

SOLAR POWER AFRICA

Global Solar Technology Advancements

Lourens Vermaak

16 February 2022

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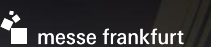
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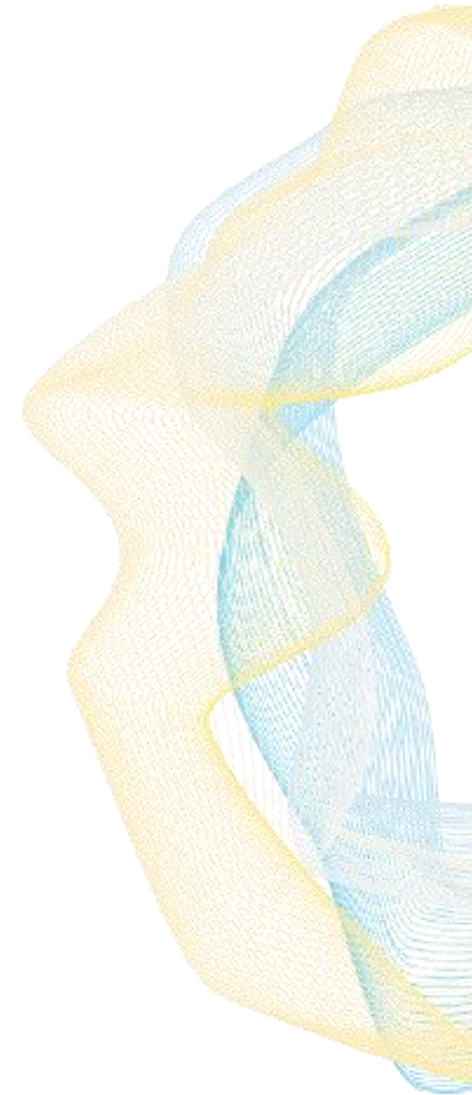
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- 01 Where we came from
- 02 Various Technology
- 03 What are the advantages



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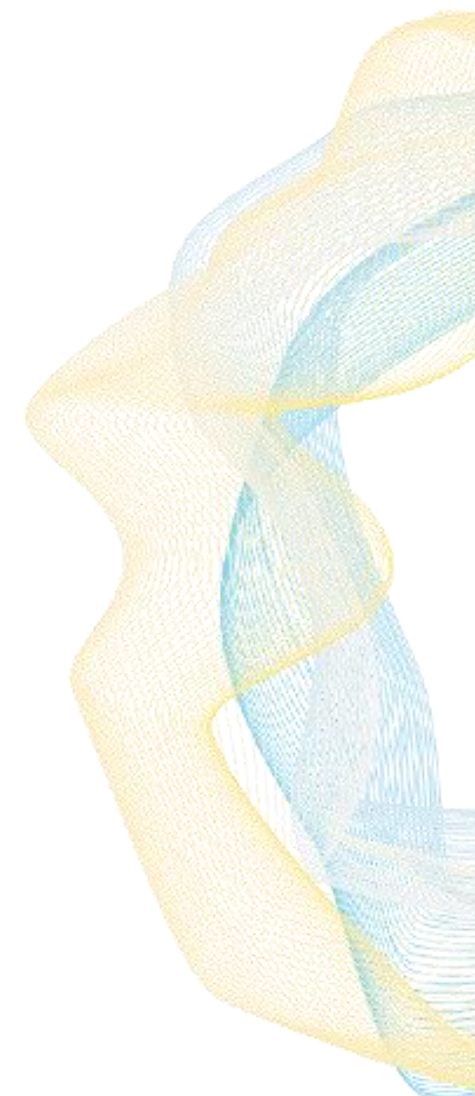
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01 Where we came from



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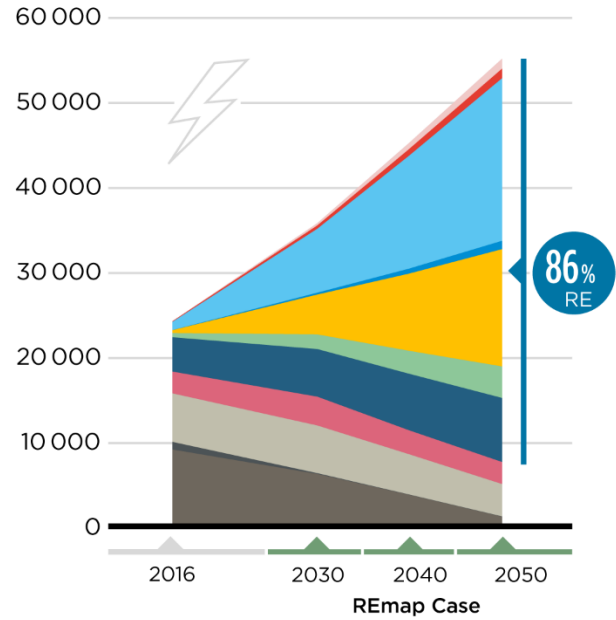


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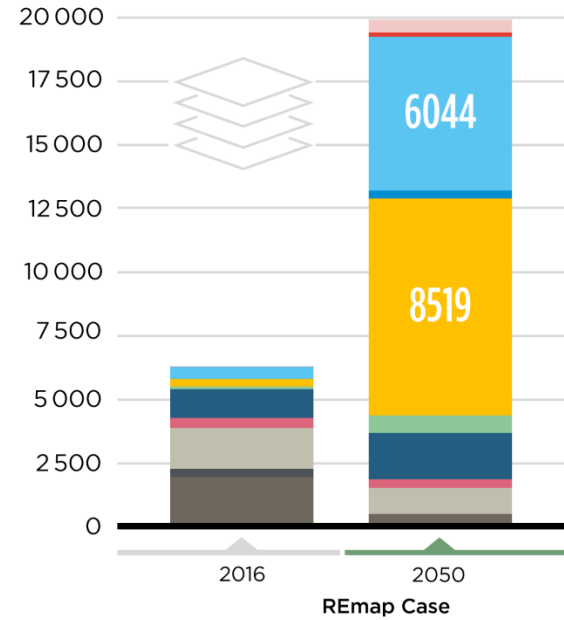


