



Innovation Changes The World

Sunport Power



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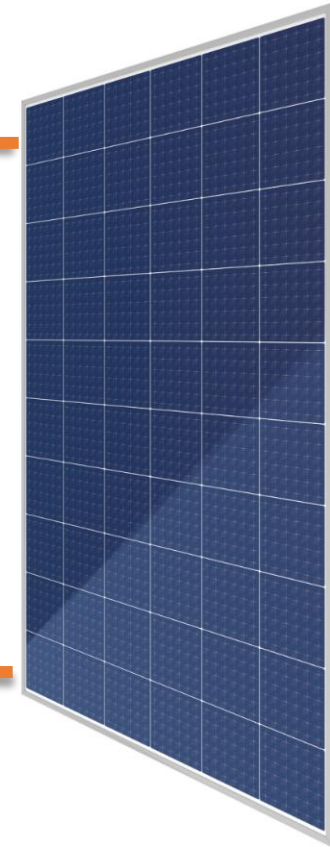
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01

About Us

The First Manufacturer for MWT PV
Modules on GW Scale



The World's **First** Manufacturer on GW Scale for MWT PV Modules.

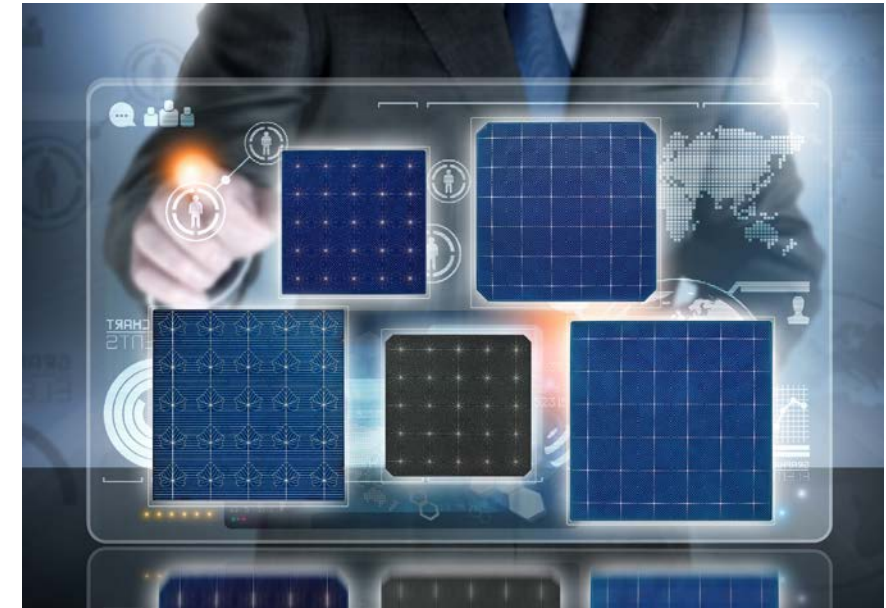
FULL SOCRE PV modules for TOP RUNNER project.

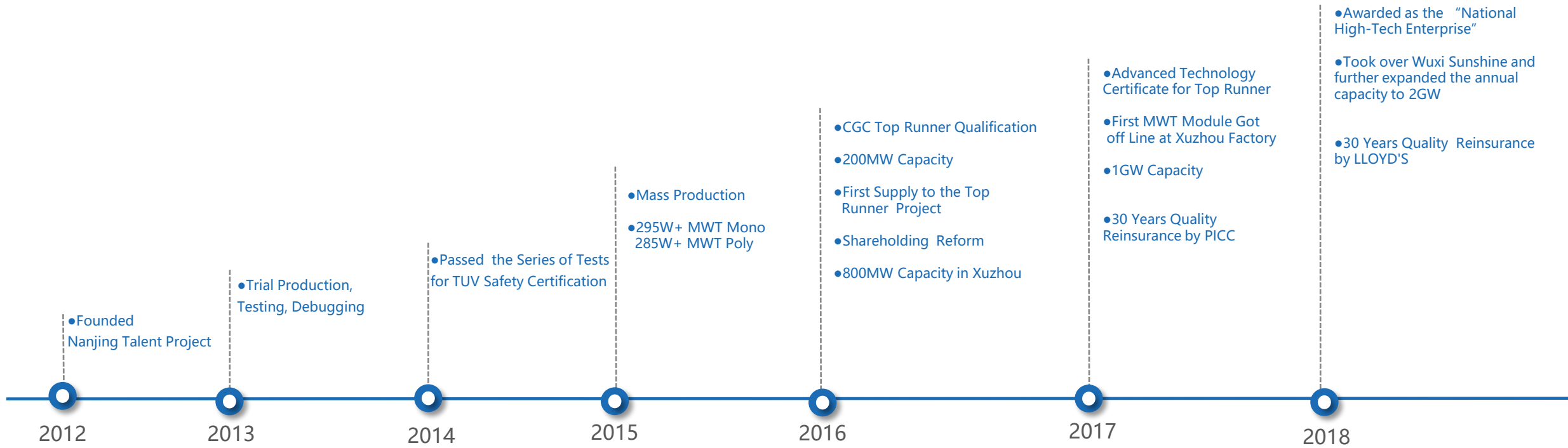
Obtained more than **100** domestic and foreign patents

Sunport Power Corp., Ltd. is located in Nanjing, China and is dedicated to the development and production of solar cells and modules with high efficiency and reliable performance. The company is founded by Dr. Fengming Zhang and his team. Dr Zhang is the leading solar physicist (nominated by the Central Governmental Recruitment Program of Global Outstanding Experts), professor and doctoral supervisor at Nanjing University.

Sunport Power has successfully developed and patented high efficient solar cells and modules based on next generation MWT (metal wrap through) technology with GW-scale production capacity. The benefits of MWT have improved and empowered all kinds of solar powered installations, solar farms and distributed generation projects.

With collaborations upstream and downstream, and the collaboration with domestic and foreign research institutions and universities, Sunport Power contributes to international friendship, innovation and a healthy development of the PV industry.



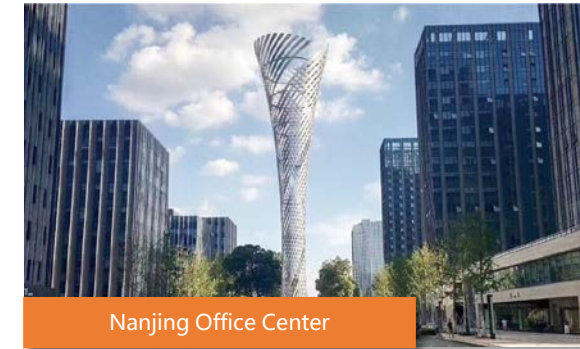
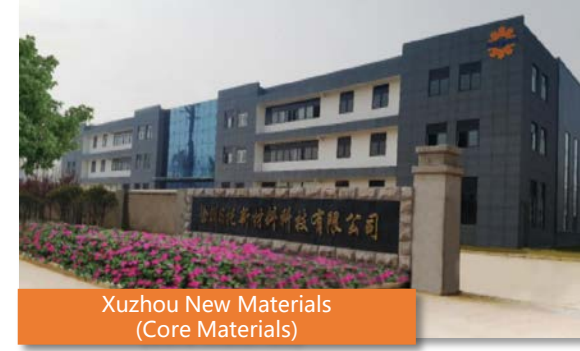


We' re lucky to participate in the historic transformation of science&technology and witness to this dynamic era.



The World's First Manufacturer on GW Scale for MWT PV Modules.

Sunport Power has three industrial bases in Nanjing, Xuzhou and Wuxi, covering solar cells, back sheets and PV modules. At present, the production capacity of high-efficiency MWT solar cells and modules are both 1.4GW, forming a complete industry chain of high-efficiency MWT PV modules.



Now that Prof. Martin Green has become the Chief Scientist of Sunport Power, we will promote the rapid development of the upgrade for high-efficiency products, with the joint efforts of Prof. Martin Green and our team of doctors.



Chief Scientist Martin Green

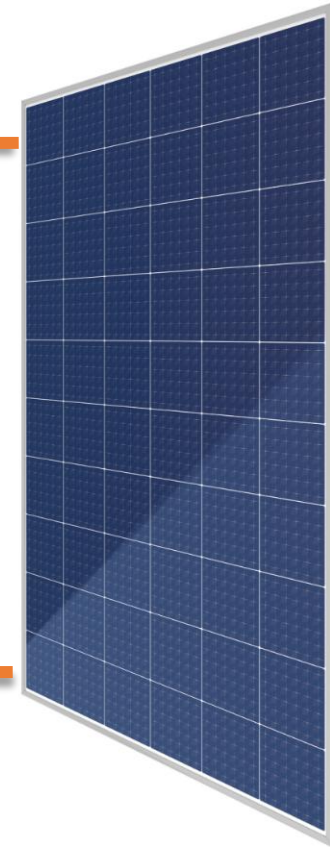
Professor of University of New South Wales,
Executive Research Director of the Center for
Ultra-Efficient Optoelectronics,
A Fellow of Australian Academy of Science.



