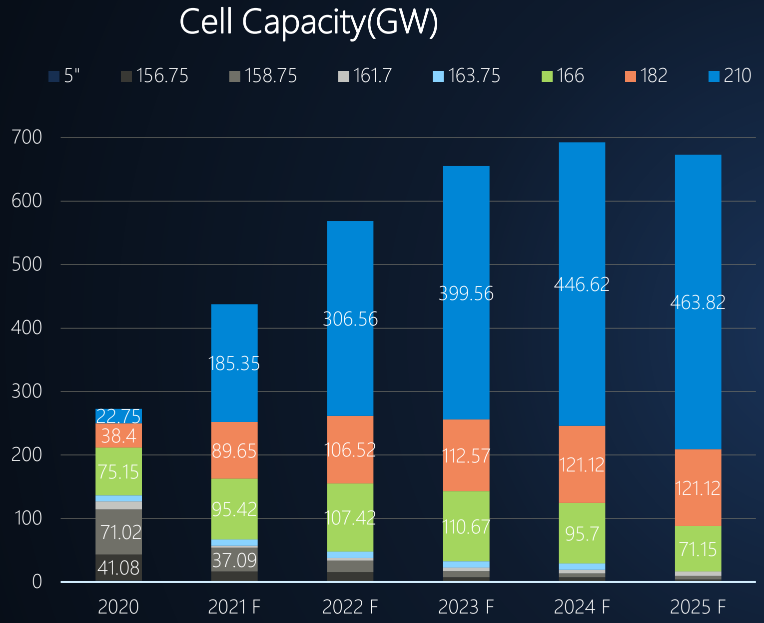
Company	Bidding scale (MW)
中核 CNNC	7610
华电 CHD	7000
大唐 DaTang	5000
广州发展 Guangzhou Development	1080
广东省能源集团 GEG	950
中广核 CGN	700
龙源电力 LongYuan	350
南网能源 Southern Power Grid	280
通威 TongWei	200
承德大元新能源 Chengde Dayuan new energy	180
黄河水电 Yellow River Hydropower	126
三峡 Three Gorges Corporation	124
协和新能源 Concord New Energy	100
湖北能源集团 Hubei Energy Group	100
粤水电 Guangdong hydropower	50
蒙能集团 Mengneng group	49
中国能建 CEEC	5
Sum	24000

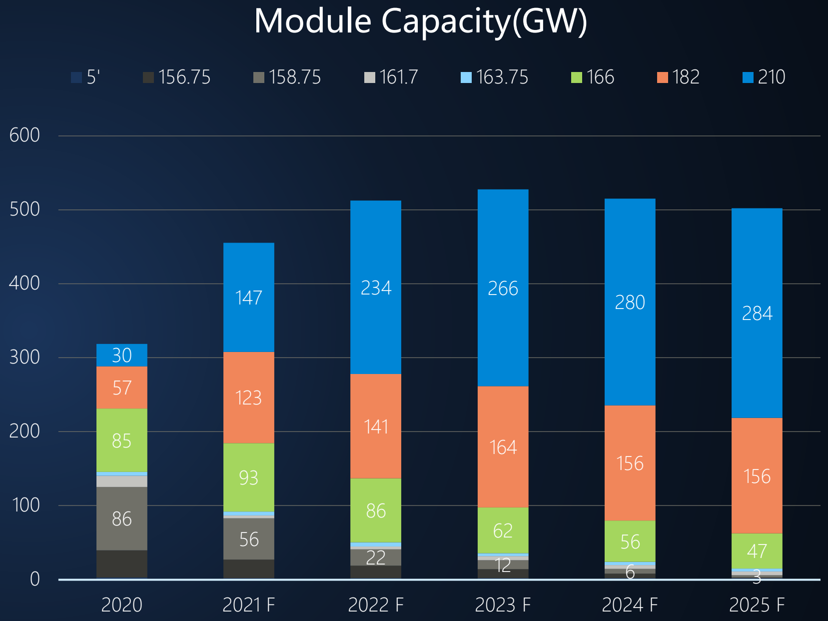
Data source: Solarbe (2021.7.15)

210 Vertex modules: over 18GW of signed orders



210 to become mainstream





数据来源：PV InfoLink 2021.7

- According to the latest report published by PVinfolink, the 210 modules production capacity will reach 147GW this year and 234GW next year(Cell capacity @ 306GW).
- High power modules will take more than 70% share of overall global modules production capacity. And the pace of growth is likely to exceed our forecasts.

210 Vertex module & cell capacity

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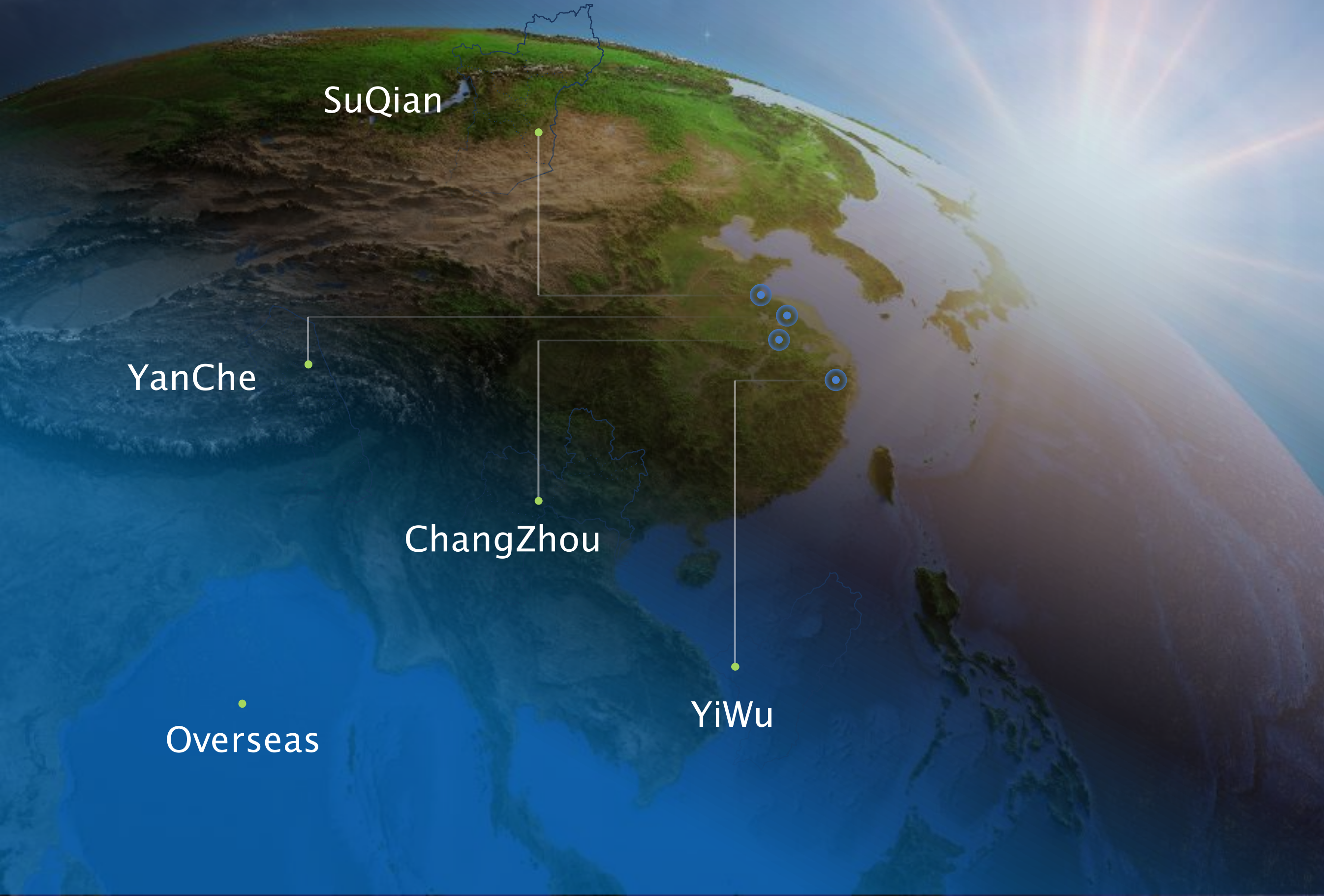


2021 Module Capacity

50 GW+

2021 Cell Capacity

35 GW+

Summary

1

210 Vertex module ecosystem has been established with compatibility with inverters, trackers & BoS.

2

210 modules to become mainstream. Global 210 cell and module capacity forecast to reach 234-306GW in 2022;

3

Trina Solar's global product capacity for 2021 is 50GW+, of which around 70% is taken up by 210 Vertex modules. 210 modules provide 35-90W power increase, delivering greater customer value.

PVTECH TECHTalk Trinasolar

THANKS!

Deploying Vertex,

Maximize Your ROI.

ANALYZING IMPACT OF MODULES WITH DIFFERENT WAFER SIZES ON THE LCOE

LCOE Study for 6 Module Types and 2 Locations

Jefferson Bor, Dilara Maria Subasi

Fraunhofer Institute for Solar Energy Systems ISE

“Special thanks to Trina Solar”

PV Tech Webinar

02.09.2021

www.ise.fraunhofer.de

LCOE Study for Solar Modules with Different Cell Sizes

Background

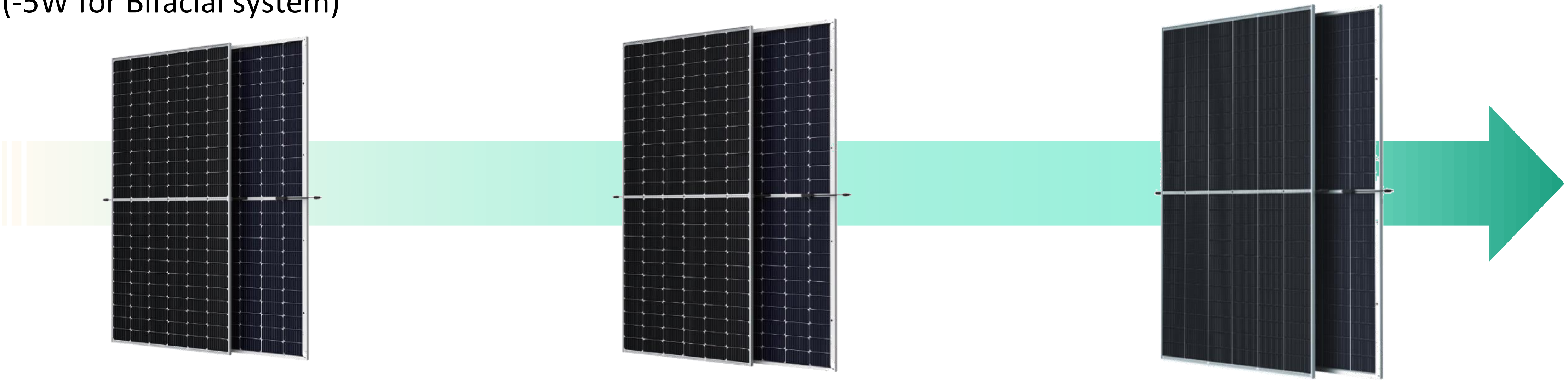
- **3 Cell Sizes**

  166mm (M6) → 182mm (M10) → 210mm (G12)

- **6 Module Designs**

  M6-455W → M10-540W → G12-550W → M10-590W → G12-605W → G12-665W

  (-5W for Bifacial system)



LCOE Study for Solar Modules with Different Cell Sizes
Background

- **2 Locations**

Germany	1087 kWh/m²	Temperate climate ; high diffuse irradiation
Spain	1796 kWh/m²	Mediterranean climate ; high direct irradiation and temperature