Where we came from – Global Renewable Energy Trend

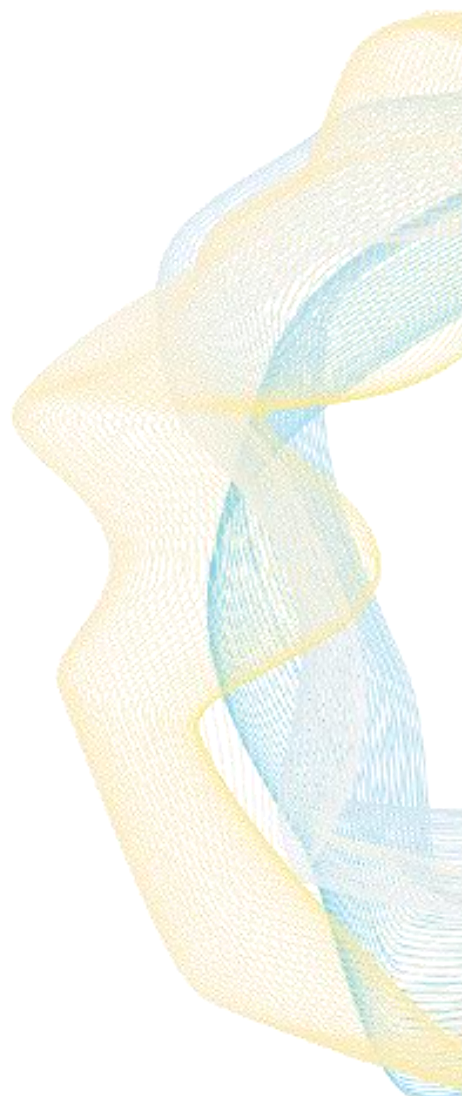
Electricity generation (TWh/yr)



Total installed power capacity (GW)



- Coal
- Oil
- Natural gas
- Nuclear
- Hydro (excl. pumped)
- Bioenergy
- Solar PV
- CSP
- Wind (onshore and offshore)
- Geothermal
- Others (incl. marine)



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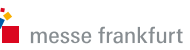
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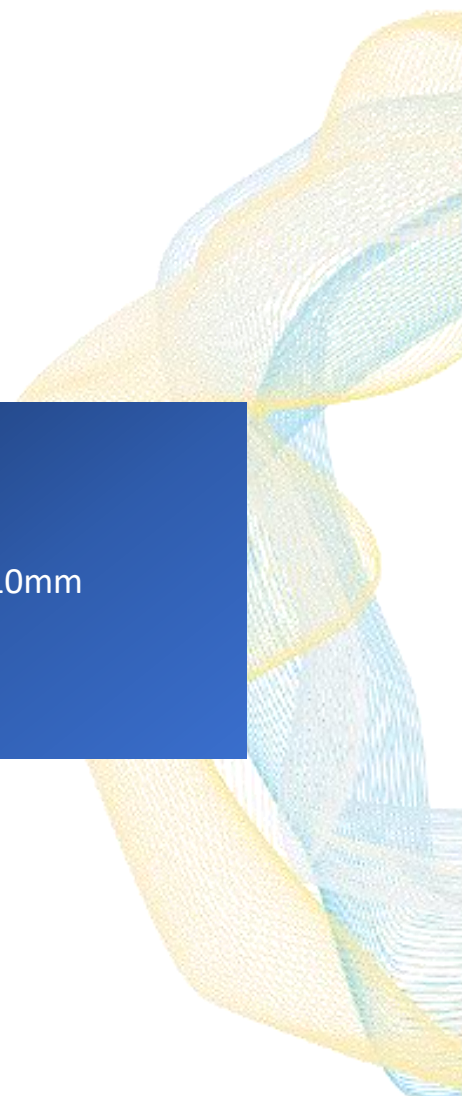
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Where we came from – Solar Cell Sizes



156.75mm

158mm

166mm

182mm

210mm

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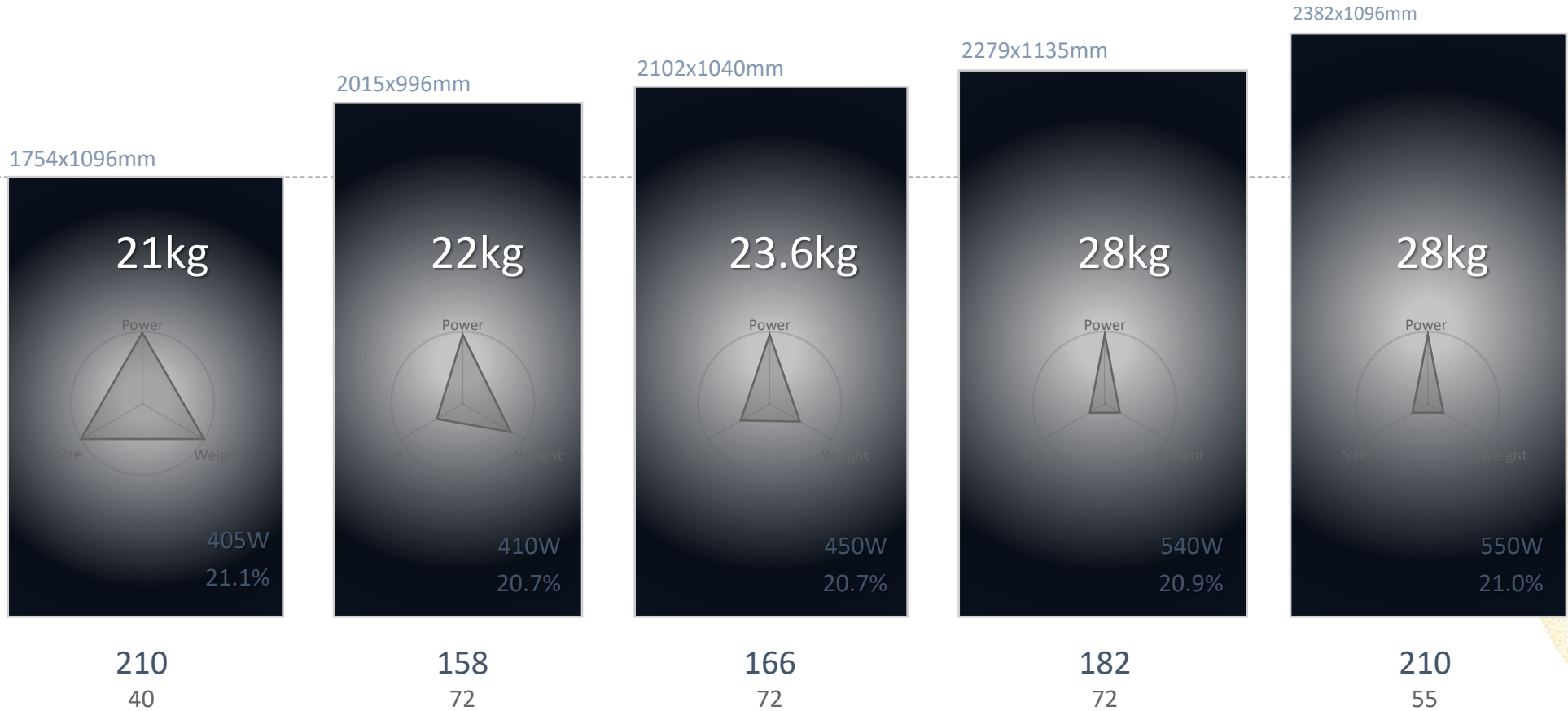
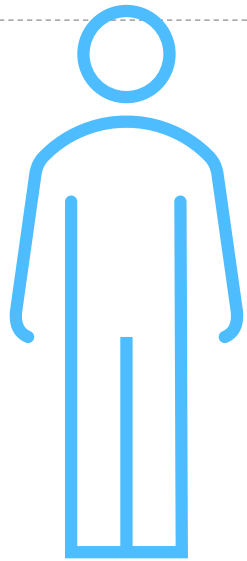
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Where we came from – PV Module Sizes