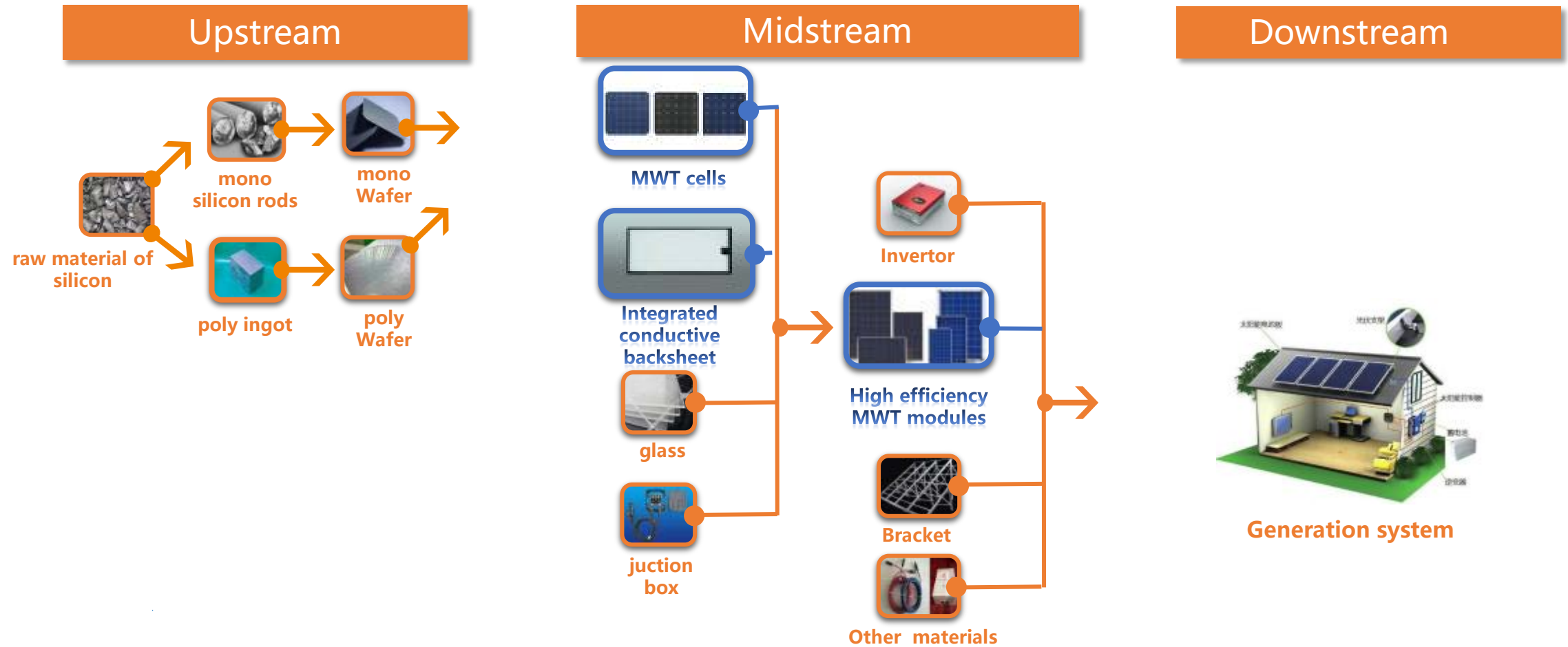
02

Technology & Products

Industrial TOP Efficiency & MWT Tech



Industry Division

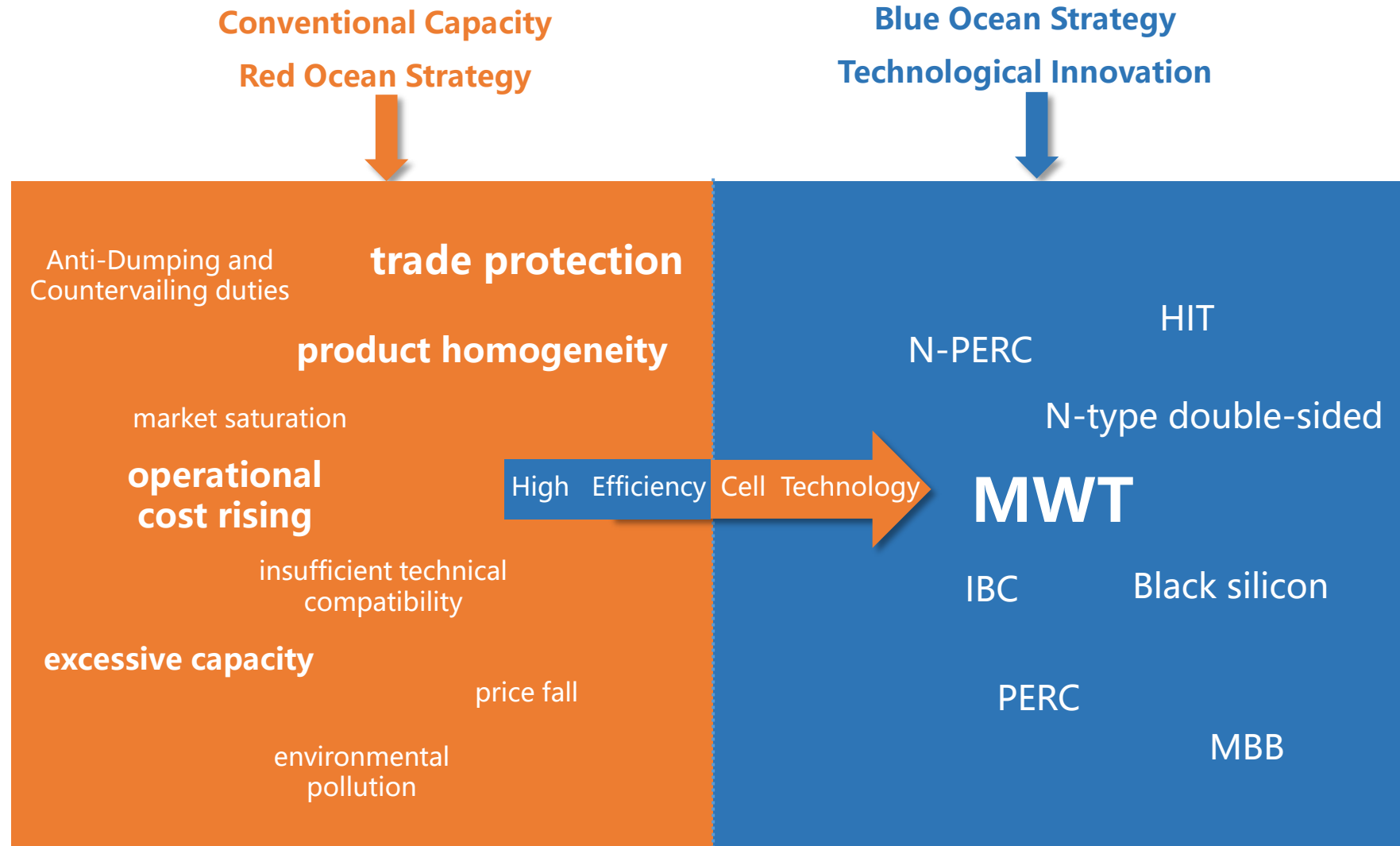


Upstream is the production of silicon raw materials, rod or ingot, and wafer.

Midstream is the production of photovoltaic modules etc.

Downstream industry is the construction of solar power generation system.

Development Status of Silicon Cell Technology



Current Status of Crystalline Silicon PV Technology

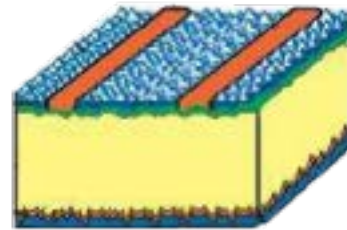
H – Pattern (p-type) (including both BSF and PERC)

Conventional Aluminum Back Field Cells

Overcapacity, low technology threshold
(Average: mono- 20.4%, poly-18.8%)

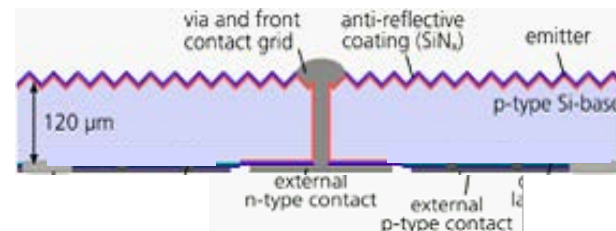
PERC Cells

Good compatibility with conventional
cells' equipment(Average: mono-21.6% ,
poly-19.4%)

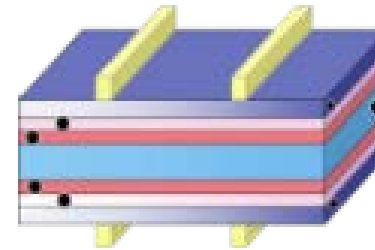


MWT (p-type or n-type)

Good compatibility with
conventional cells ' equipment
and processing (Average:
mono-22.4% , poly-20.8%)



HIT (n-type)



Only a few manufacturers achieve
industrialization, poor
compatibility with conventional
cells' equipment, high technical
threshold, complex process and
high cost (Average: mono-22.8%)

IBC (n-type)



Only a few manufacturers achieve
industrialization, poor
compatibility with conventional
cells' equipment, high technical
threshold, complex process and
high cost (mono- 23%)



High Efficiency MWT Technology Metal Wrap Through

Metal Wrap Through (MWT) is a new cell technology to increase the conversion efficiency by reducing the BUSBAR-shaded area on the front side, with positive and negative electrodes on the same rear side.

Manufacturing Steps:

1. Design and drill the holes that go through cells.
2. Fill with conductive paste to direct the electrode from the front to the rear side via drilled holes.
3. Isolate the back field.

As both the positive and negative electrodes are on the rear side of the cells, it's named as MWT Rear-Contact solar cell.