- **3 Mounting Systems**

10 MWp	50 MWp	50 MWp
Fixed in Germany	1P Tracker in Spain	2P Tracker in Spain



LCOE Study for Solar Modules with Different Cell Sizes

Background

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- **3 Mounting Systems**

10 MWp	50 MWp	50 MWp
Fixed in Germany	1P Tracker in Spain	2P Tracker in Spain

LCOE Study for Solar Modules with Different Cell Sizes

Background – PV Systems in Germany

Module Power [W]	455	540	550	590	605	665
Cell Type	M6	M10	G12	M10	G12	G12
Module Size [mm]	2102 x 1040	2256 x 1133	2384 x 1096	2411 x 1134	2172 x 1303	2384 x 1303
Inverter	SUN2000-215KTL-H0 / SUN2000-215KTL-H3					
Modules/String	28	28	37	26	34	31
Strings/Inverter	19	16	12	16	12	12
String power [W]	12.74	15.12	20.35	15.34	20.57	20.62
DC/AC Ratio	1.14	1.13	1.15	1.14	1.15	1.15
Pitch [m]	6.03	6.56	6.35	6.56	7.53	7.53
Tilt [°]	20°					
Shading angle[°]	35°					
GCR	54.8%					
DC Capacity [kW]	9,924	9,919	10,012	10,063	10,120	10,143
AC Capacity [kW]	8,815					
Module numbers	21,812	18,368	18,204	17,056	16,728	15,252
Inverter numbers	41					

- Monofacial system + String inverter + Fixed Landscape installation
- G12 module
  - Low voltage
  - High current
  - → More modules / string
  - → Higher current (power) per string
- SUN2000-215KTL-H3 for G12 modules with high current in string
- Dense installation due to high land cost
  - 35° instead of optimizing 14°
- Other control factors same or mostly similar, i.e. GCR, DC/AC, Inverter numbers…

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LCOE Study for Solar Modules with Different Cell Sizes

Background - PV Systems in Spain

Module Power [W]	**450**	**535**	**545**	**585**	**600**	**660**
Cell Type	M6	M10	G12	M10	G12	G12
Module Size [mm]	2111 x 1046	2256 x 1133	2384 x 1096	2411 x 1134	2172 x 1303	2384 x 1303
Inverter	SG3125HV-20					
Modules/String	28	29	38	26	34	31
Strings/Inverter	330	268	201	273	204	203
String power [W]	12.60	15.52	20.71	15.21	20.40	20.46
DC/AC Ratio	1.16	1.16	1.16	1.16	1.16	1.16
Pitch [m]	5.28	5.64	5.96	6.03	5.43	5.96
Strings/Tracker	4	4	3	4	3	3
Tracker number	990	804	804	819	816	812
GCR	40%					
DC Capacity [kW]	49,896	49,896	49,953	49,828	49,939	49,841
AC Capacity [kW]	43,116					
Module numbers	110,880	93,264	91,656	85,176	83,232	75,516
Inverter numbers	12					

- Bifacial system + Central inverter + 1P Tracking

  Portrait installation

- Strings on tracker are determined by the max. tracker length

  → Less strings/tracker for high current G12 module

- Looser installation
  - GCR 40%

- Others same concept as Germany

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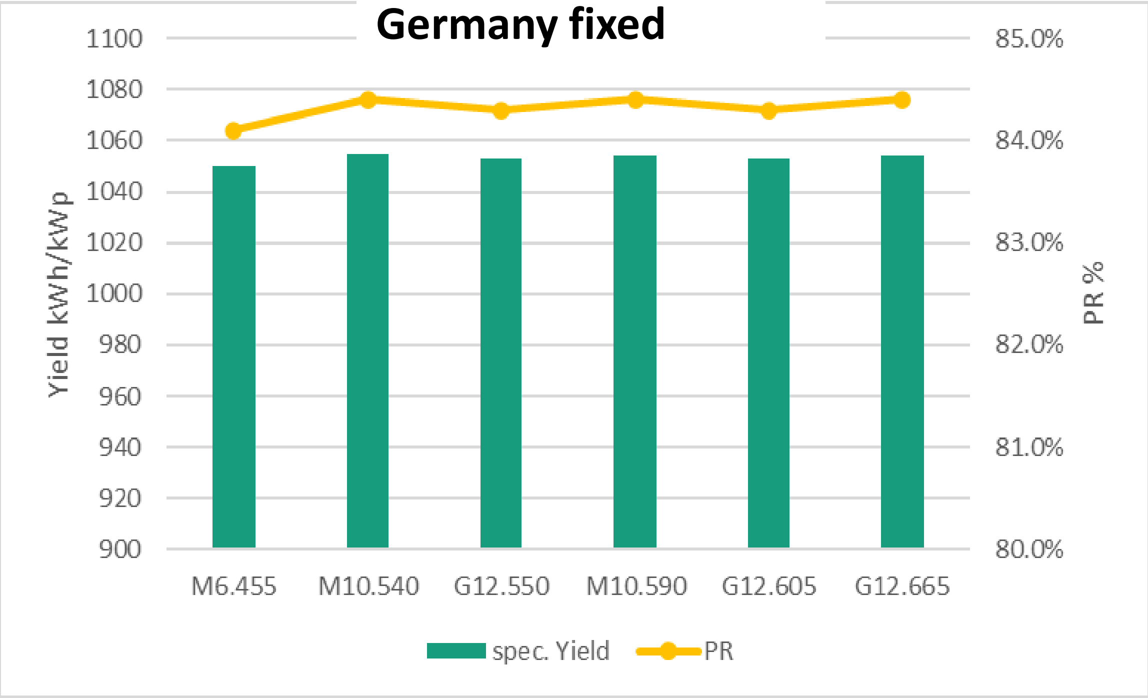
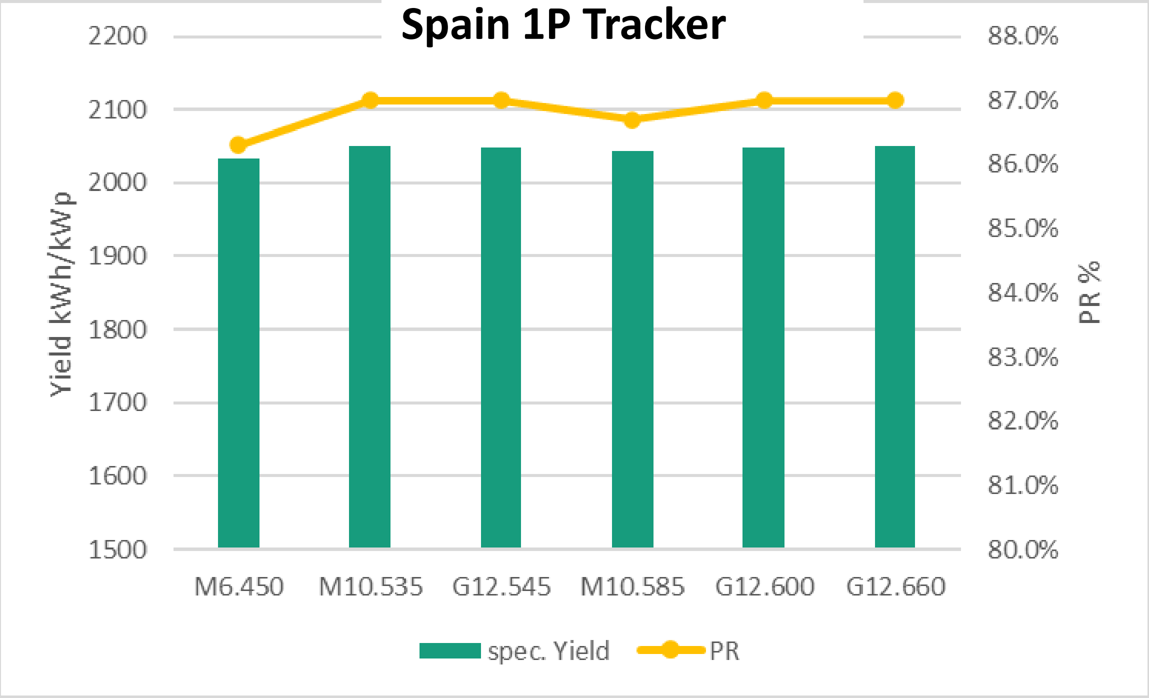
Energy Yield and Performance Ratio

PV Systems in Germany and Spain

- Yield and PR differences only in a small range*
- M6.455W/450W slight worse due to cell technology

→ **Must take a closer look at LCOE**





*for the G12 systems in Spain, 6mm² instead of 4mm² DC cable for connecting strings and combiner boxes are simulated in the study . For the rest of systems and all cases in Germany, 4mm² DC cable is simulated.

Levelized Cost of Electricity (LCOE)

Calculation Formula

$$LCOE_{nom} = \frac{\overbrace{\left(CAPEX_{PV,total} + \sum\left[\frac{OPEX(t)}{(1+WACC_{nom})^t}\right] - \frac{ResValue}{(1+WACC_{nom})^N}\right)}^{\substack{\textbf{Lifecycle cost} \\ \text{Costs during system operation}}}}{\underbrace{\sum\left[\frac{Yield(0)(1-Degradation)^t(Availability)}{(1+WACC_{nom})^t}\right]}_{\substack{\textbf{Lifetime energy production} \\ \text{Energy yield during system operating time}}}}$$

T	lifetime
N	economic lifetime of the system
$CAPEX_{PV,\ total}$	investment
OPEX(t)	annual operation expenditure in year t
$WACC_{nom}$,	nominal weighted average cost
ResValue	residual value of the PV system after its lifetime
Yield	electricity produced
Degradation	degradation rate
Availability	percentage of the power plant's operation

Levelized Cost of Electricity (LCOE)

Calculation Formula

$$LCOE_{nom} = \frac{\left(\boxed{CAPEX_{PV,total}} + \sum \left[\frac{\boxed{OPEX(t)}}{\boxed{(1+WACC_{nom})^{t}}}\right] - \frac{\boxed{ResValue}}{\boxed{(1+WACC_{nom})^{N}}}\right)}{\sum \left[\frac{\boxed{Yield(0)}\boxed{(1-Degradation)^{t}(Availability)}}{\boxed{(1+WACC_{nom})^{t}}}\right]}$$