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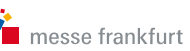
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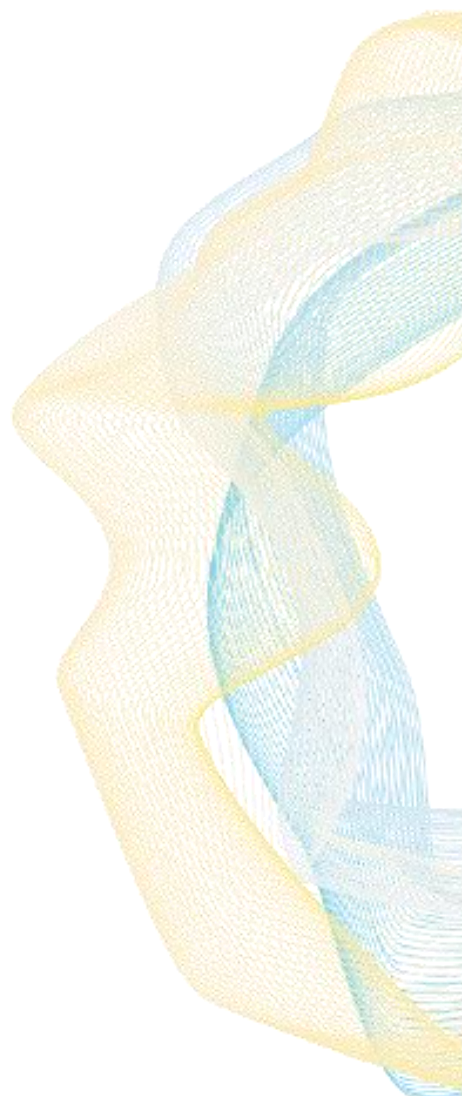
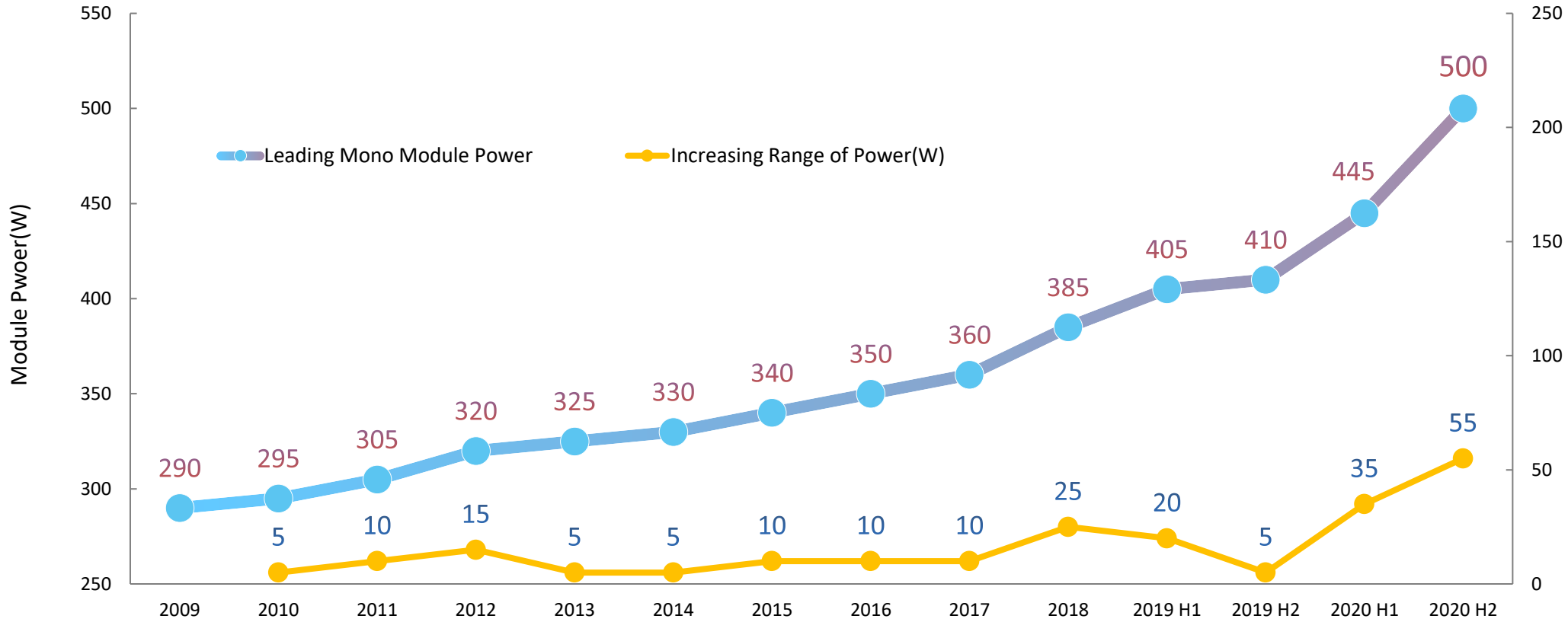
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- Where we came from – Power Trends