	PERC	HIT/IBC	MWT
Technical Difficulty	★★	★★★★	★★★★☆
Equipment Investment	★★★	★★★★	★★★★☆
Productin Cost	★★	★★★★	★★
Conversion Efficiency	★★☆	★★★★☆	★★★★

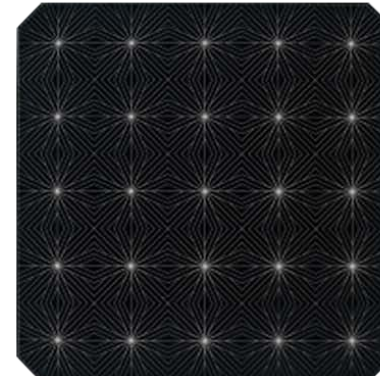
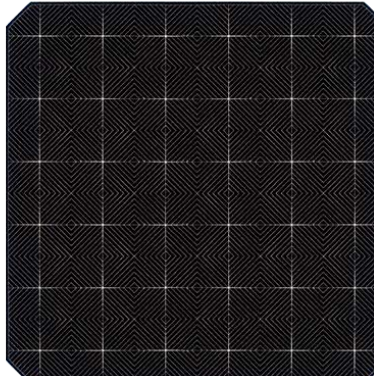
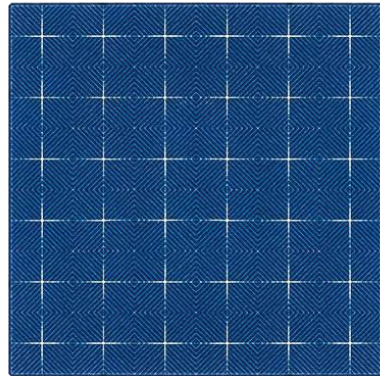
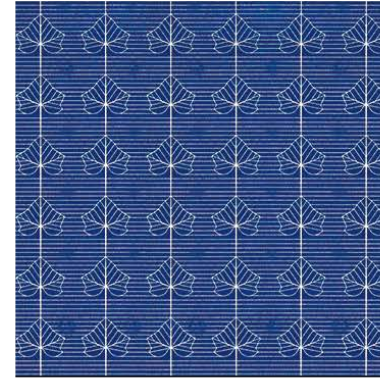
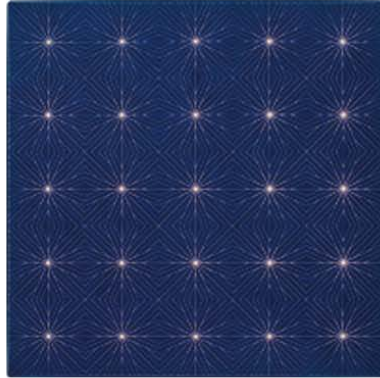
MWT is the most cost-efficient path .

whatsmore, **MWT+** can be compatible with almost all the other technonoly. Thus it shall be considered as the most promising technology in the crystal silicon industry.



High-efficiency MWT Solar Cells

Customized Graphics Design on MWT Cells

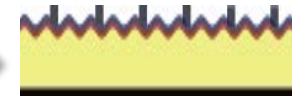


MWT PV modules

Conventional MBB Modules



Positive and negative electrodes both on the back side of the cell.



The positive and negative electrodes are located on the front and back of the cell.



No Busbar on the cell surface, which increases the light area and reduces the use of silver.



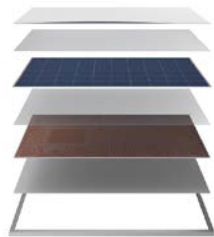
Positive and negative electrodes connected in series through welding the busbars on the front side of the cell, which covers the cell surface and consumes silver paste.



By replacing the interconnection strip with conductive foil the series resistance of MWT modules is lower and the encapsulating loss is less.



The stress of high temperature welding and the hidden crack of bad welding cannot be avoided



With encapsulating technology alike semiconductor, MWT modules is more reliable on performance and higher on output power.



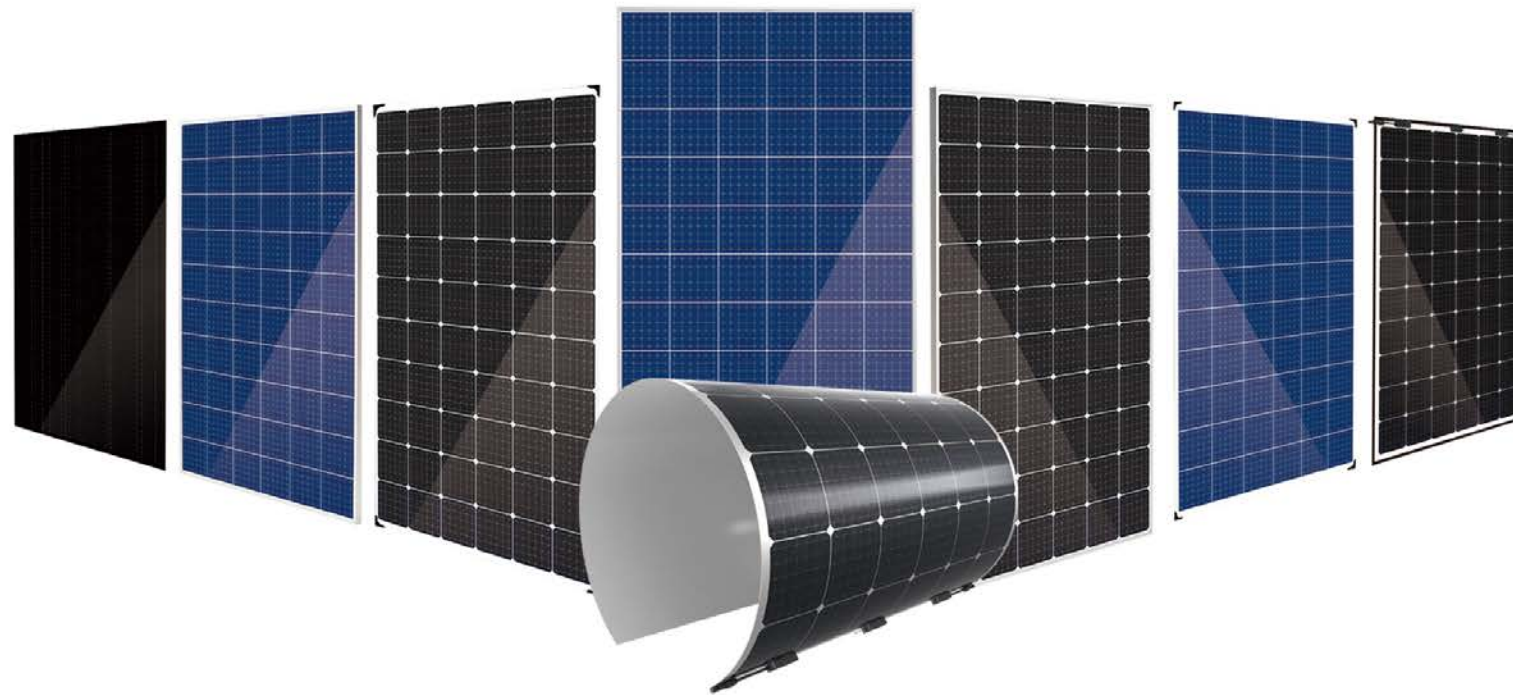
For conventional modules, cells are connected by welding belt and then then pass through the high temperature laminating machine.



High-Efficiency PV modules

TOP RUNNER Performance for 30 Years

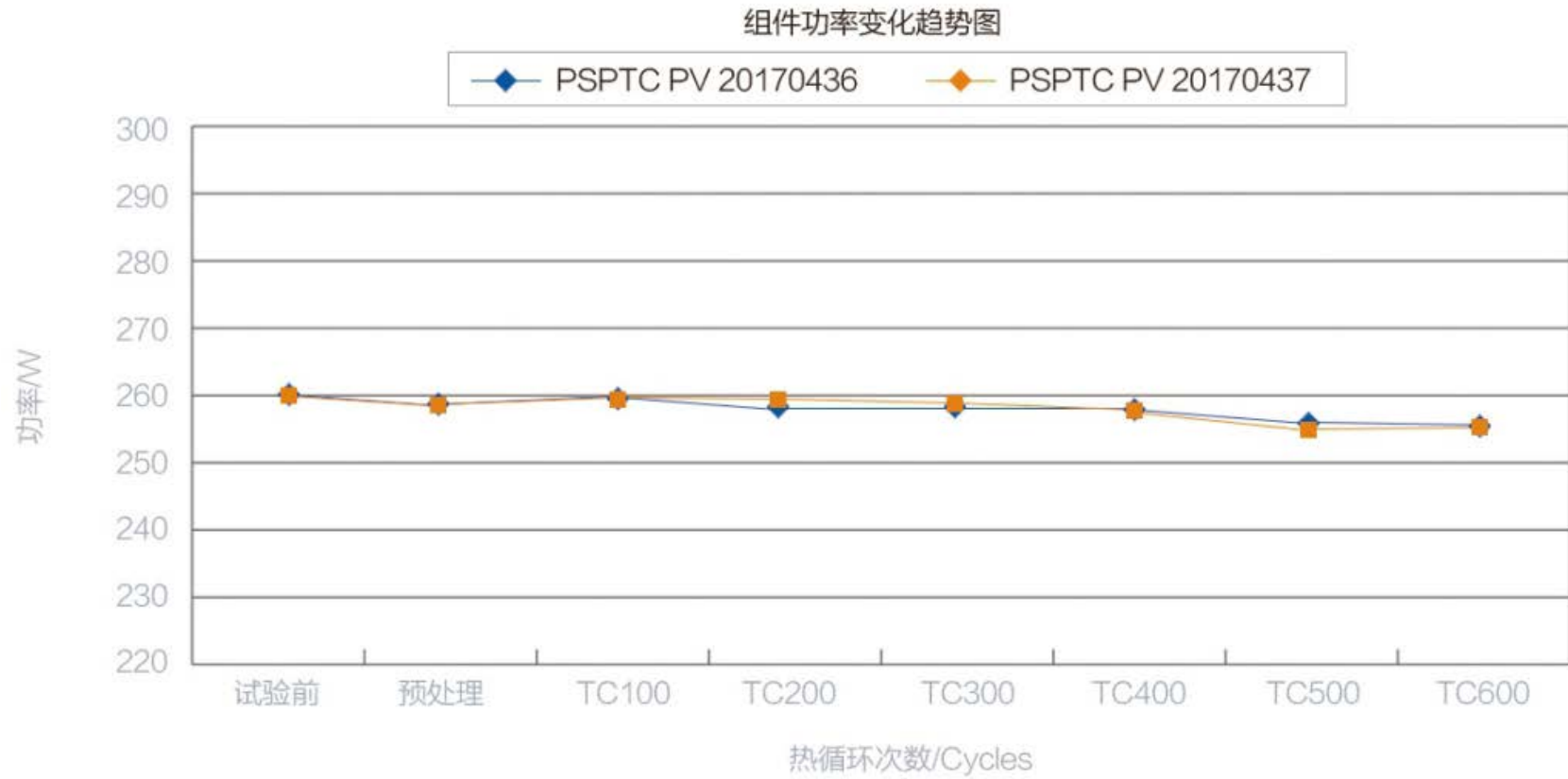
Benchmark Series MWT PV Modules



Triple Extreme Environmental Testing

No appearance defected after TC600.The maximum output power is respectively ↓0.39% and↓0.49%. Insulation test, wet leakage current test, hot and humid test,all of these experiments are qualified.