Varing parameters

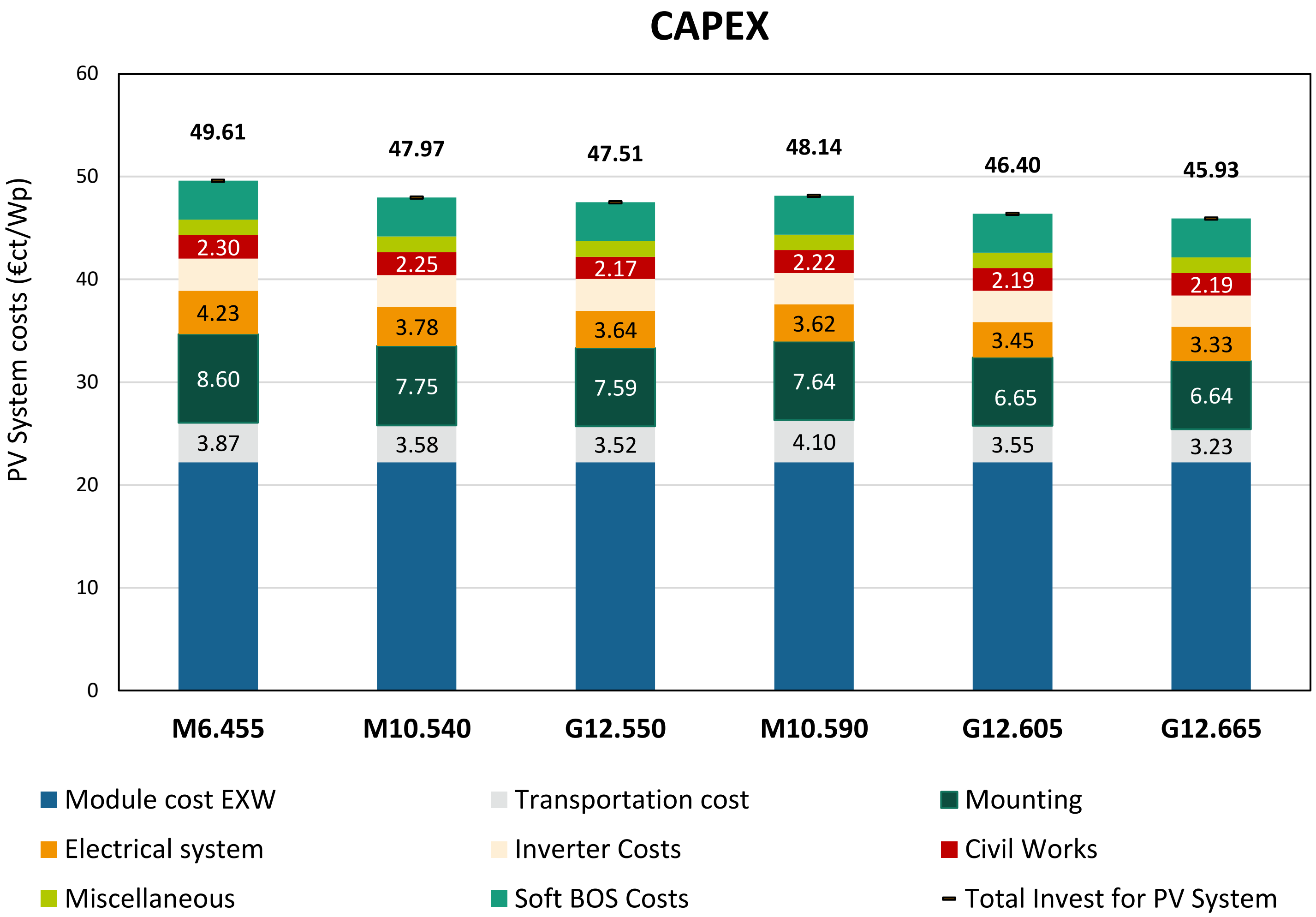
Same for all systems (at same location)

→ In this study, CAPEX is the dominating parameter for LCOE

CAPEX & LCOE Results

CAPEX - PV System in Germany

- Module € / Wp and Inverter € / Wac same for all
- Major differences:
  - Module transport
  - Mounting structure
  - Electrical system
  - Civil works
- Miscellaneous, soft BOS cost same for all

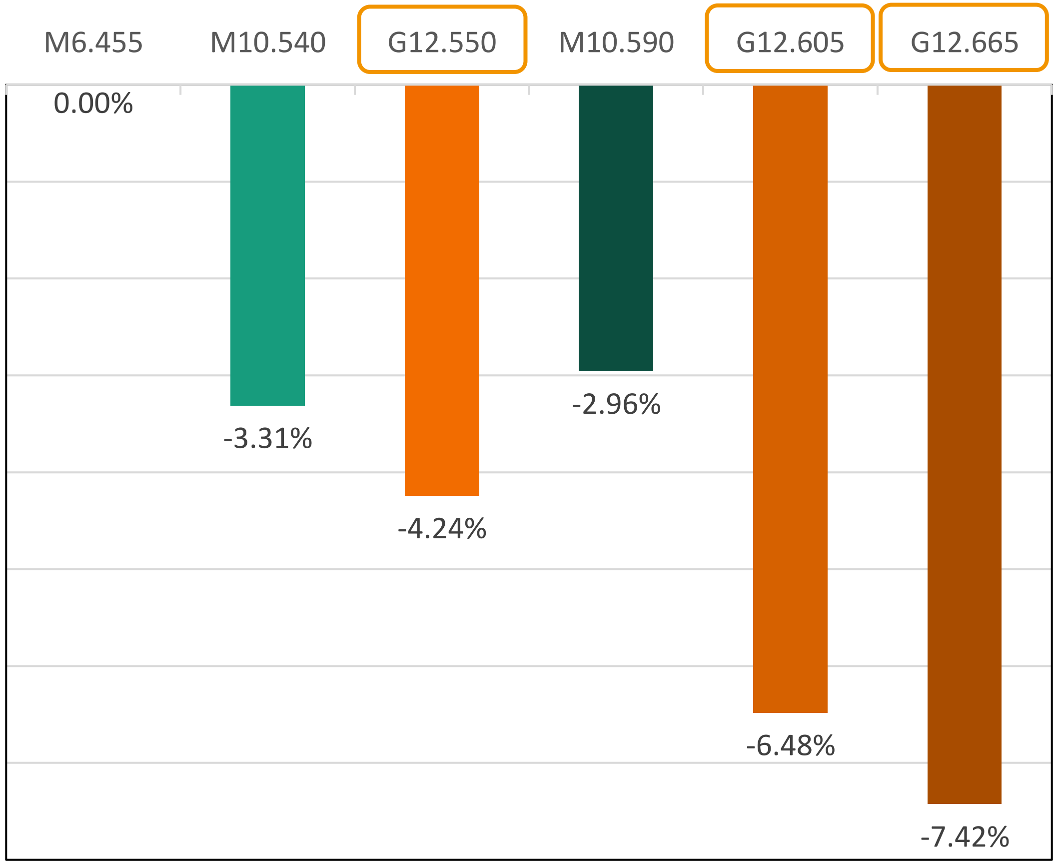


CAPEX & LCOE Results
CAPEX - PV System in Germany

	M6.455	M10.540	G12.550	M10.590	G12.605	G12.665
	€ct/Wp					
Module	26.07	25.78	25.72	26.30	25.75	25.43
Inverter	3.11	3.11	3.08	3.07	3.05	3.04
Civil Works	2.30	2.25	2.17	2.22	2.19	2.19
Electrical system	4.23	3.78	3.64	3.62	3.45	3.33
Mounting	8.60	7.75	7.59	7.64	6.65	6.64
CAPEX	**49.61**	**47.97**	**47.51**	**48.14**	**46.40**	**45.93**
Land	0.17	0.17	0.17	0.16	0.17	0.17
OPEX	0.99	0.96	0.95	0.96	0.93	0.92
	€ct/kWh					
LCOE	**5.08**	**4.89**	**4.86**	**4.91**	**4.75**	**4.69**
LCOE comparison	**-**	**-3.7%**	**-4.4%**	**-3.4%**	**-6.6%**	**-7.6%**

*miscellaneous and soft BOS cost are not shown in the table

CAPEX difference % compared with M6.455



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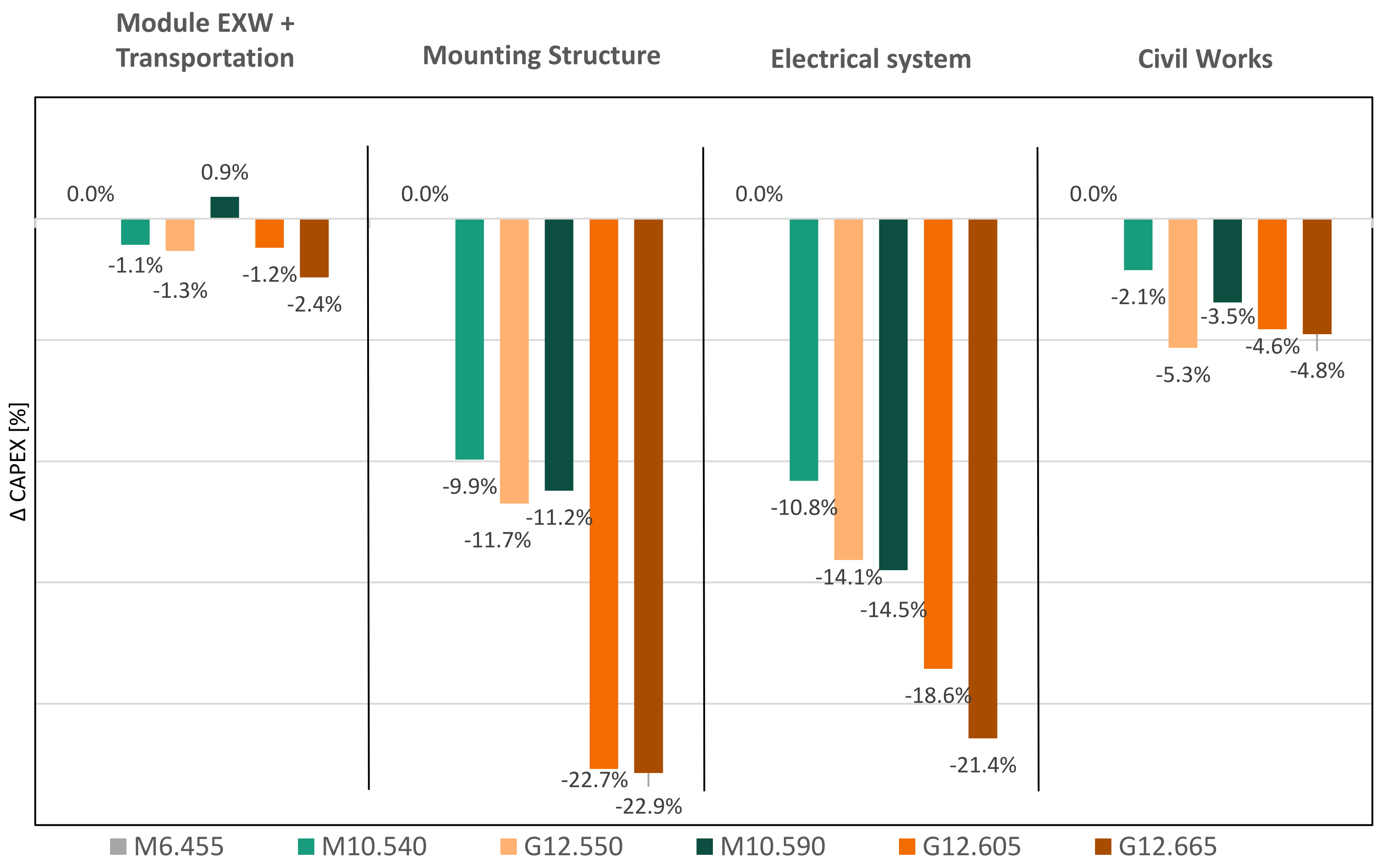
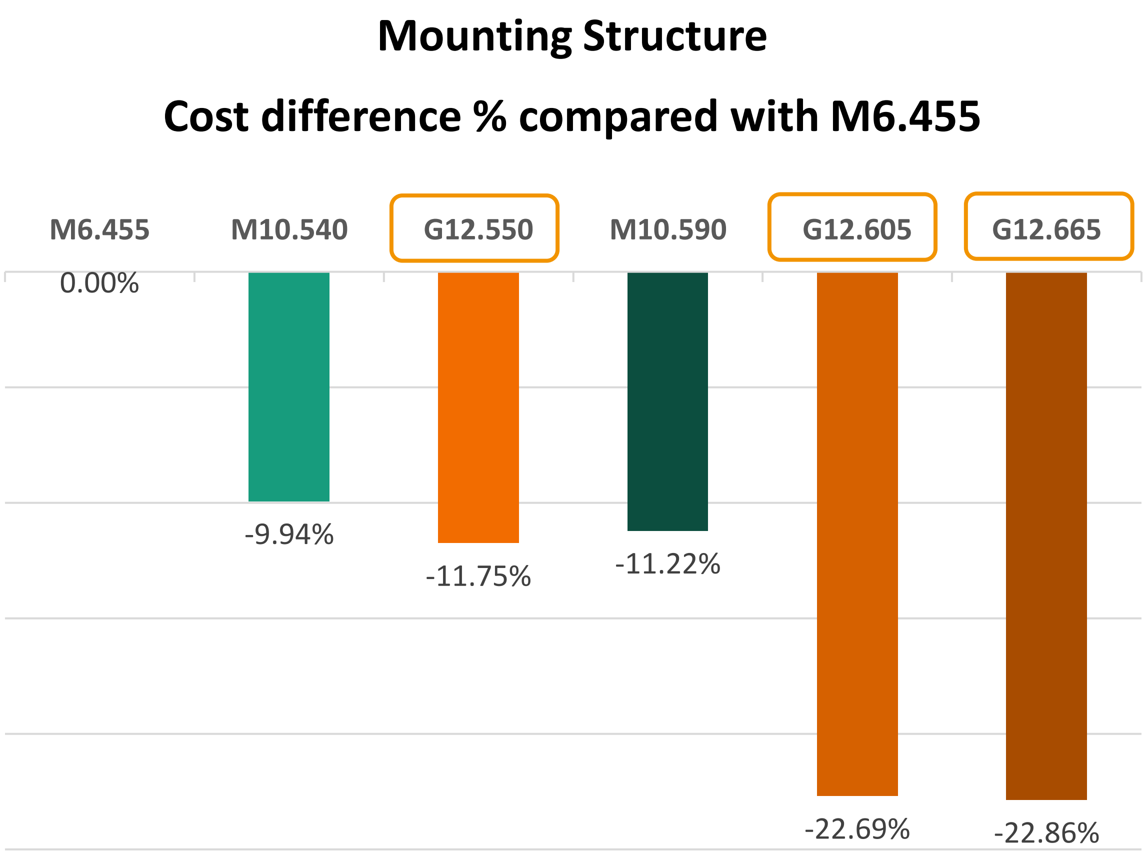
CAPEX & LCOE Results