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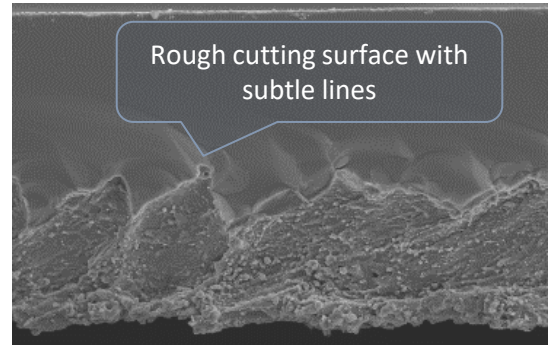
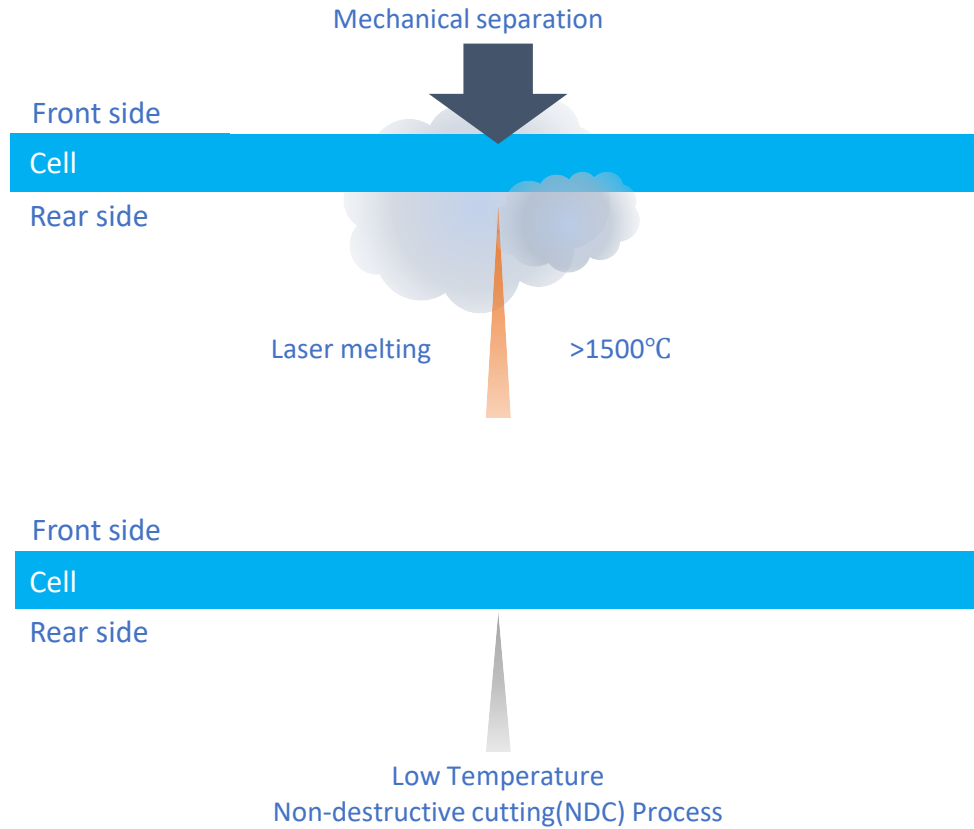
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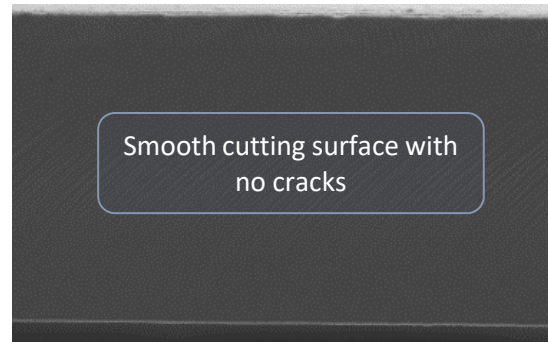
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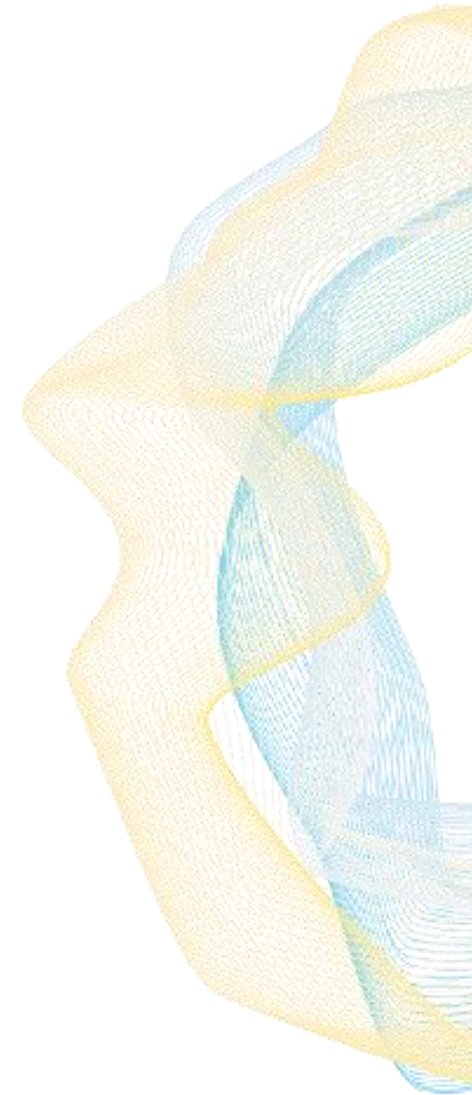
- Where we came from – Wafer Separation



Section after traditional cutting



Section after Non-destructive cutting



- Where we came from – Semiconductors and Busbars

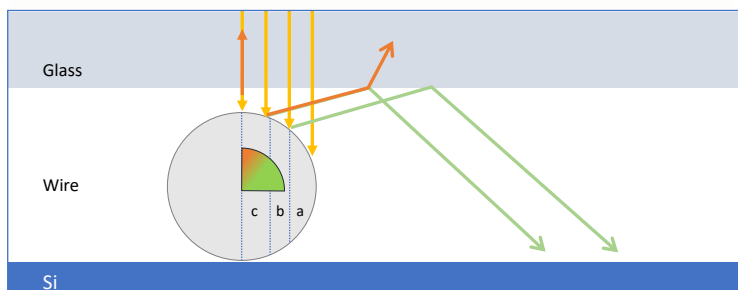
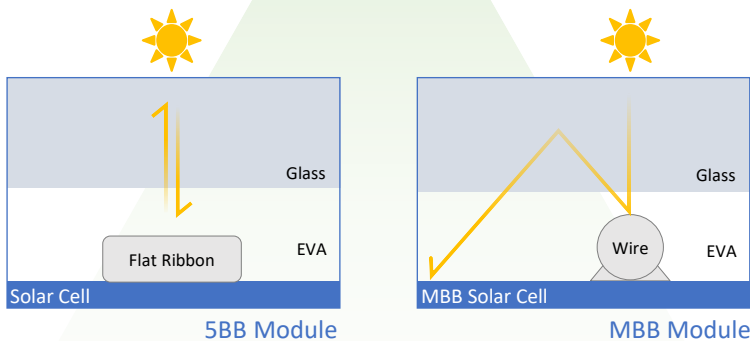
Module efficiency improvement