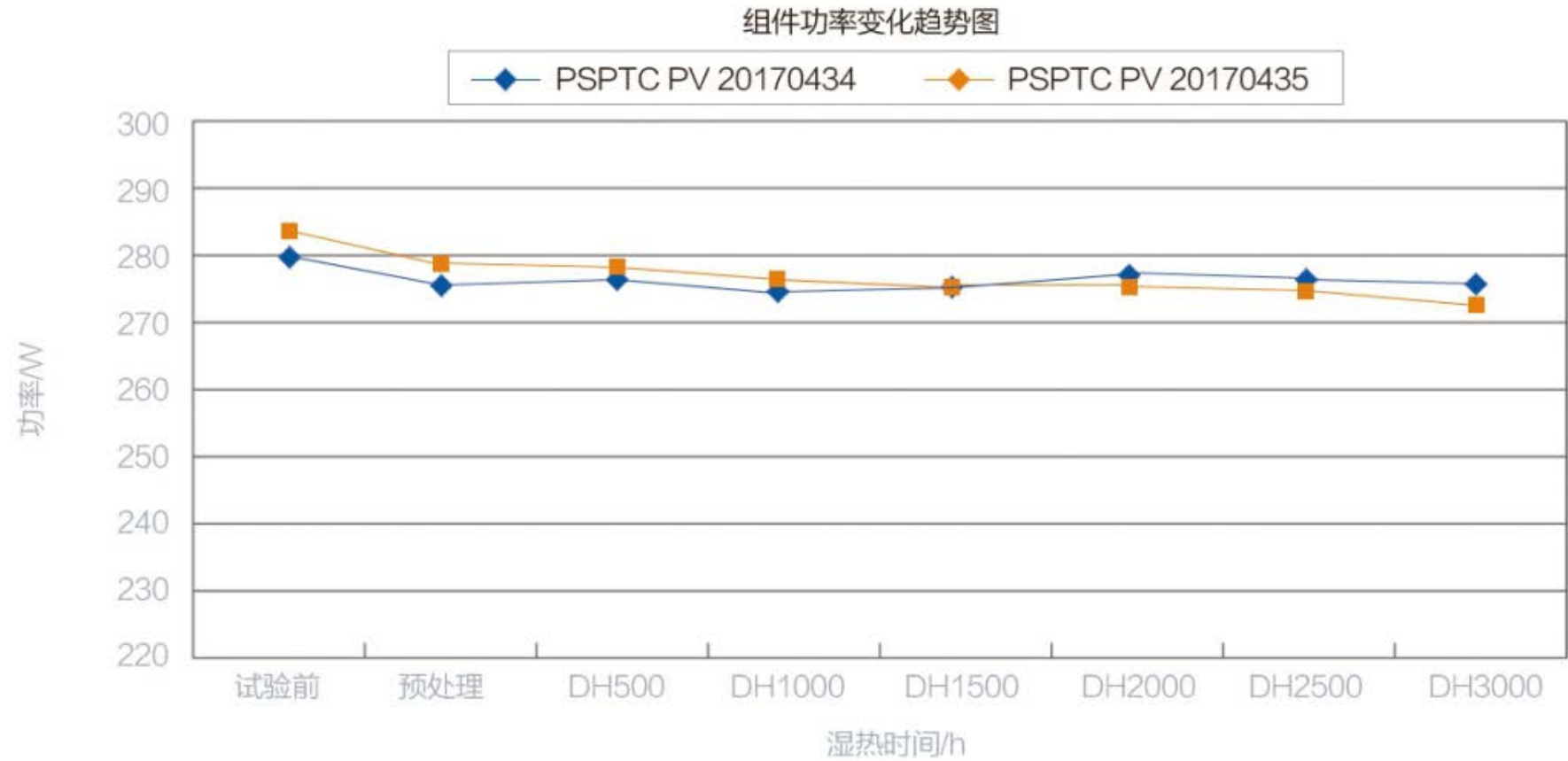
TC600



Triple Extreme Environmental Testing

No appearance defected after DH3000h. The maximum output power is $\uparrow 0.21\%$ and $\downarrow 1.22\%$ respectively .
Insulation test, wet leakage current test, hot and humid test, all of these experiments are qualified.

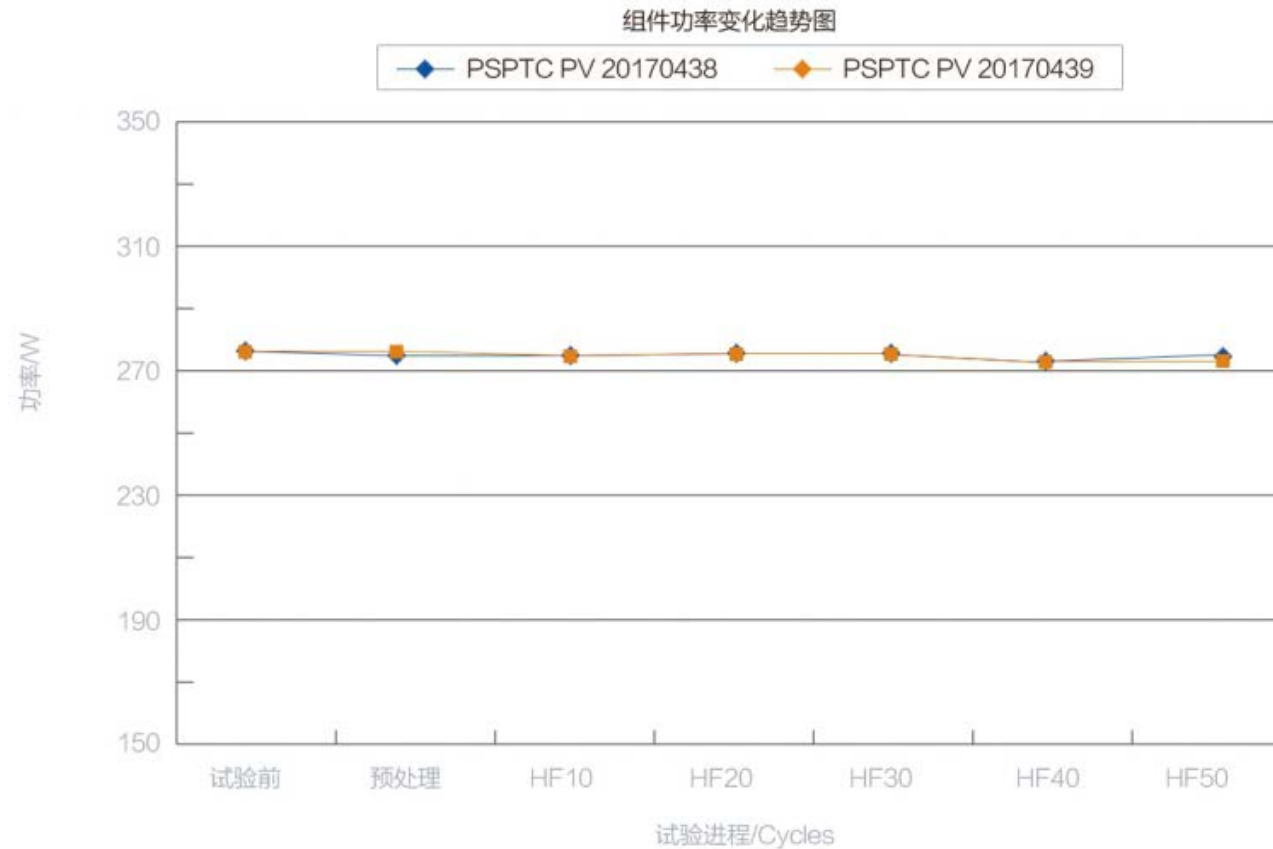
DH3000



Triple Extreme Environmental Testing

No appearance defect found after HF50. The maximum output power is respectively $\downarrow 0.22\%$ and $\downarrow 0.47\%$. Insulation test, wet leakage current test, hot and humid test, all of these experiments are qualified.

HF50



TOP RUNNER Performance for 30 Years

High Efficiency

Zero main grid, output power increased by 3% on the same area.

- 7% more power output than conventional modules for each module.
- Lower NOCT: $-0.36\% / ^\circ\text{C}$, higher power output.
- The first 10 months work performance in top-runner projects in Datong, the power generation efficiency of SPP MWT modules higher than other conventional modules.