CAPEX break-down in Germany



CAPEX & LCOE Results

CAPEX break-down in Germany



G12 modules

- Longer string and longer table

→ Less amount of table

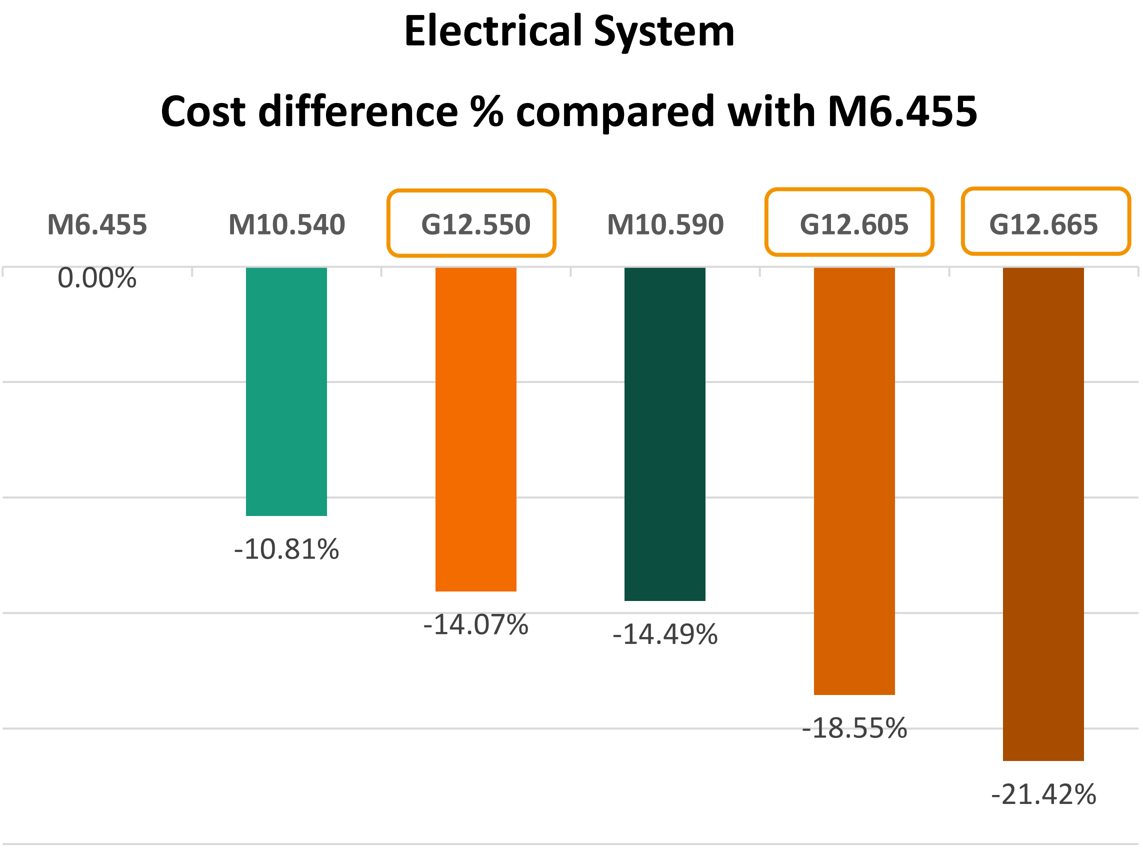
Landscape G12 + wider modules (G12.605, 665)

- Length instead of width dominates the table cost
- Higher Wp / m

→ Significantly lower € / Wp

CAPEX & LCOE Results

CAPEX break-down in Germany



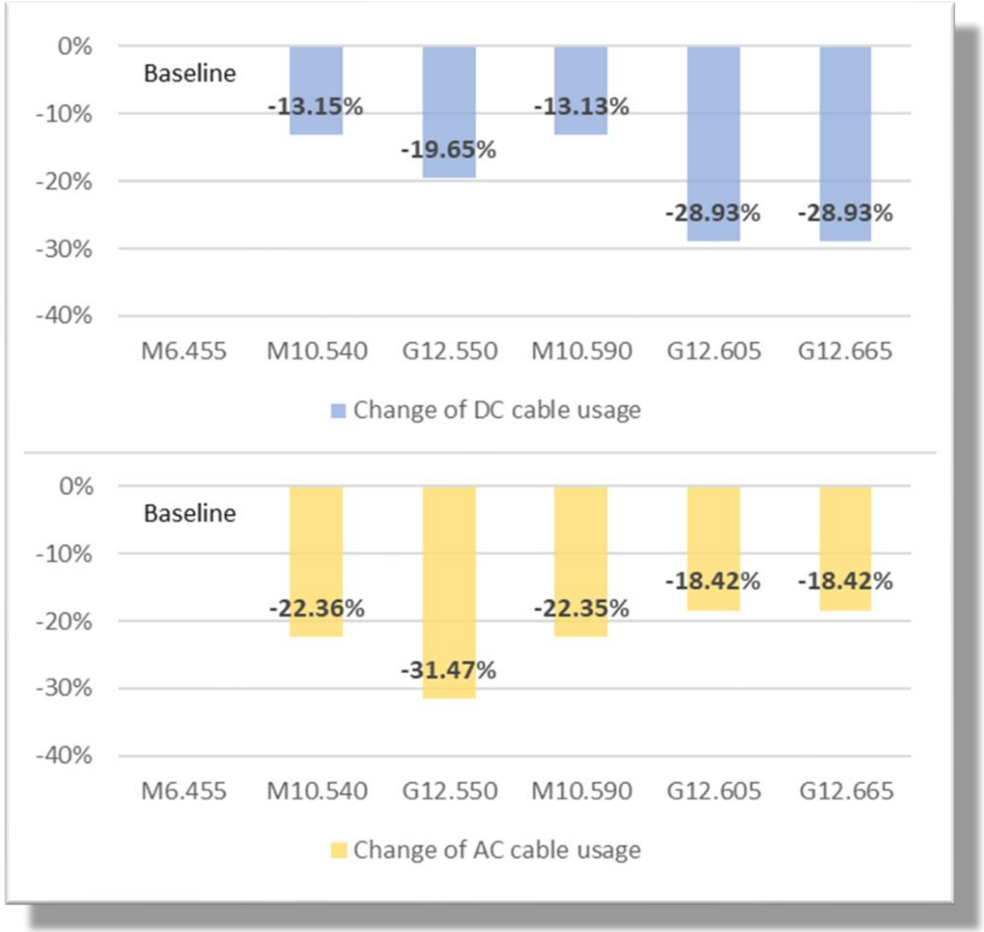
- Includes module, inverter installation in the study

CAPEX & LCOE Results

CAPEX break-down in Germany

DC cable saving

AC cable saving



G12 modules

- Strong reduction of DC cable use
- Reduction of AC cable depends on module geometry

→ DC+AC € / Wp lower compared to M10

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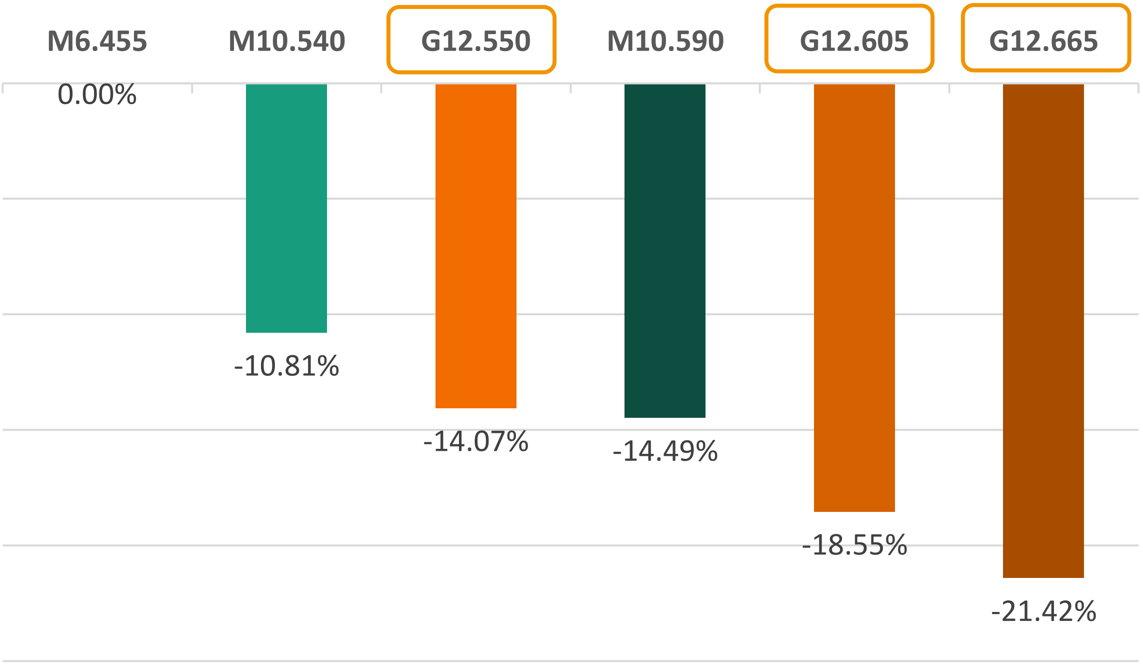
CAPEX & LCOE Results