0.4%~0.6%

Optical performance

Power improvement

1%~1.5%



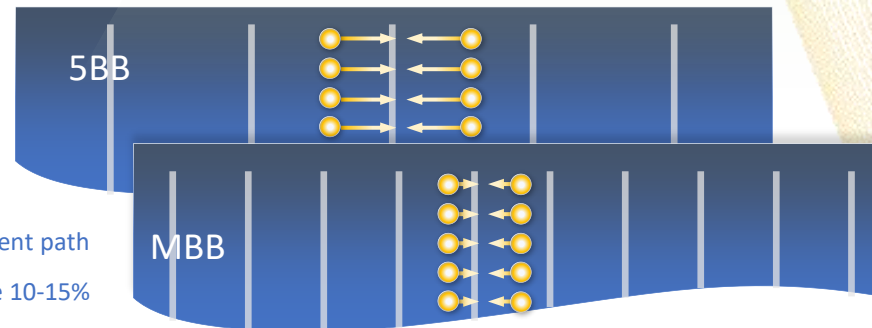
- Shading reduction
- Light trapping effect

- Shorter current path
- Lower Series Resistance 10-15%

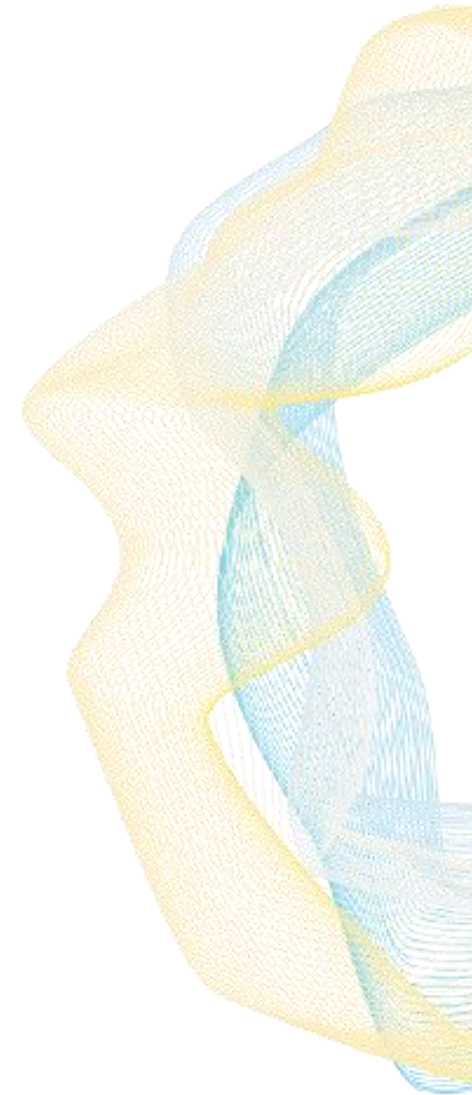
Electrical performance

Power improvement

1%~1.5%



02 Various Technology



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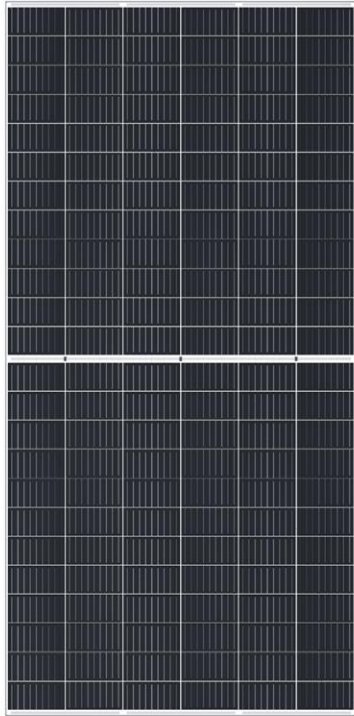
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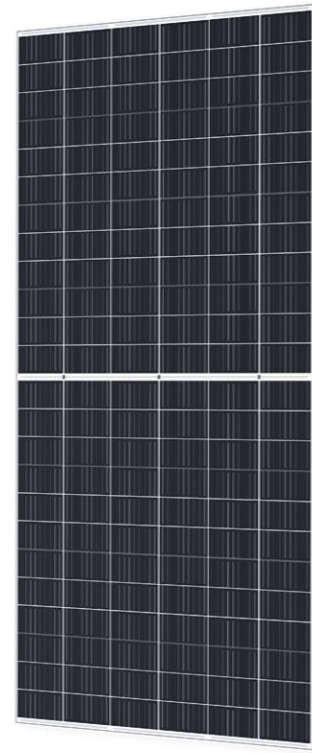
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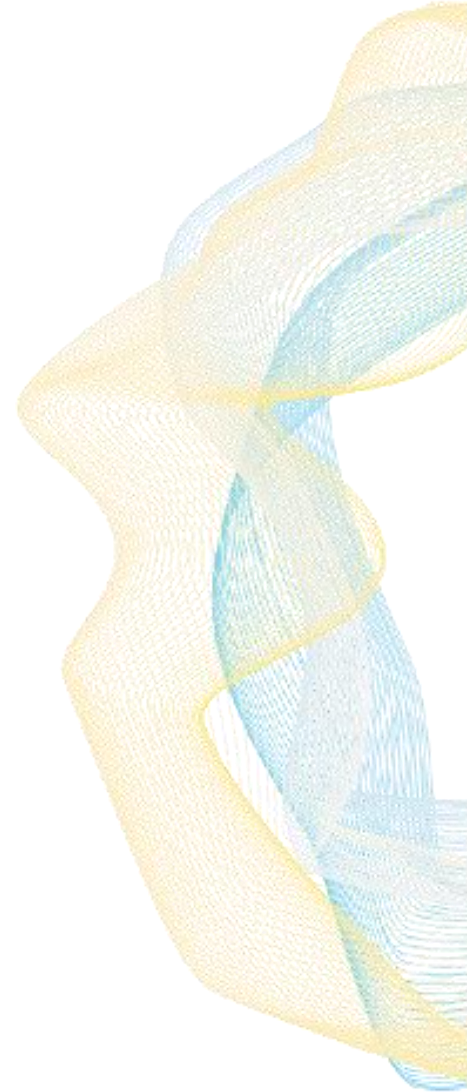
- Various Technology