High Reliability

Advanced MWT Technology with imported Industrial 4.0 equipment from Europe

- Semiconductor-alike 2D encapsulating technology reduces the encapsulation loss;
- By abandoning the traditional high-temperature welding, the stress and micro cracks caused by welding can be avoided;
- Our products have passed the Triple harsher and extreme environmental tests based on the IEC standard in the independent 3-party lab

Superior Warranty

**30 Years Quality Re-Assurance
by PICC and LLOYD'S**

- Guarantee that the first year of degradation is within 2%, the power generation ensures that more than 80% after 30 years.
- Adopted the "conductive foil line" and metal foil, so that the module backsheet greatly reduced by the water permeability and improve the resistance and reliability of the modules.



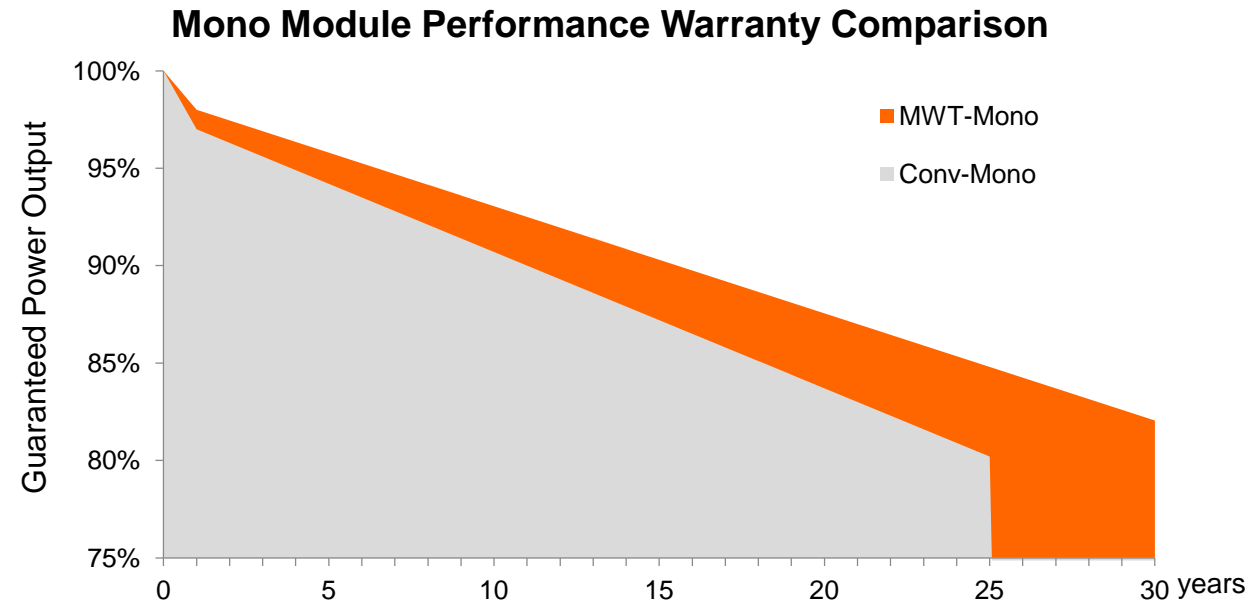
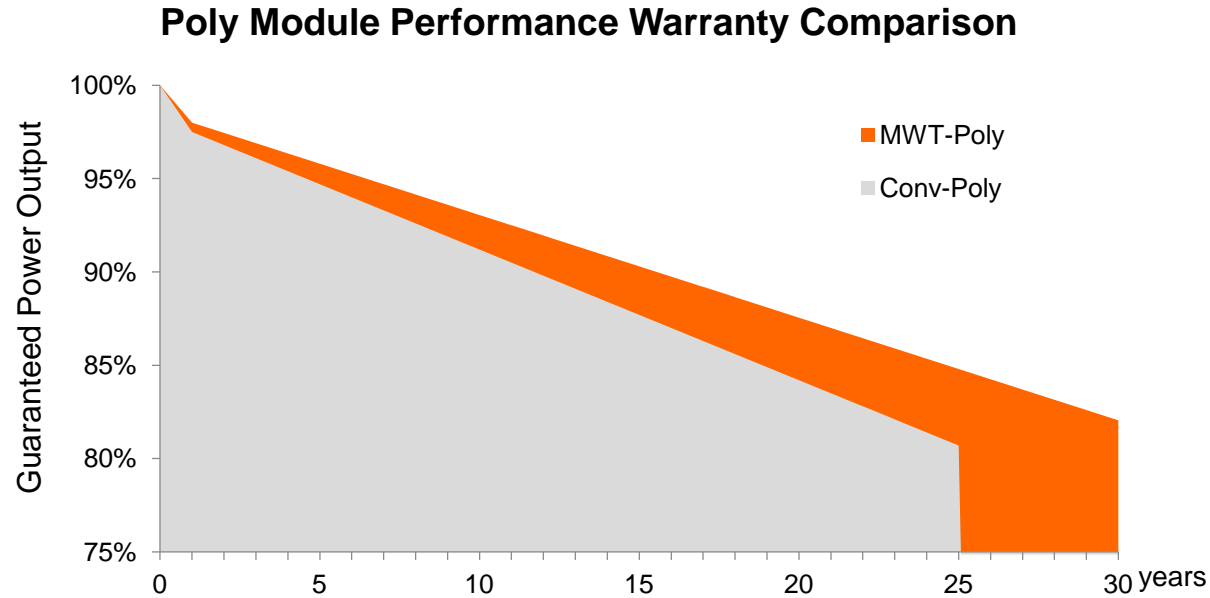
Aesthetics Appearance

High-efficiency modules with beautiful patterns

- Differentiation from conventional modules obviously, more stylish appearance.
- The only large-scale module in the market without main grid, higher recognition.
- Different from the conventional modules, unique pattern layout comes with "security".



Relative Advantage of MWT Module' s Performance Warranty



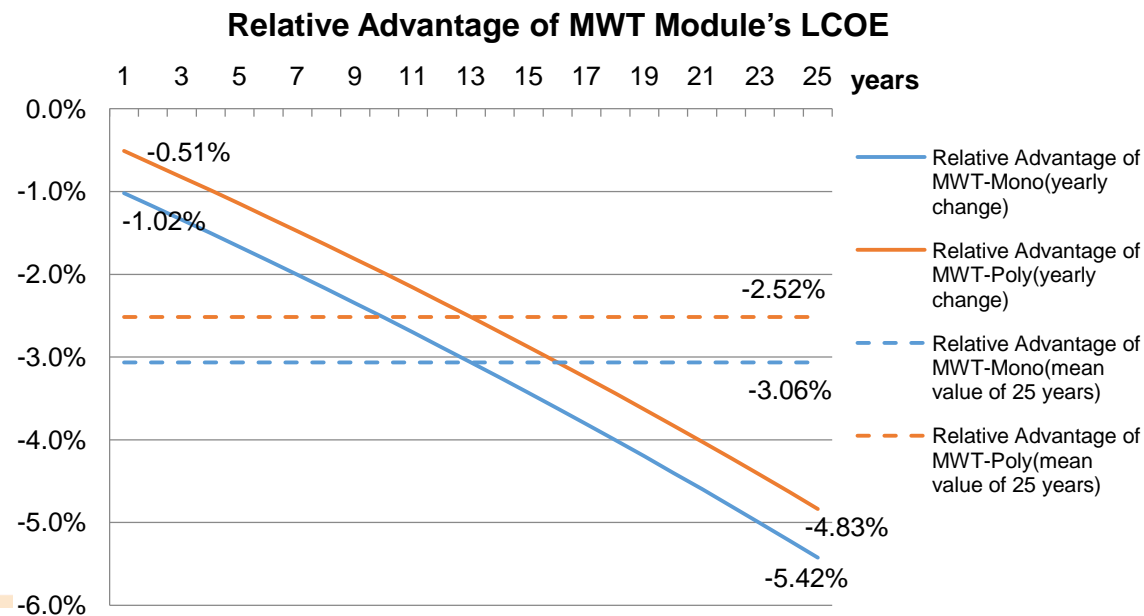
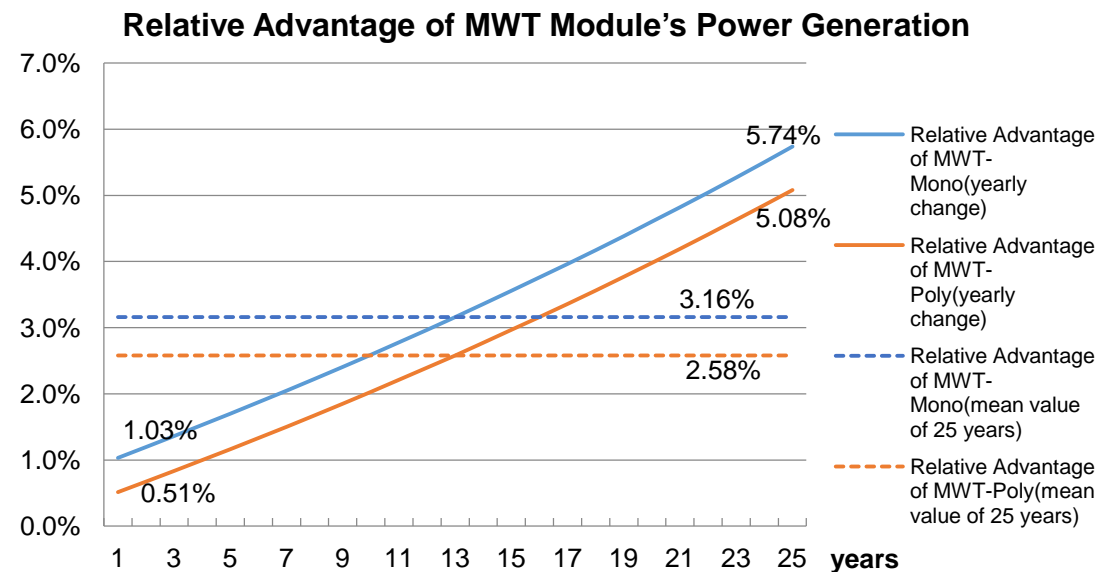
Module Type	First-year Decay	Liner Decay Value	Residue Power after 25 Years	Residue Power after 30 Years
MWT-Mono	2.00%	0.55%	84.80%	82.05%
MWT-Poly	2.00%	0.55%	84.80%	82.05%
Conv-Mono	3.00%	0.70%	80.20%	
Conv-Poly	2.50%	0.70%	80.70%	