CAPEX break-down in Germany

Electrical System

Cost difference % compared with M6.455



High power modules

- Lower module installation € / Wp

G12 + high power modules

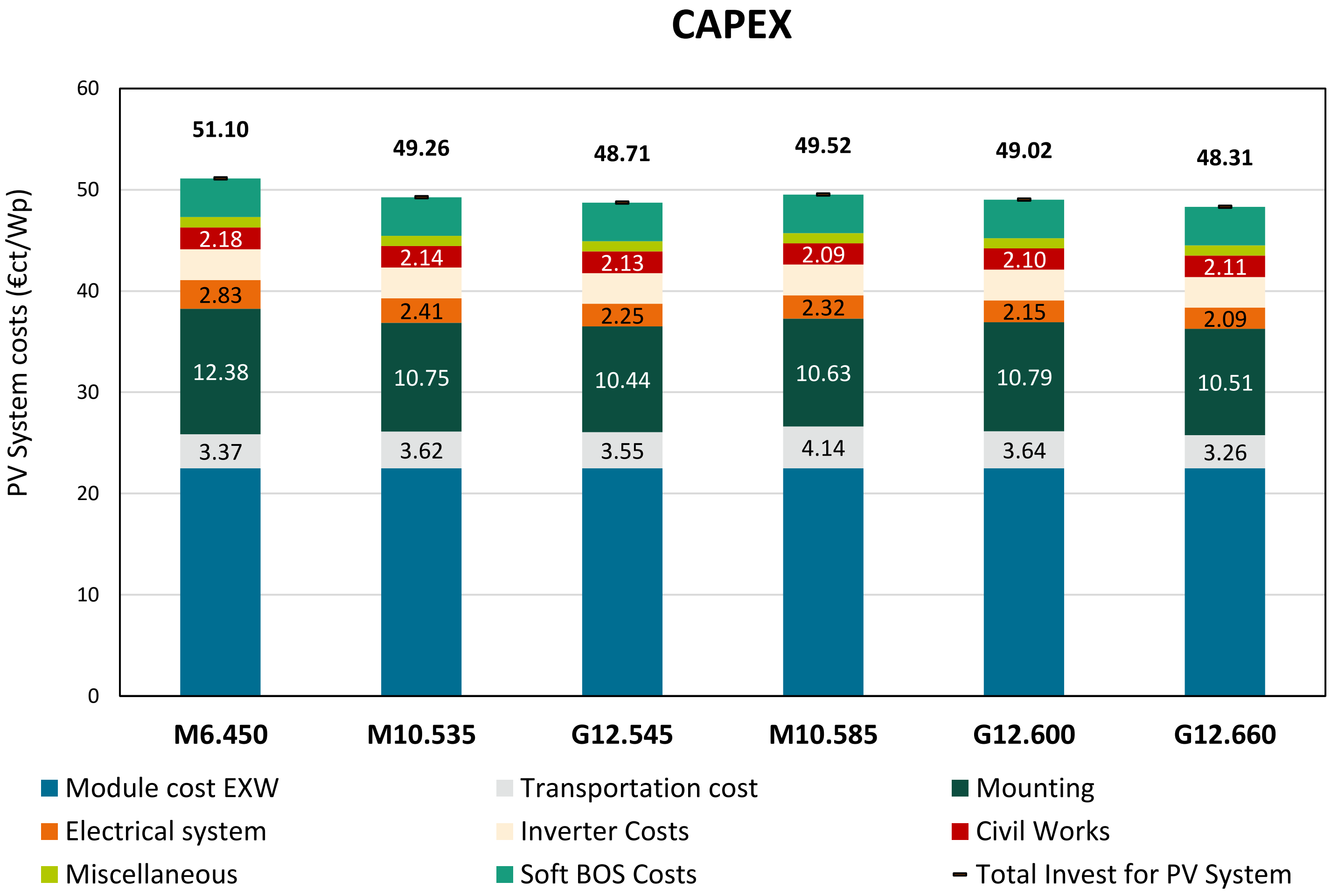
- Lower cable cost
- Lower module installation € / Wp

→ Lowest € / Wp

CAPEX & LCOE Results

CAPEX - PV System in Spain: 1-row Tracking

- Module € / Wp and Inverter € / Wac same for all
- Major differences:
  - Module transport
  - Tracker
  - Electrical system
  - Civil works
- Miscellaneous, soft BOS cost same for all

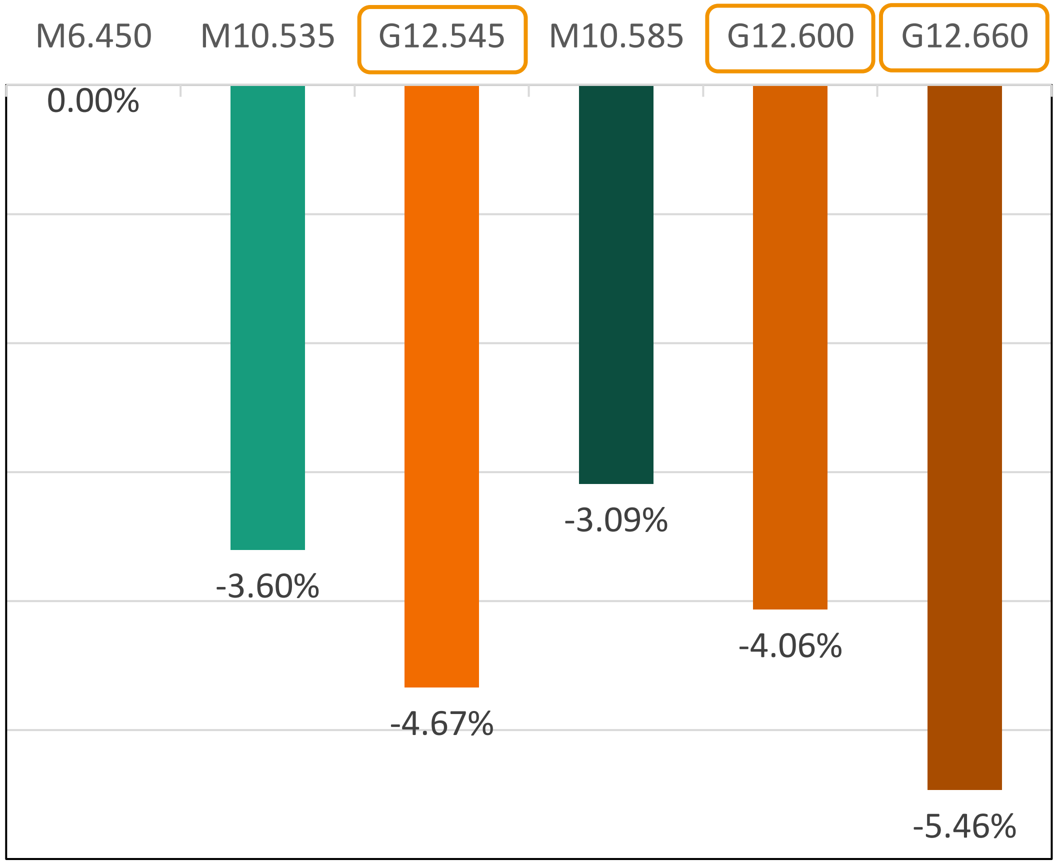


CAPEX & LCOE Results

CAPEX - PV System in Spain: 1-row Tracking

	€ct/Wp					
	M6.450	M10.535	G12.545	M10.585	G12.600	G12.660
Module	25.87	26.12	26.05	26.64	26.14	25.76
Inverter	3.03	3.03	3.03	3.03	3.03	3.03
Civil Works	2.13	2.09	2.08	2.04	2.05	2.06
Electrical system	2.54	2.13	1.97	2.04	1.87	1.81
Tracker & Mounting	12.38	10.75	10.44	10.63	10.79	10.51
CAPEX	**51.10**	**49.26**	**48.71**	**49.52**	**49.02**	**48.31**
Land	0.16	0.15	0.15	0.15	0.15	0.15
OPEX	1.02	0.99	0.97	0.99	0.98	0.97
	€ct/kWh					
LCOE	**2.82**	**2.70**	**2.67**	**2.72**	**2.68**	**2.65**
LCOE comparison		**-4.2%**	**-5.3%**	**-3.6%**	**-4.7%**	**-6.1%**

CAPEX difference % compared with M6.450



*miscellaneous and soft BOS cost are not shown in the table

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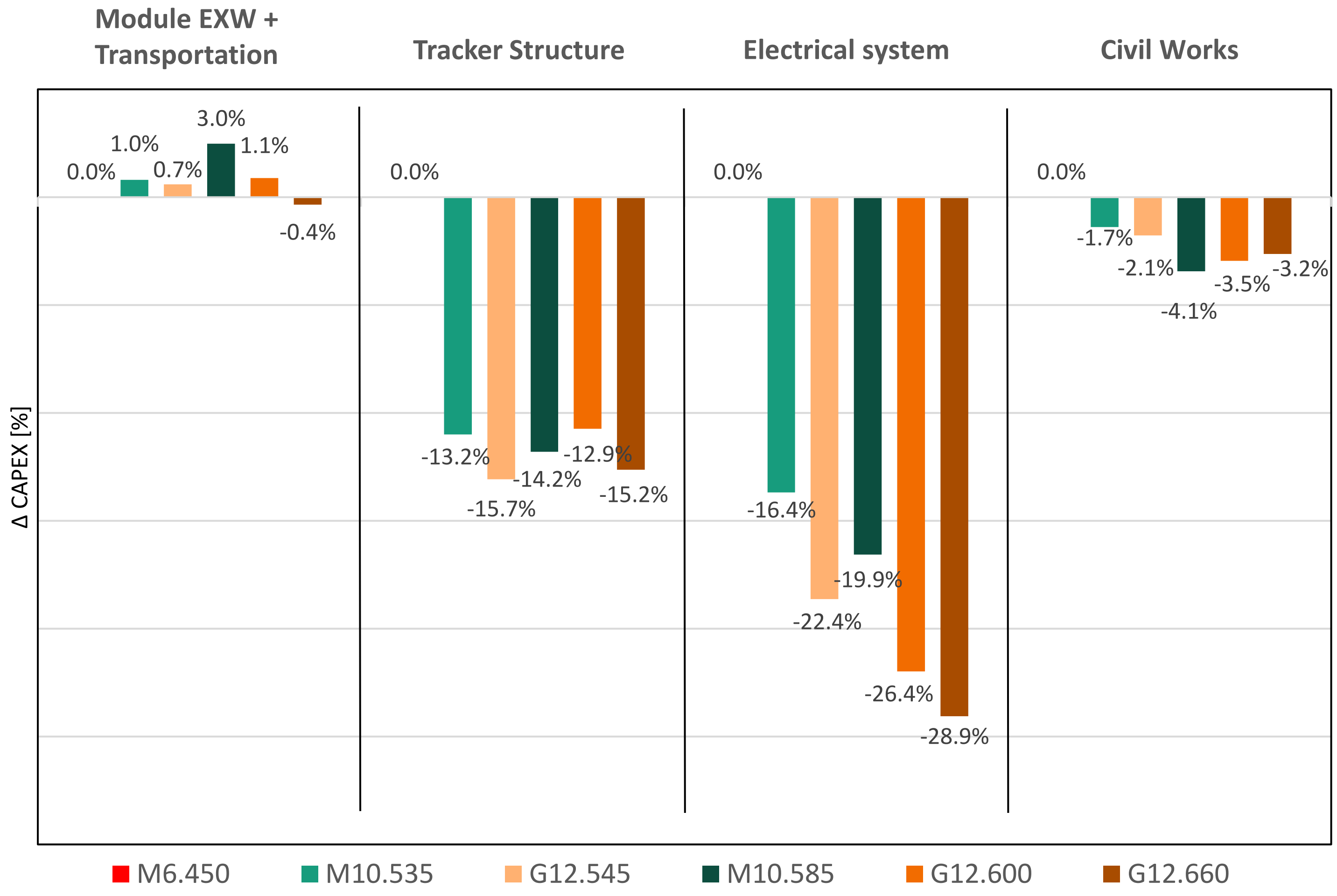
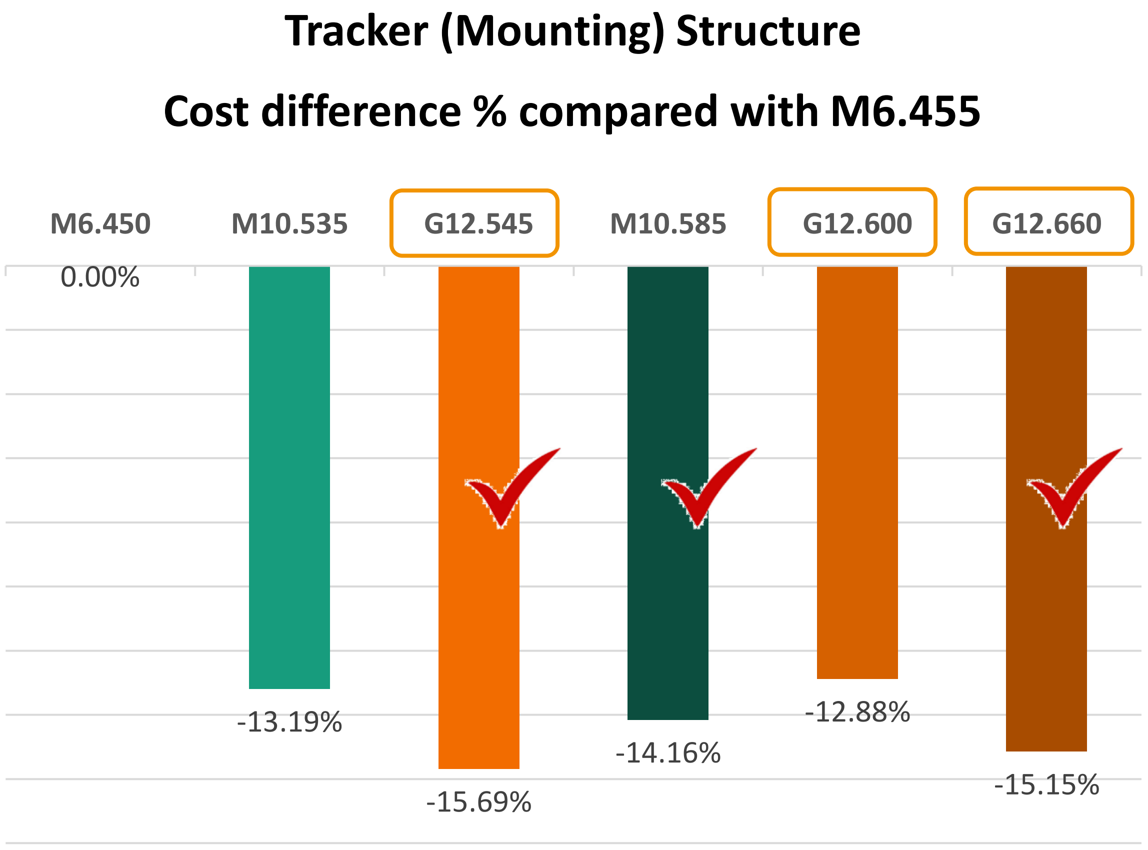
CAPEX & LCOE Results