Mono Facial PV Module



Bi-Facial PV Module



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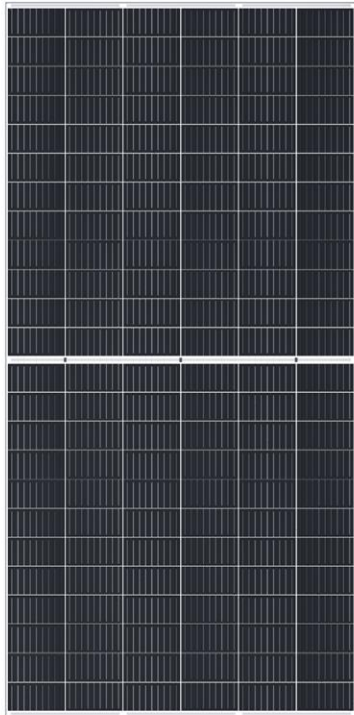
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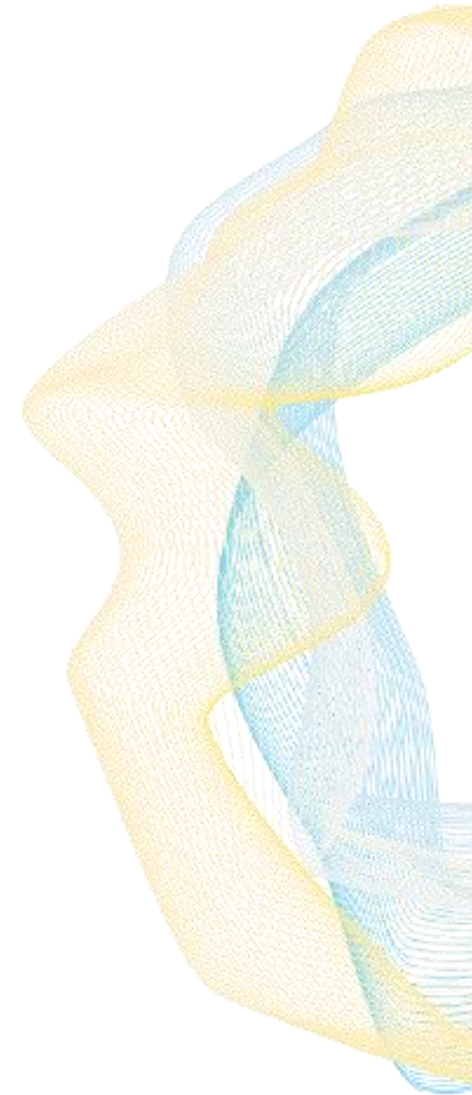


- Various Technology – Mono Facial



Mono Facial PV Module

- Characteristics
 - 2.1m to 2.4m in length
 - 1.1m to 1.4m in width
 - 30mm to 40mm in thickness
 - 28kg to 31kg in weight
- Construction
 - Glass
 - EVA
 - Solar Cells
 - Backsheet
- Powerbins
 - 450watt to 680Watt

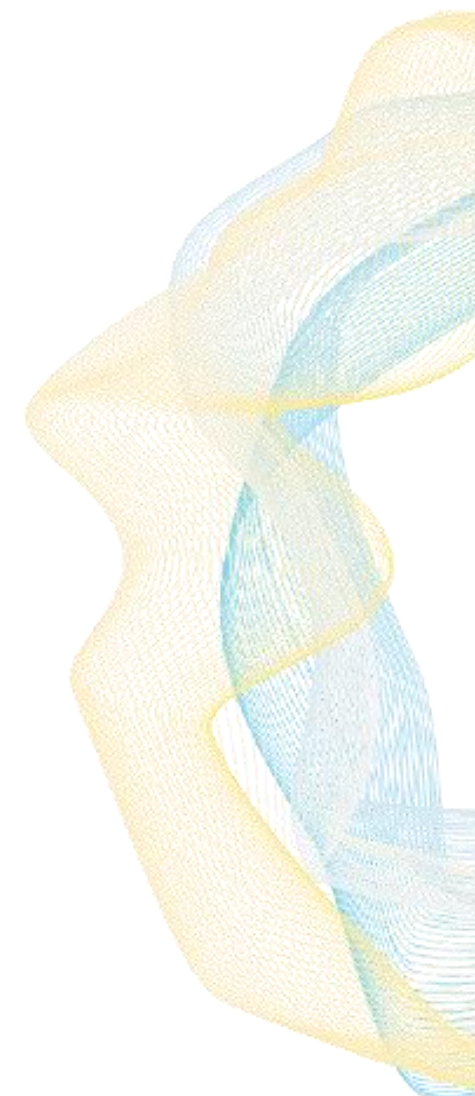


- Various Technology - Bifacial



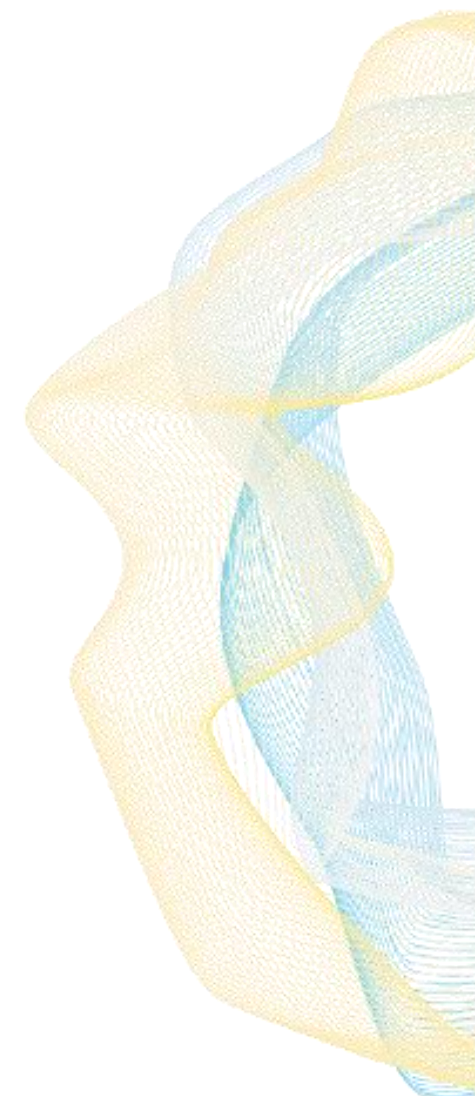
Bi-Facial PV Module

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- Construction
 - Glass
 - EVA
 - Solar Cells
 - EVA
 - Glass
- Powerbins
 - 450watt to 680Watt