Relative Advantage of MWT Module's Power Generation and LCOE



Year	MWT-Mono & MWT-Poly Power Output	Conv-Mono Power Output	Conv-Poly Power Output	MWT-Mono Yield More Power	MWT-Poly Yield More Power	Lower LCOE of MWT-Mono Compared to Conv-Mono	Lower LCOE of MWT-Poly Compared to Conv-Poly
1	98.00%	97.0%	97.50%	1.03%	0.51%	-1.02%	-0.51%
2	97.45%	96.3%	96.80%	1.19%	0.67%	-1.18%	-0.67%
3	96.90%	95.6%	96.10%	1.36%	0.83%	-1.34%	-0.83%
4	96.35%	94.9%	95.40%	1.53%	1.00%	-1.50%	-0.99%
⋮							
24	85.35%	80.9%	81.40%	5.50%	4.85%	-5.21%	-4.63%
25	84.80%	80.2%	80.70%	5.74%	5.08%	-5.42%	-4.83%
Relative Advantage of 25 Years Power Generation				3.16%	2.58%	-3.06%	-2.52%
Relative Power Generation Advantage Taking 30 Years Lifetime Warranty of MWT Module into Account				21.93%	21.25%	-17.99%	-17.52%



Relative Income Advantage of MWT Module



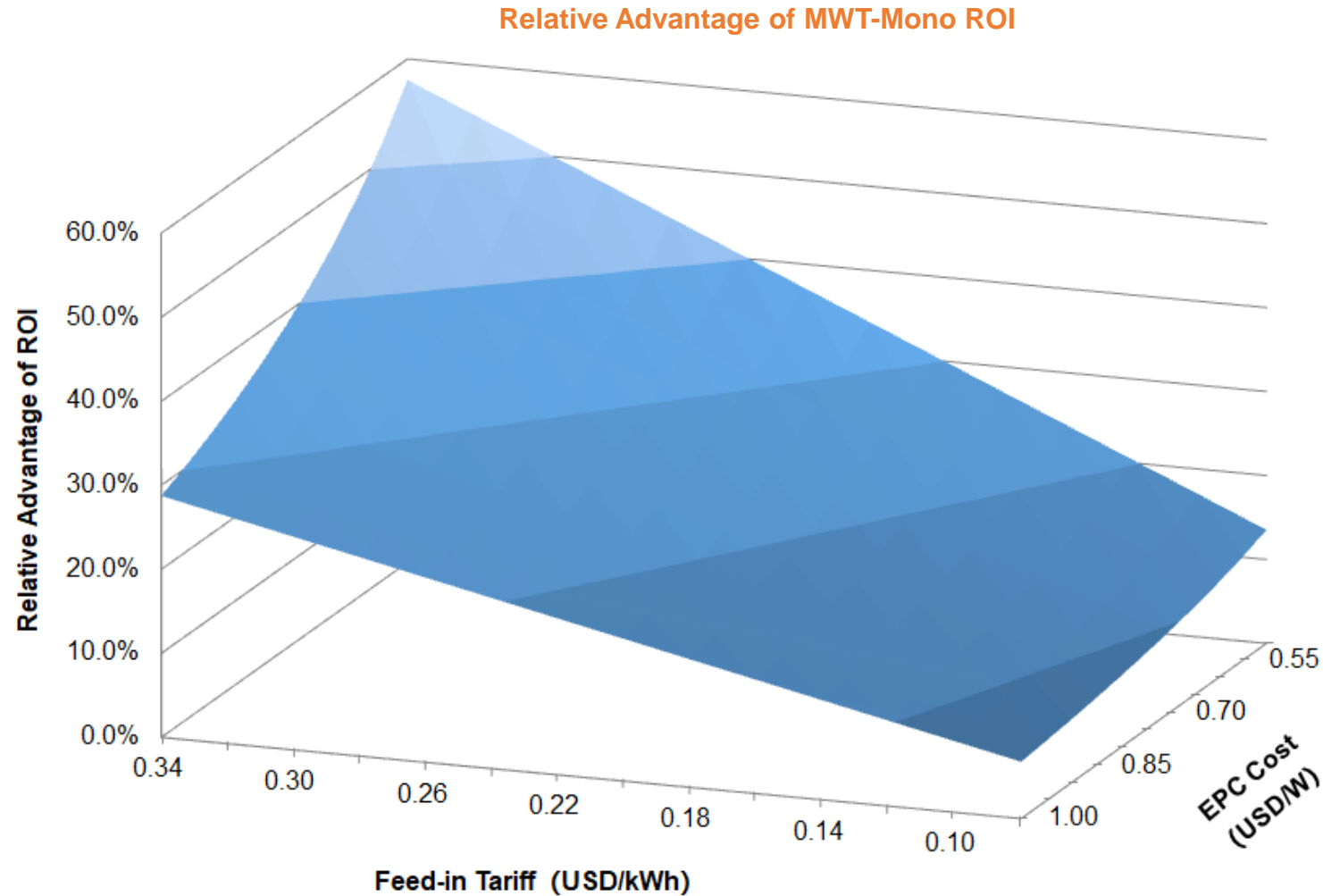
Year	Unit Income of MWT-Mono & MWT-Poly	Unit Income of Conv-Mono	Relative Income Advantage (MWT-Mono vs Conv-Mono)	Unit Income of Conv-Poly	Relative Income Advantage (MWT-Poly vs Conv-Poly)
1	0.93	0.92	1.03%	0.93	0.51%
2	1.81	1.79	1.11%	1.80	0.59%
3	2.64	2.61	1.19%	2.62	0.67%
4	3.43	3.38	1.27%	3.40	0.74%
⋮					
24	12.51	12.19	2.61%	12.26	2.05%
25	12.74	12.41	2.67%	12.48	2.10%
26	12.97	12.41	4.45%	12.48	3.88%
27	13.18	12.41	6.14%	12.48	5.56%
28	13.37	12.41	7.74%	12.48	7.14%
29	13.56	12.41	9.24%	12.48	8.64%
30	13.74	12.41	10.66%	12.48	10.05%

Comment: The income calculation takes 5% discount rate per year into account.

Relative ROI Advantage of MWT Module



Advantage of ROI (MWT-Module vs Conv-Module) EPC Cost (USD/W) Feed-in Tariff(USD/kWh)	1.00	0.95	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50
0.34	28.75%	30.26%	31.94%	33.82%	35.93%	38.33%	41.07%	44.23%	47.91%	52.27%	57.49%
0.32	27.06%	28.48%	30.06%	31.83%	33.82%	36.07%	38.65%	41.62%	45.09%	49.19%	54.11%
0.30	25.37%	26.70%	28.18%	29.84%	31.71%	33.82%	36.24%	39.02%	42.28%	46.12%	50.73%
0.28	23.67%	24.92%	26.30%	27.85%	29.59%	31.57%	33.82%	36.42%	39.46%	43.04%	47.35%
0.26	21.98%	23.14%	24.43%	25.86%	27.48%	29.31%	31.40%	33.82%	36.64%	39.97%	43.97%
0.24	20.29%	21.36%	22.55%	23.87%	25.37%	27.06%	28.99%	31.22%	33.82%	36.89%	40.58%
0.22	18.60%	19.58%	20.67%	21.88%	23.25%	24.80%	26.57%	28.62%	31.00%	33.82%	37.20%
0.20	16.91%	17.80%	18.79%	19.89%	21.14%	22.55%	24.16%	26.02%	28.18%	30.75%	33.82%
0.18	15.22%	16.02%	16.91%	17.90%	19.02%	20.29%	21.74%	23.41%	25.37%	27.67%	30.44%
0.16	13.53%	14.24%	15.03%	15.92%	16.91%	18.04%	19.33%	20.81%	22.55%	24.60%	27.06%
0.14	11.84%	12.46%	13.15%	13.93%	14.80%	15.78%	16.91%	18.21%	19.73%	21.52%	23.67%
0.12	10.15%	10.68%	11.27%	11.94%	12.68%	13.53%	14.49%	15.61%	16.91%	18.45%	20.29%
0.10	8.46%	8.90%	9.39%	9.95%	10.57%	11.27%	12.08%	13.01%	14.09%	15.37%	16.91%
0.08	6.76%	7.12%	7.52%	7.96%	8.46%	9.02%	9.66%	10.41%	11.27%	12.30%	13.53%



As left graph shows, The relative advantage of MWT module ROI is more obvious with higher feed-in tariff and lower unit EPC cost.