PV System Located in Spain: 1-row Tracking



CAPEX & LCOE Results

PV System Located in Spain: 1-row Tracking



- Different from table, tracker length is quite fixed

→ Similar amount of tracker for M10, G12 systems

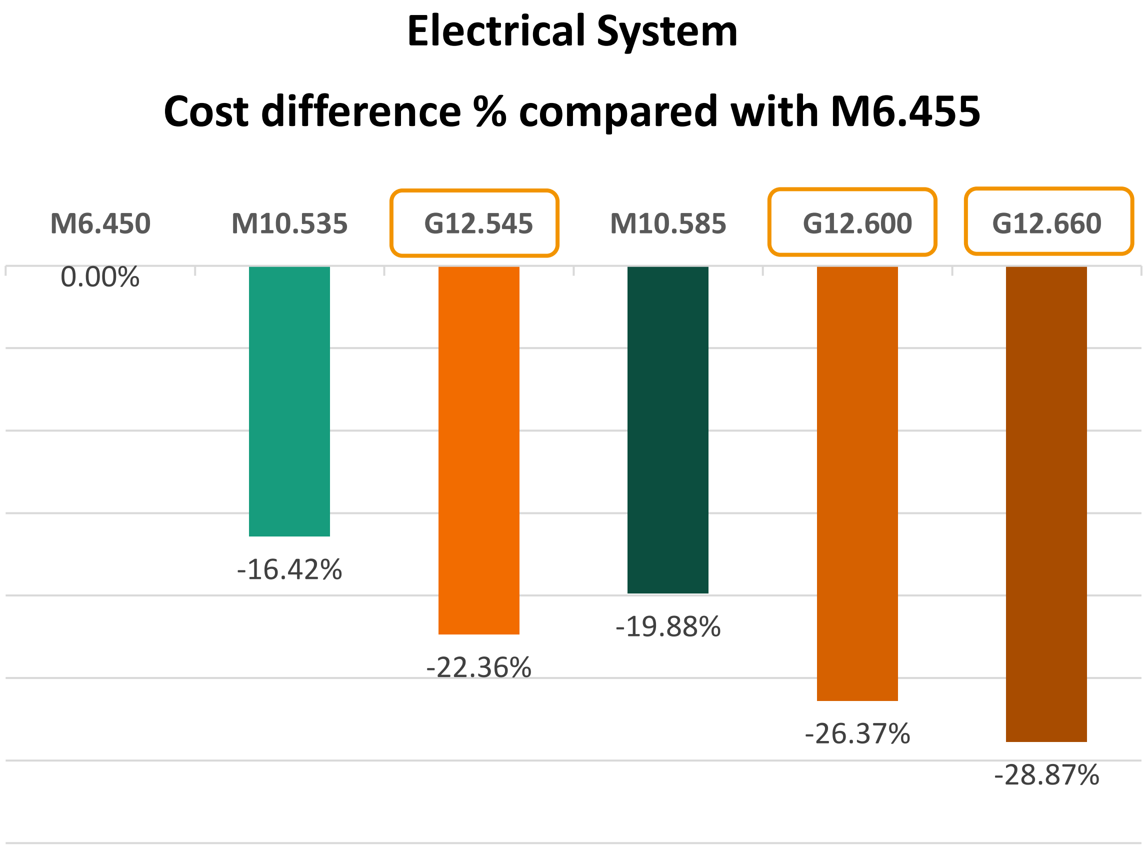
- Module geometry may have more impact than M10 or G12

✔ G12.545, M10.585, G12.660 lower € / Wp

→ for the same width(1.3m), G12.600 has higher € /m than G12.660

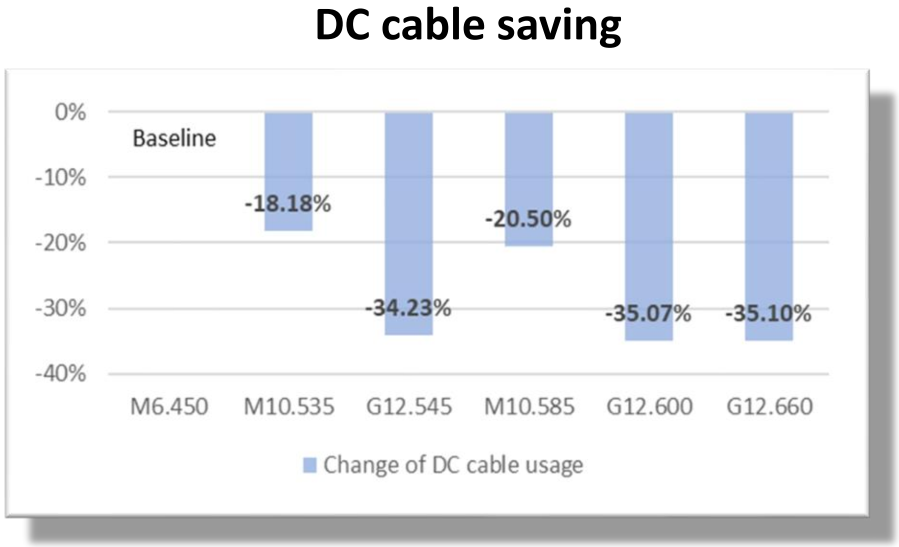
CAPEX & LCOE Results

PV System Located in Spain: 1-row Tracking



- Similar to results in Germany, but without AC cabling due to central inverter

→ G12 higher DC cable reduction dominates the cost reduction



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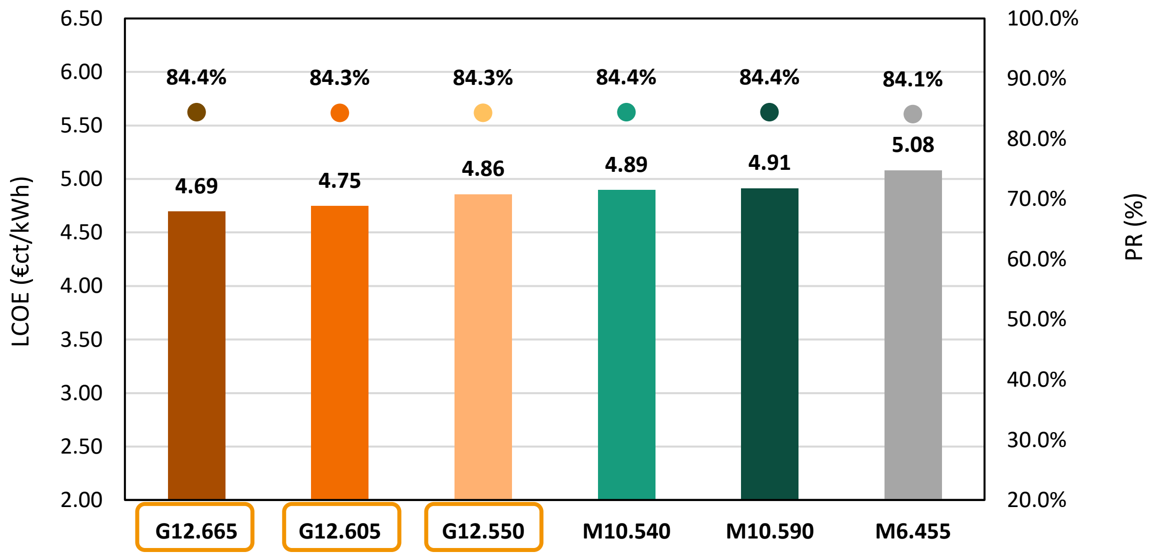
CAPEX & LCOE Results

LCOE - PV System in Germany and in Spain (1P)