03

What are the advantages



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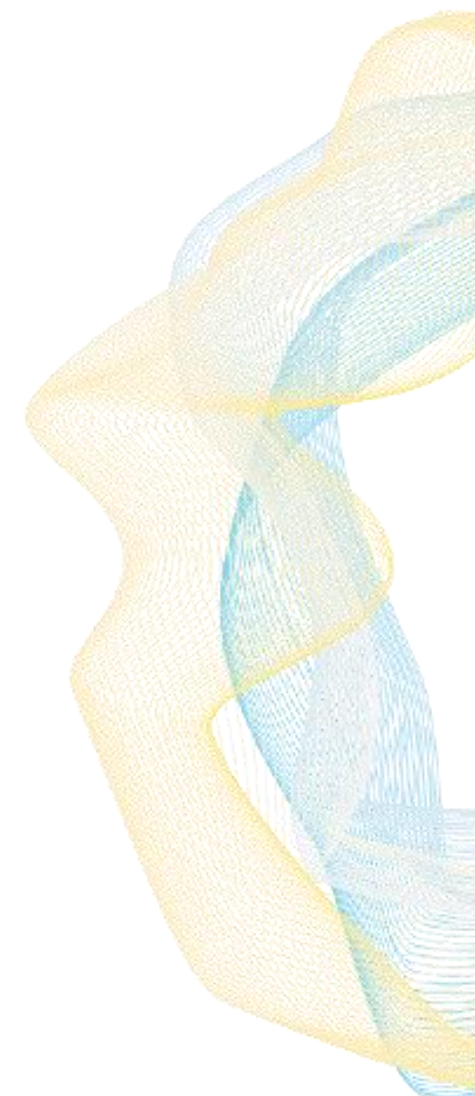


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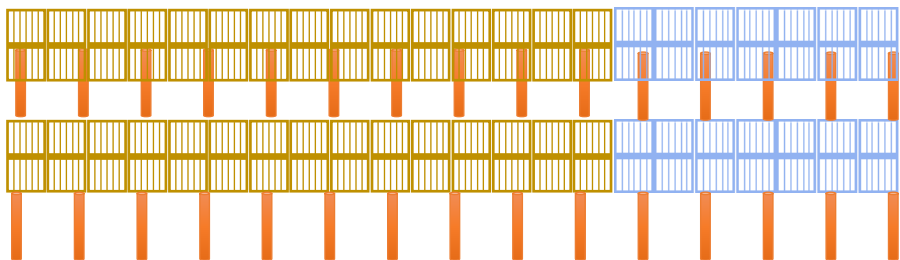
- What are the advantages – Reduction in BOS

	450W	535W	545W	585W	600W	660W
System DC power	50 MW _{DC}					
Number of modules	110880	93264	91656	85176	83232	75516
Power per 40HC container (kW)	356	332	338	290	329	368
Pitch (m)	5,28	5,64	5,96	6,03	5,43	5,96
Number of inverters	12					
System AC power	43,166 MW _{AC}					
Modules per string	28	29	38	26	34	31
Number of strings	3960	3216	2412	3276	2448	2436
DC cable length (m)	270.861	217.252	166.040	209.255	165.313	163.592
Strings per tracker	4	4	3	4	3	3
Number of trackers	992	805	804	821	817	814
Total beam length (m)	57990 m	52834 m	50227 m	48295 m	54226 m	49199 m

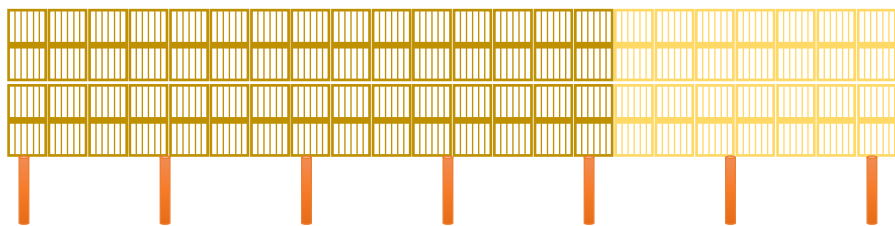


- What are the advantages – Tracker configuration

1P tracker X 2 Row (Typical Row Length: Up-to 72m)



2P tracker (Maximum length: 68m)