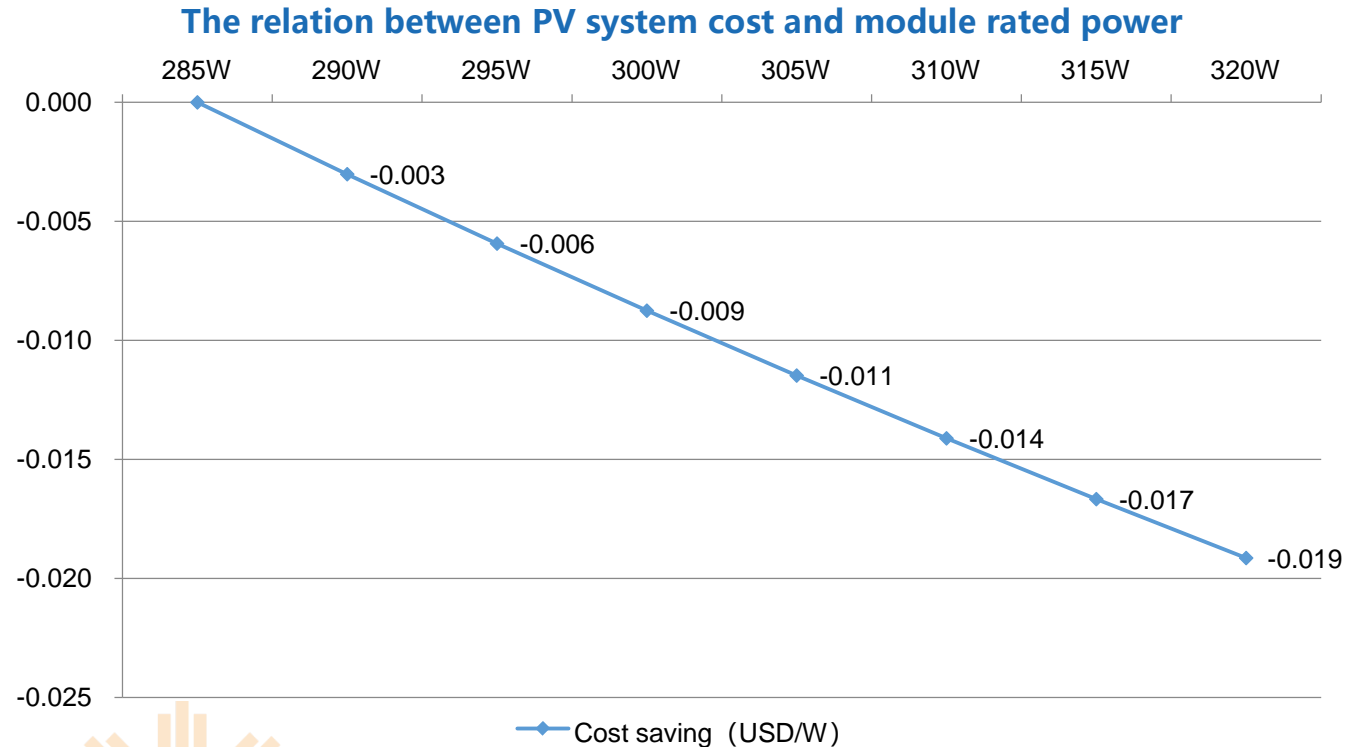
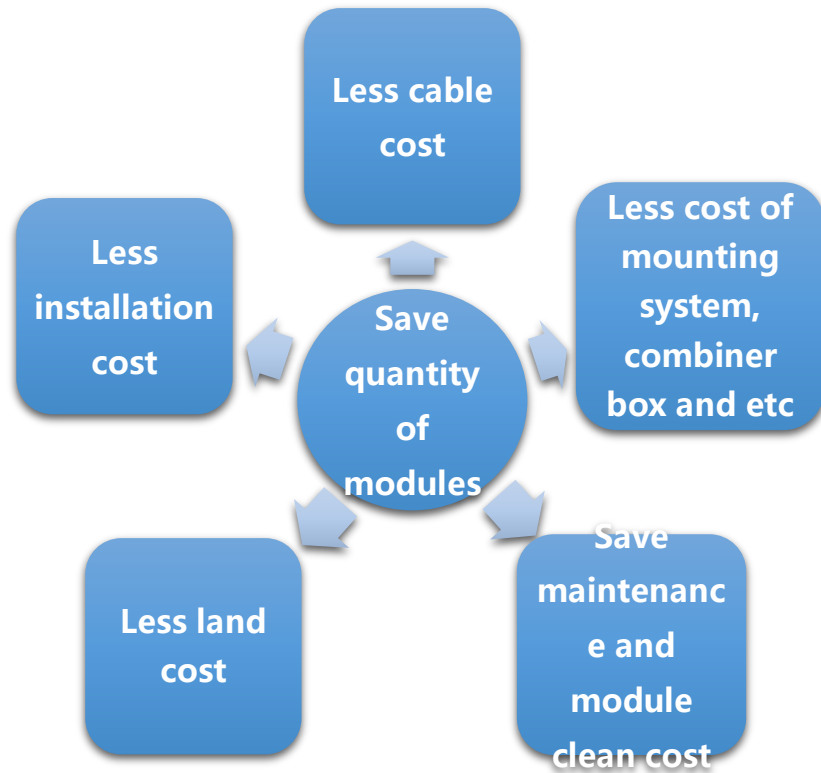


Advantage of MWT Module Higher Rated Power

Suppose the rated power of MWT module is P and the rated power of conventional module is P_0 . The cost advantage of PV system " Δ " caused by using MWT modules can be calculated as:

$$\Delta = \eta C_s \frac{P - P_0}{P}$$

C_s means PV system cost per watt. η is a influence factor that affect PV system price by using higher rated power modules. Usually the value of η is 20-30%.



MWT module can be benefited by lower power degradation, longer lifetime (30 years) and higher rated power.

➤ **Advantage due to lower power degradation and longer lifetime**

Advantage of MWT Module (Compared with Conventional Module)	Advantage of 25 years			Advantage of 30 years (5 more years lifetime of MWT module)		
	More Power Generation	Lower LCOE	More Income	More Power Generation	Lower LCOE	More Income
MWT Mono vs Conventional Mono	+3.16%	-3.06%	+2.67%	+21.93%	-17.99%	+10.66%
MWT Poly vs Conventional Poly	+2.58%	-2.52%	+2.10%	+21.25%	-17.52%	+10.05%

And the relative advantage of MWT module ROI is in connection with unit EPC cost and feed-in tariff. The relative advantage of MWT module ROI is more obvious with higher feed-in tariff and lower unit EPC cost.

Eg. Suppose the EPC cost is 0.70 USD/W and the feed-in tariff is 0.12 USD/kWh, the ROI using MWT modules should will be 14.49% higher than that using conventional modules.

➤ **Advantage due to higher rated power**

EPC cost decreases about 0.003 USD/W while using one higher power grade (5W) modules. MWT module is usually 20-25W higher than conventional module, which means EPC cost can decrease about 0.012 USD/W.