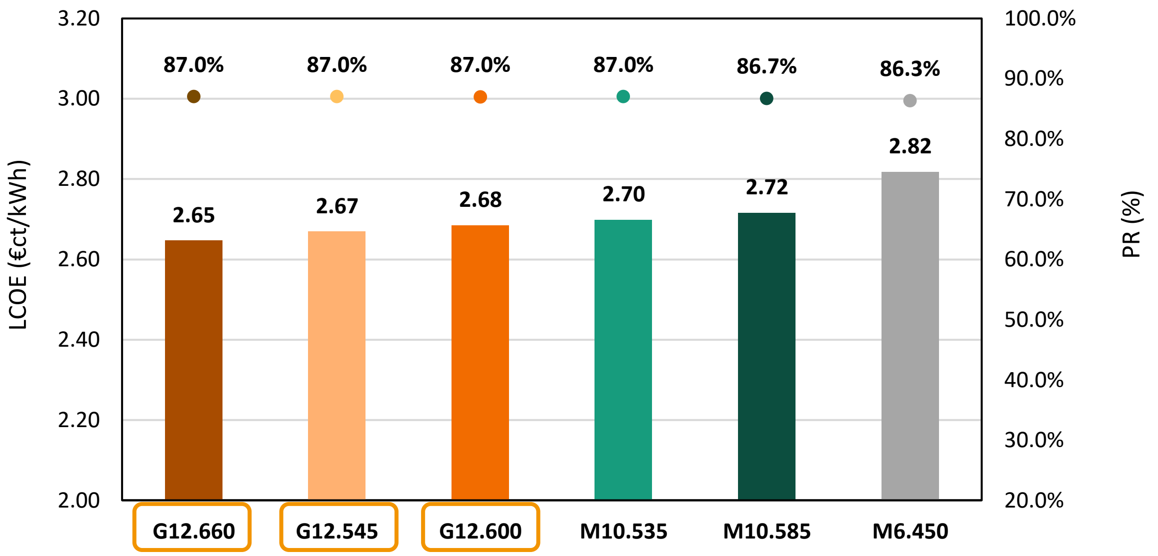
Germany : fixed

- WACC : 6.0 %
- Lifetime : 25 y
- Residual value : 0 €



Spain : 1-row tracker

- WACC : 7.4 %
- Lifetime : 30 y
- Residual value : 0 €



CAPEX & LCOE Results

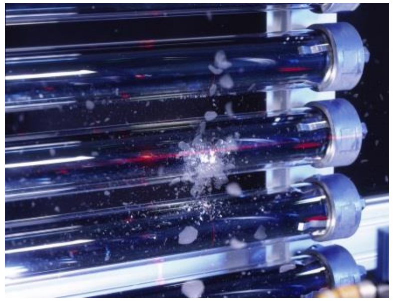
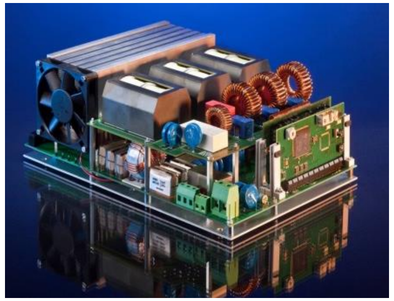
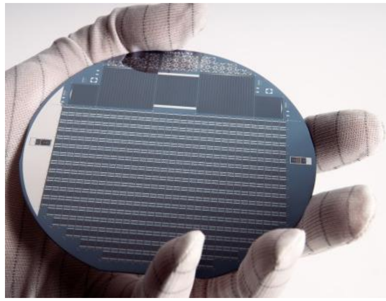
Conclusions and Takeaways

For systems with similar yield and PR, we learn that:

- G12 systems show the best LCOE at both locations
- Compared to M6, M10 and G12 modules have lower BOS due to their <u>higher power output</u>
- G12 has additional benefits on BOS costs (mounting, cabling, combiner boxes, MC4…) due to its <u>low-voltage → less strings needed</u>
- Module geometry has different impacts on the mounting structure cost depending on types and installation methods, i.e. fixed table or tracker structure ; landscape or portrait

Thank you for your Attention!

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Enhanced Reliability – 670W Vertex Module

Harsh Environment VS Module Durability

Trinasolar

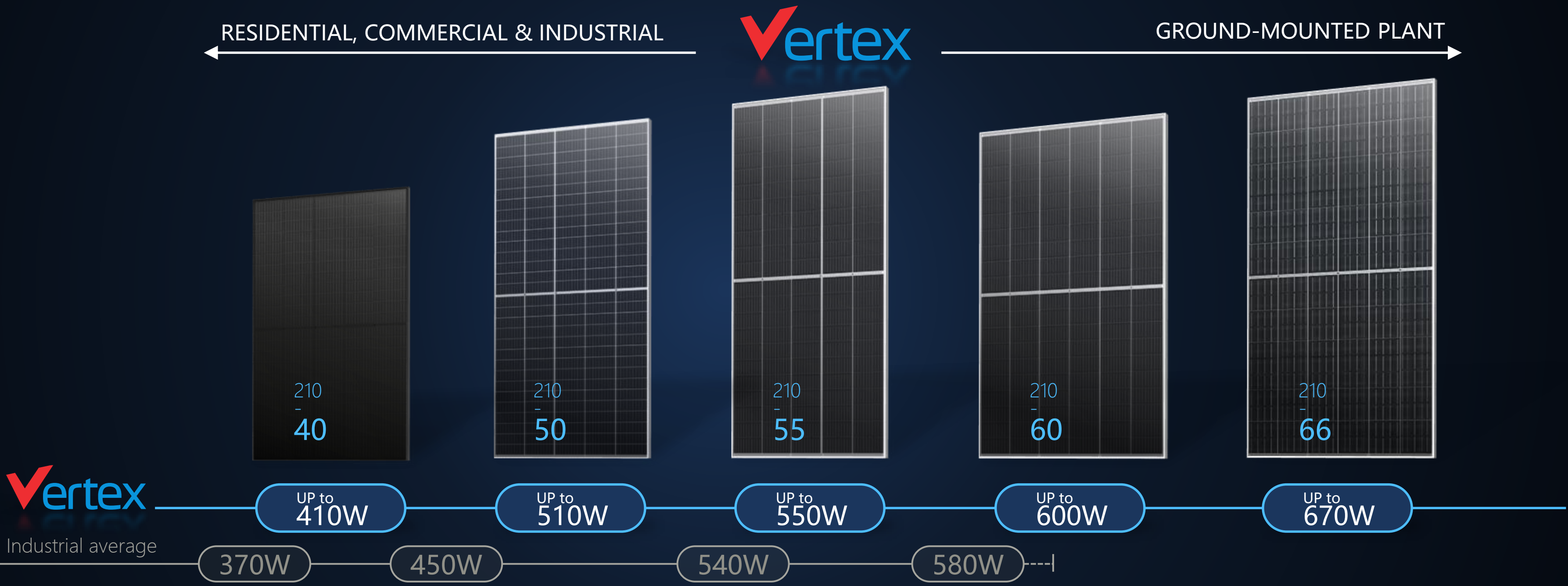
The Diverse Scenarios of Photovoltaic Applications

GEOGRAPHY

- Extreme weather conditions such as strong winds, heavy snow, and hail present serious challenges for all PV module manufacturers, in mechanical performance terms.

Trina Solar Vertex Family

Trina Solar – Pioneering Ultra-high Power Modules



- Vertex modules are available from 410 to 670W+ in power, covering all applications
- In various applications, Vertex output is 35W to 90W higher than the industry average, BOS savings in range of 0.5~1.6 c USD/W

5 Enhanced Tests

670W - Proven Mechanical Performance

Trinasolar

Static Load

Non-uniform Snow Load

Static Loading under -40℃

Hail Impact

Enhanced Dynamic Load

Wind Tunnel Test

- High reliability ensures extended power generation
- All tests conducted by independent 3rd parties
- All test samples are randomly picked from mass production (DEG21C.20)
- Mechanical load and warranty should comply with latest official Trina Solar User Manual and Trina Solar Warranty

Static Load

Equivalent Level to Traditional Modules

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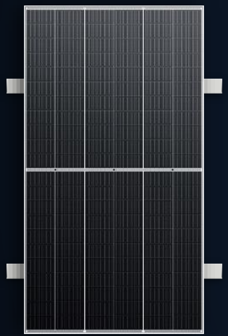
TÜVRheinland Precisely Right.

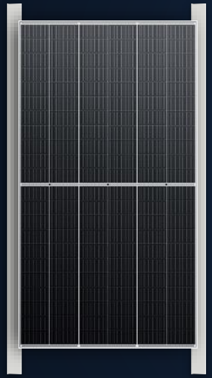
IEC 61215
IEC 61730
Granted in 2021.1

UL

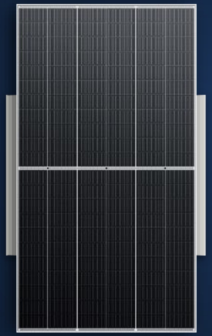
670W Module reliability simulations evaluating wind and snow resistance.



Static load
+5400Pa/-2400Pa

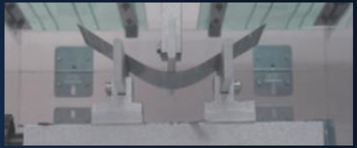


Static load
+3600Pa/-2400Pa



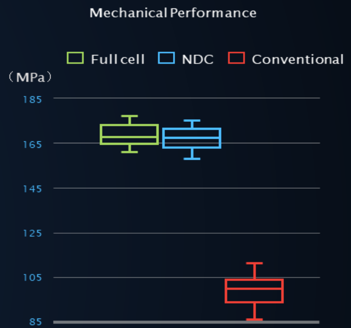
Static load
+2400Pa/-2400Pa

Fixed tilt **Tracker**

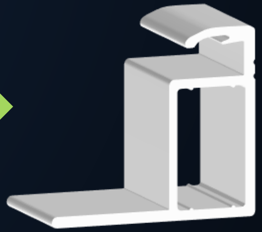


Vertex non-destructive cutting cell

Conventional cutting cell



Conventional module structure

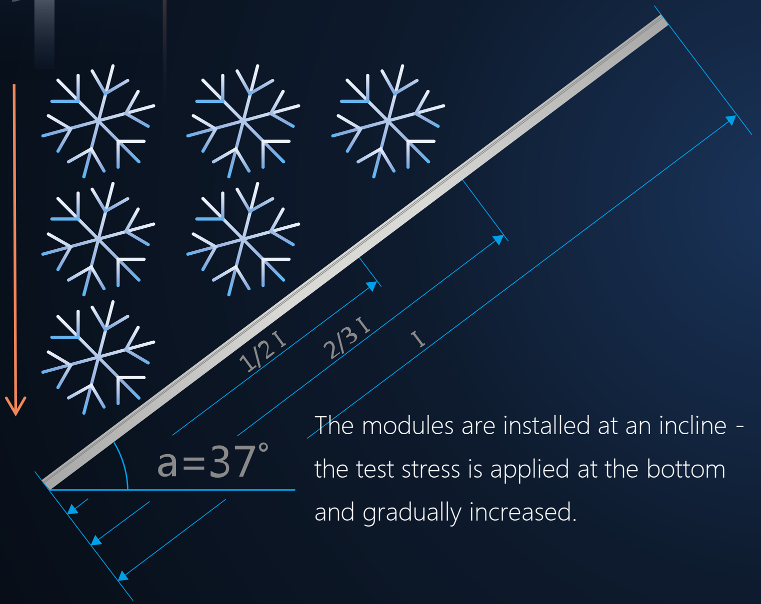


670W Vertex module structure

Non-uniform Snow Load Tests

2.8M Snow Load Endurance

1



The modules are installed at an incline - the test stress is applied at the bottom and gradually increased.

7000Pa, 2.8 m of snow

Post testing, power degradation is only 0.56%.

*Test modules： 210-670 bifacial and dual-glass modules, clamping installation

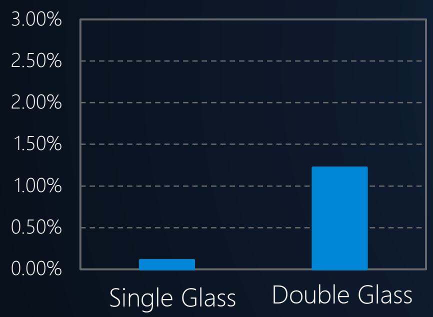
Static Load Test Under -40℃

Enhanced Mechanical Load Characteristics

2

Mechanical load test under (-40℃): Working in extreme low-temperature environments is one of the critical situations, which can result in reduced mechanical performance/damage.