210mm Wafer 655Watt

51 Module Per Row
66.81 kW/Tracker
Table length: 68 mtr/row

182mm Wafer 575Watt

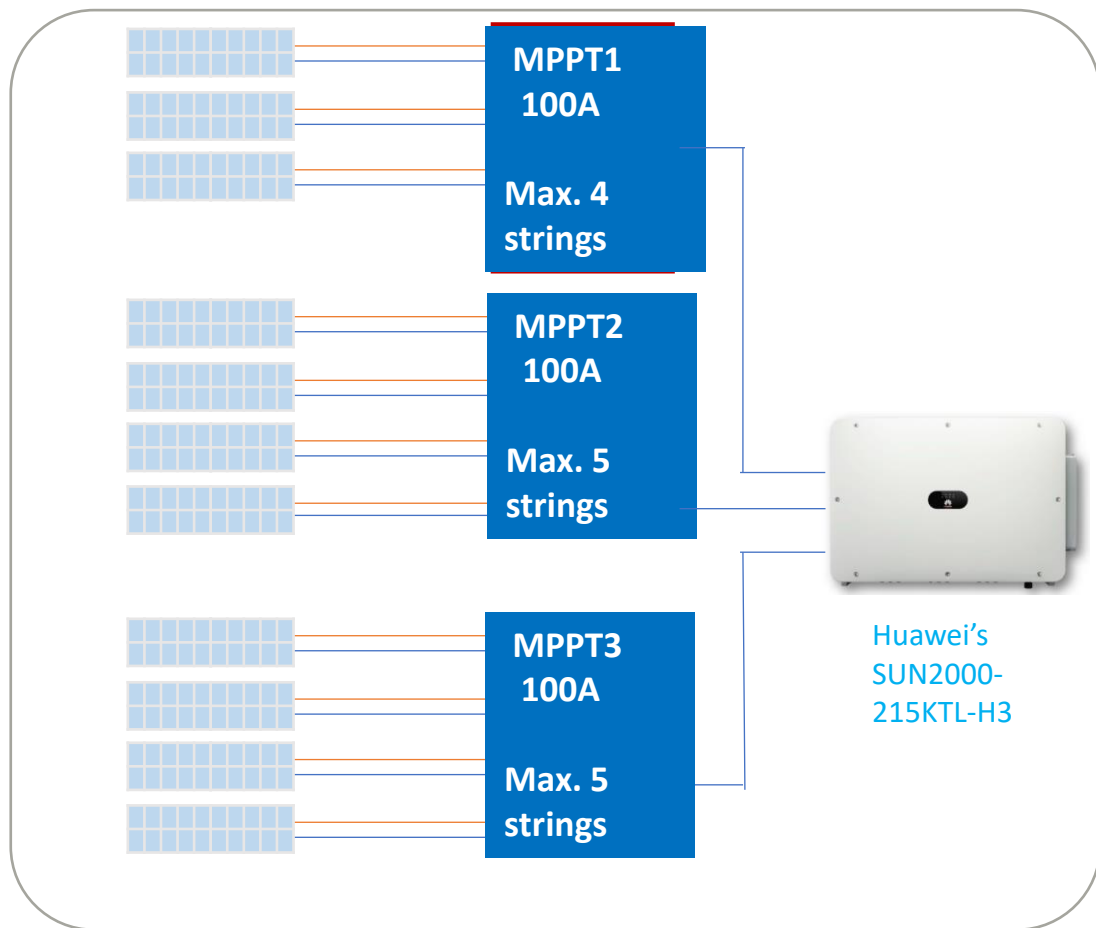
54 Module Per Row
62.10 kW/Tracker
Table length: 60 mtr/row

3 Strings Per Tracker (3*34)
66.81 kW/Tracker
Table Length: ~68 mtr

4 Strings Per TRK (4*27)
62.10 kW/Tracker
Table Length: ~60 mtr

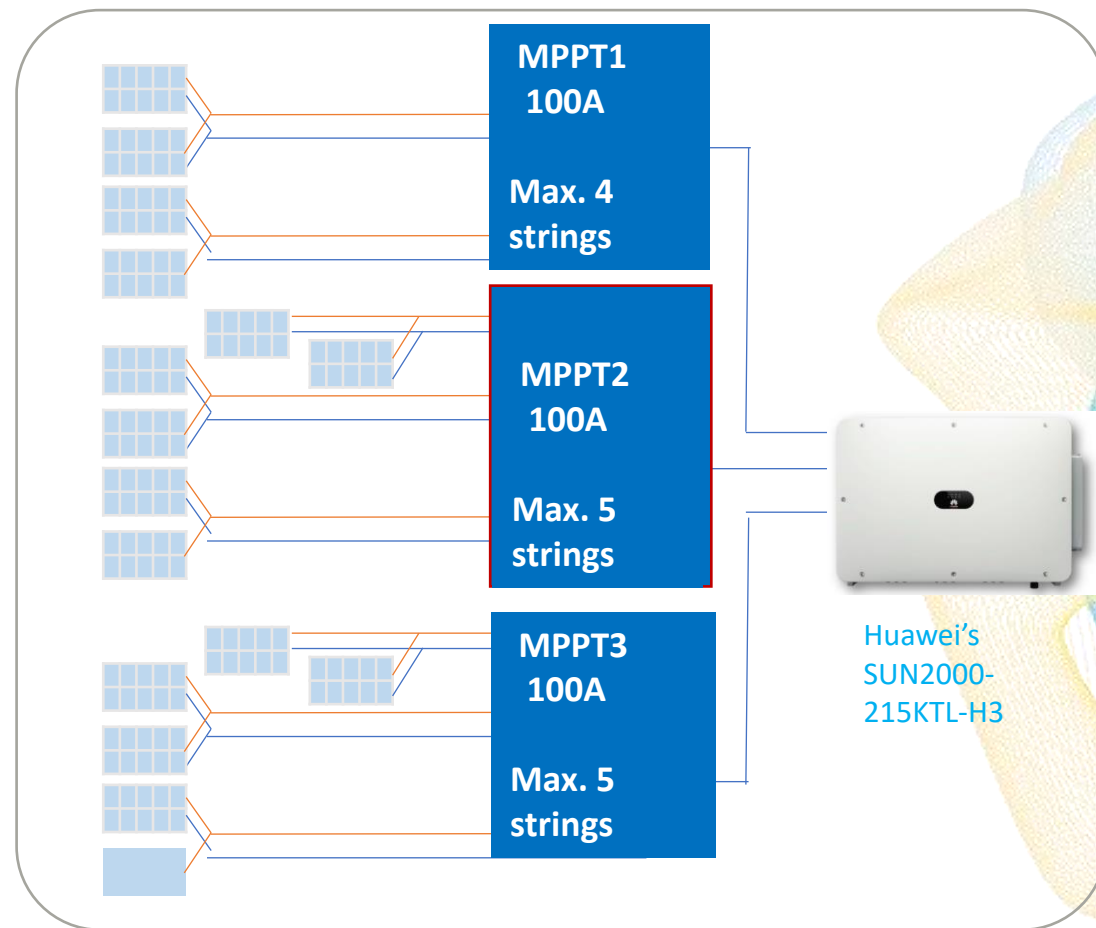
- What are the advantages – More Power String

210mm solar Cell



Total power: 244.97kW, 1.25x, 11 strings

182mm Solar Cell



Total power: 244.4kW, 1.25x, 16 strings

- What are the advantages – LCoE Reduction

$$LCOE = \frac{\text{Total cost}}{\text{Total power generation}} = \frac{\text{Initial investment} + \text{total O\&M cost} + \text{other costs} - \text{system residual}}{\text{Total power generation}}$$

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

Module power generation per watt



High Power



High Reliability



Lower Cost



Reduce LCOE



High Power Generation

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