Power degradation after test

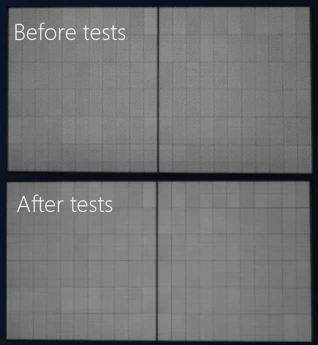


-40℃

+5400Pa
- 2400Pa

PASS

EL Image



Dependable in extreme low-temperatures

*Vertex 670 single and dual glass modules with cross-beam screw installation: static load criteria +5400Pa/-2400Pa

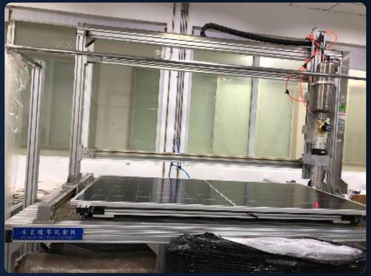
Hail Impact

35mm Hail Impact Resistance

Simulated impact of different sized hail on module output.

Trina test size

IEC test size



Single glass—— hail test

IEC standard		Trina test results		Tests passed
Hail size	Power degradation	Hail size	Power degradation	
25mm	< 3%	35mm	0.17%	

Dual glass —— hail test

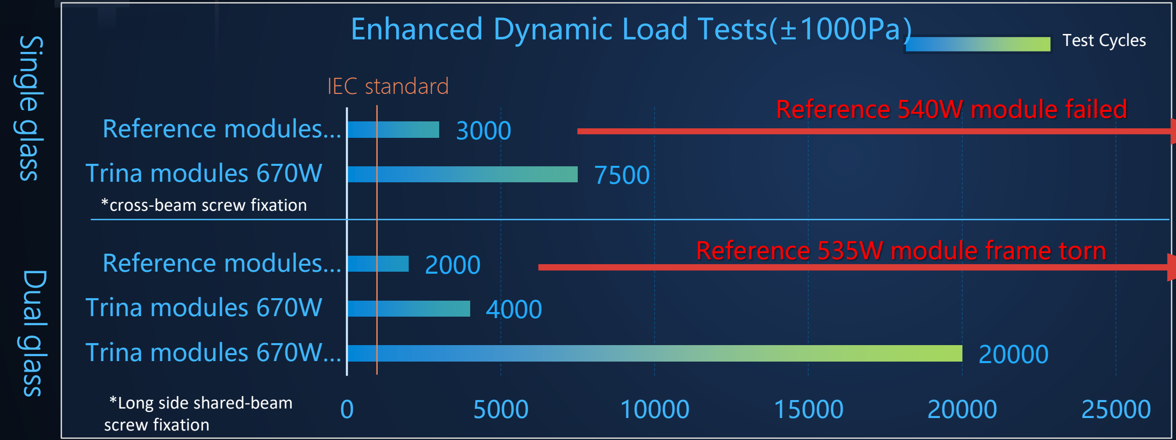
IEC standard		Trina test results		Tests passed
Hail size	Power degradation	Hail size	Power degradation	
25mm	< 3%	35mm	0.53%	

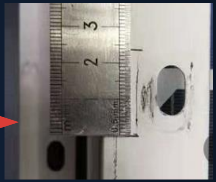
Enhanced Dynamic Load Test

±1000PA **@20000** Cycles Passed

During their lifecycle, modules endure long-term dynamic stresses on their upper and back sides. The frame, cells and BoS are subjected to fatigue stress which can be simulated by dynamic load testing.

"IEC62782: DML±1000Pa: positive and negative cycles 3~7 time/min，5.6h/1000times"




Screw hole partially deformed


Vertex module is pass

Test results: after 1000Pa dynamic load in 20,000 cycles, - power degradation was only 0.1%.

7.5 times IEC standard
Single glass module

4 times standard
Dual glass module

20 times (clamping) strength than standard

Note: National Key Laboratory for PV Science and Technology

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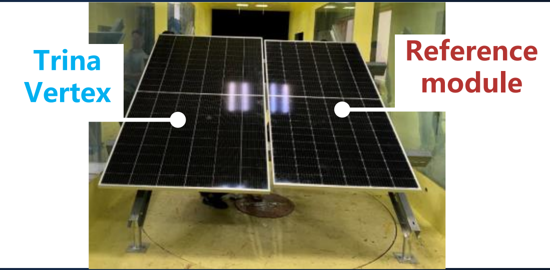
5

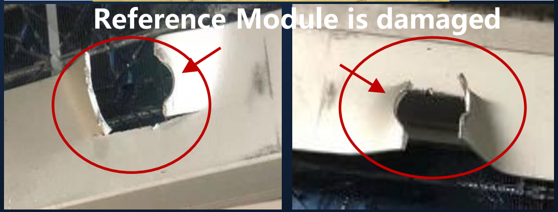
Wind Tunnel Test

62m/s Extreme Wind Performance

Wind tunnel test: One of the best methods to verify mechanical stability. Wind loads applied from 30m/s to 62m/s, each lasting 30 second. Once target wind speed is achieved and stabilized, test is maintained for 900 seconds.

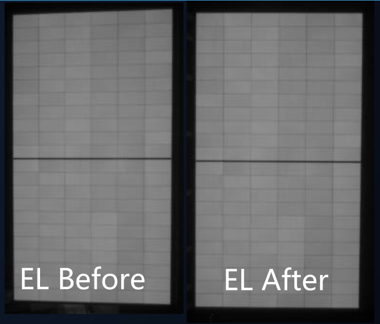
Wind speed (m/s)	Reference modules(530W)	Trina Vertex modules(670W)
30.53	Slight vibration.	Slight vibration.
45.80		The surface of the module distorts in the middle; severe vibration
59.54	Mounting failed with module under test blown away	
62.60	/	Under highest wind speed the module experiences damage





Vertex 53m/s wind test:

	30° tilt	45° tilt
Screw	Pass	Pass
Hybrid	Pass	Pass



Robustness of Vertex module outperforms reference module

Installation Tips

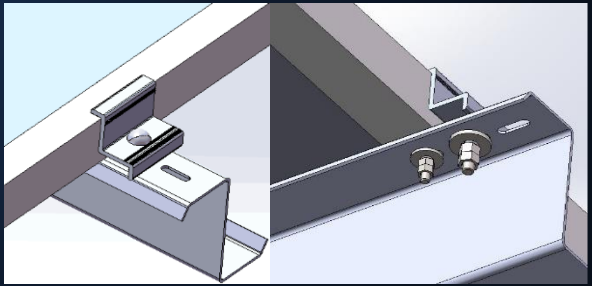
The Installation Method Strongly Impacts System Stability.

Enhanced Installations >

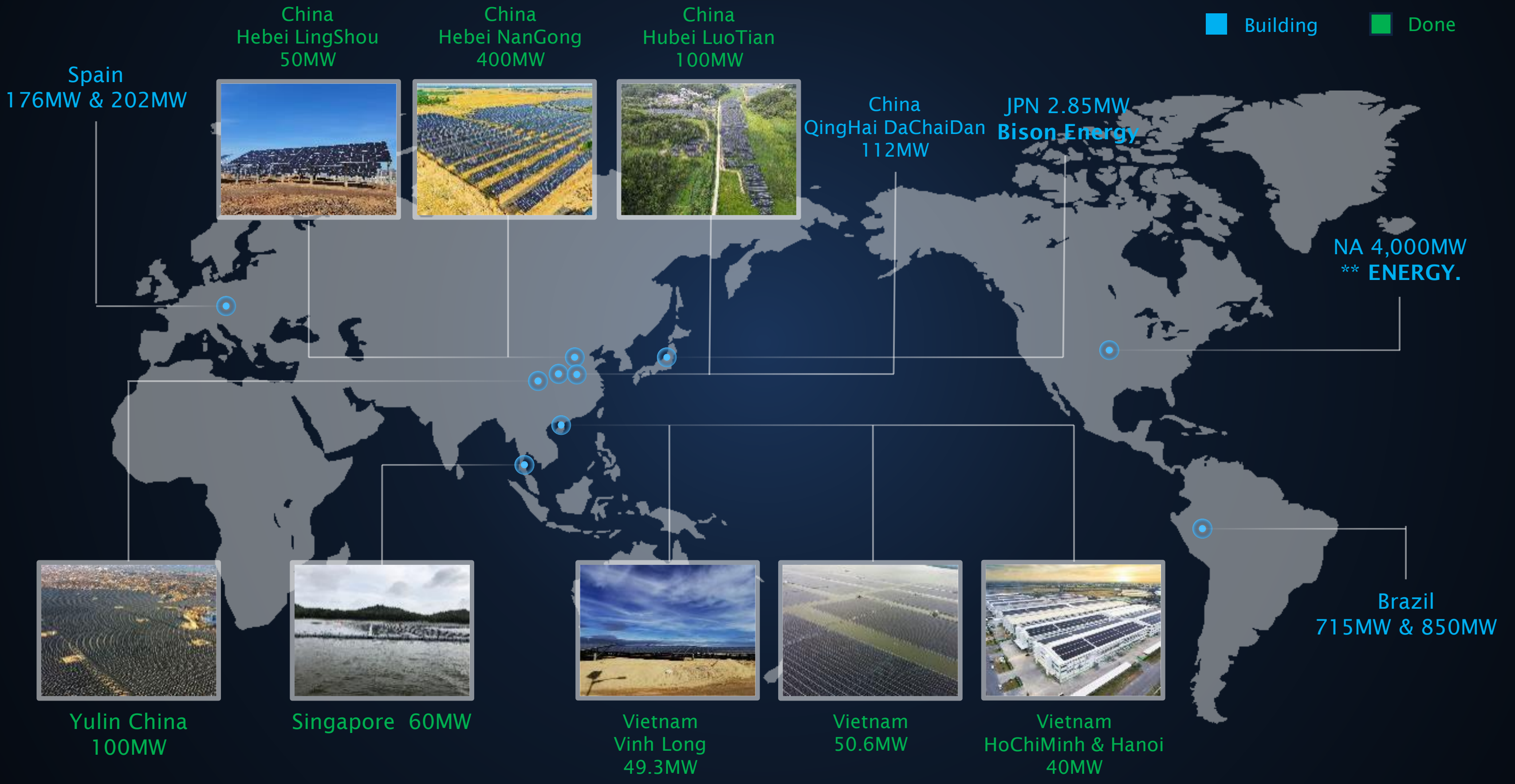
To optimize for extreme weather such as heavy snow or strong winds Trina Solar recommends hybrid installation methods to ensure better system stability

Hybrid Fixation

Clamp + Bolt



210 Vertex modules: over 18GW of signed orders

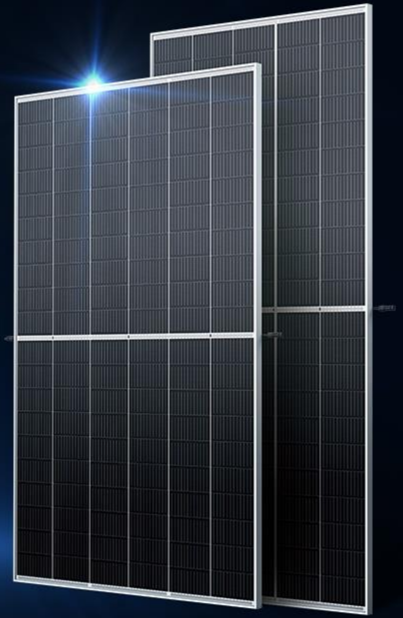


SUMMARY

1. The Vertex 670W module achieves outstanding mechanical load performance.

2. Verified in enhanced tests for extreme weather conditions such as strong wind, heavy snow, extreme cold and hail.

3. The installation method strongly impacts system stability. Hybrid fixation is recommended for extreme weather conditions.



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THANKS!

Vertex