SPP-FLex 1.0



Flexible



High efficiency



Ultra thin



Light weight



Easy Installation



Attractive design



Top Runner Project in Baicheng, Jilin



Top Runner Project in Delingha, Qinghai



Yuling Power Plant in Shanxi



Solar plant for Sewage treatment Plant



Zhenfa Building Power Plant in Wuxi





Power Plant in Shandong



Solar roof for Benz factory in Beijing



Power Plant in Jiangxi



Pharmaceutical Factory in Beijing



Power Plant in Nantong



Power Plant in Shandong



Jiangxi Province Project



Henan Province Project



Hebei Province Project



Hebei Province Project



Hebei Province Project



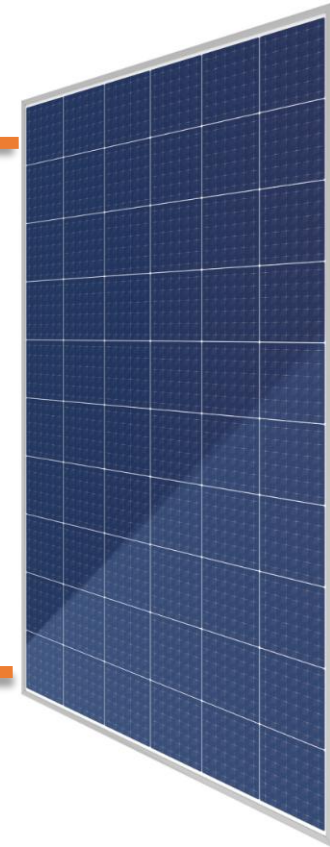
Hebei Province Project



03

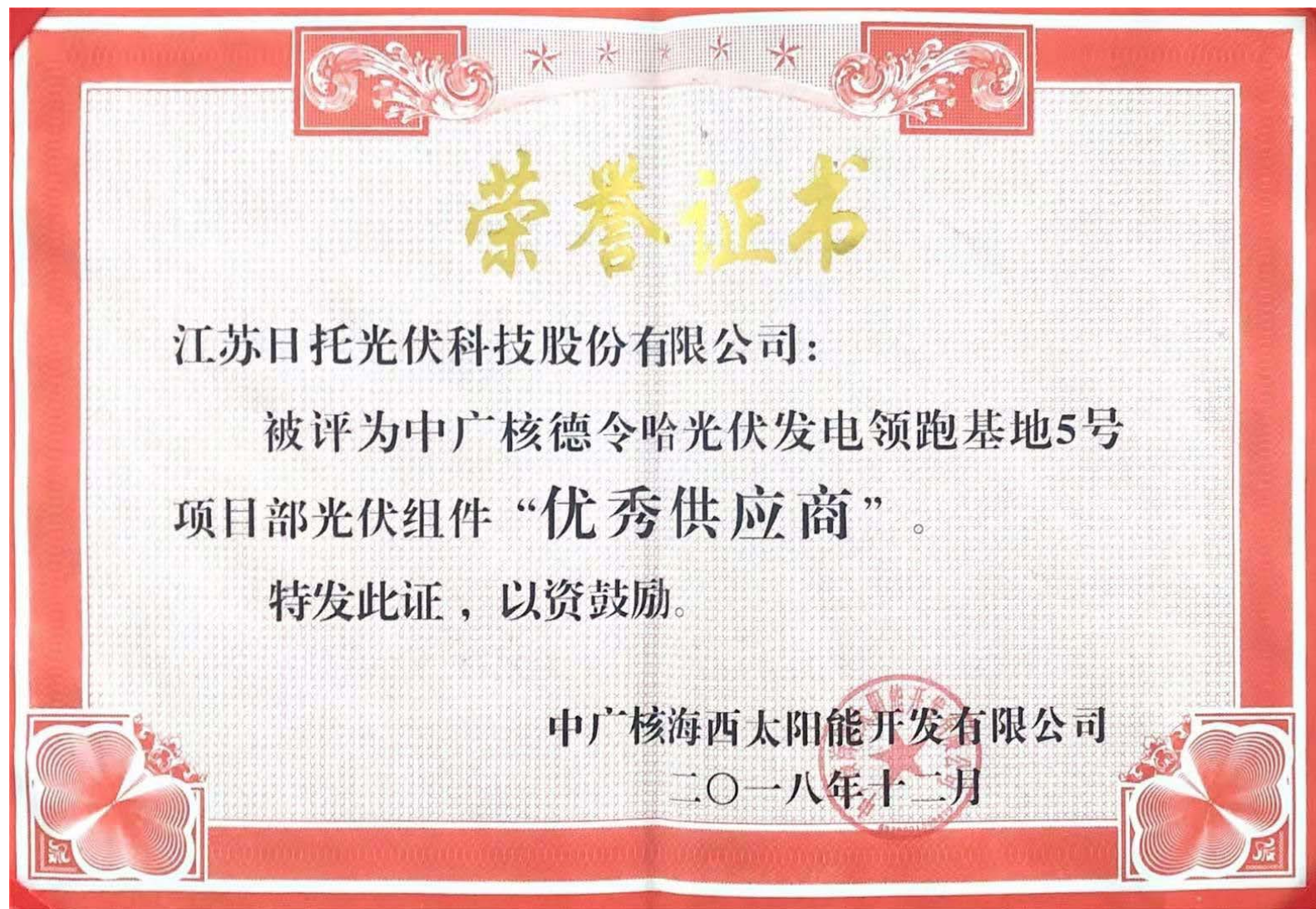
Advantage&Awards

Multiple Recognition and Support



Qualificaitons&Certifications





First-Class Strategic Partners



Global Marketing Network

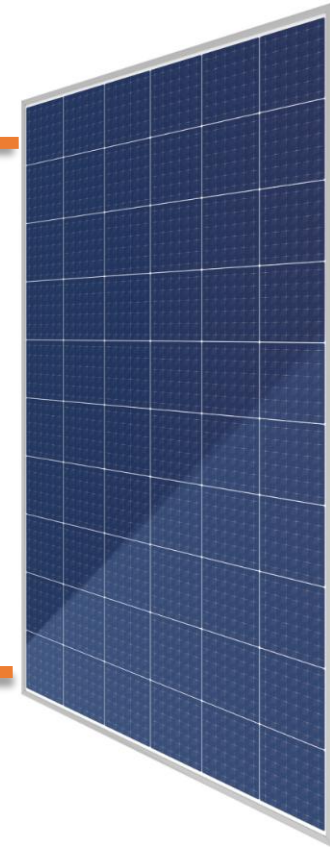
Exporting to Asia, Europe, Australia etc.



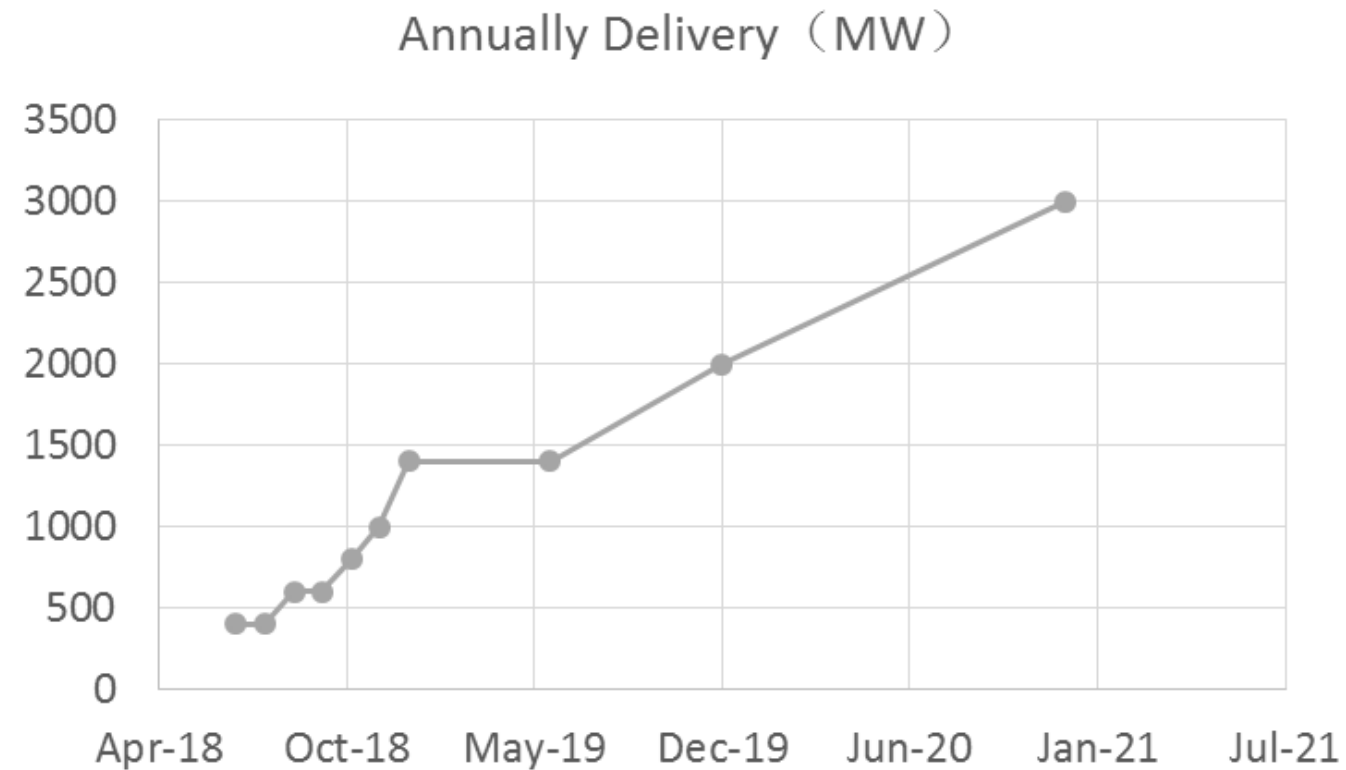
04

Planning & Vision

Become the Industrial Leading Player



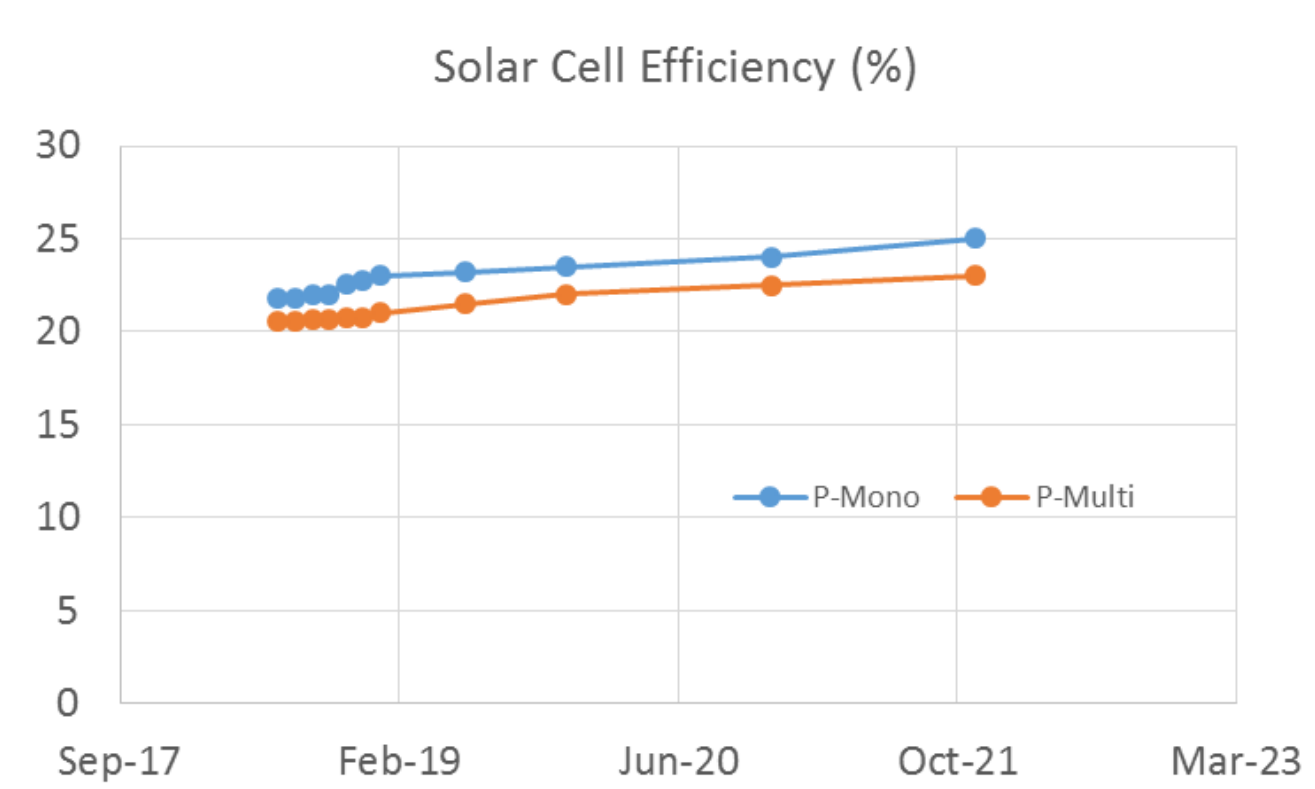
Capacity



The capacity of High-Efficiency MWT PV modules is steadily increasing.



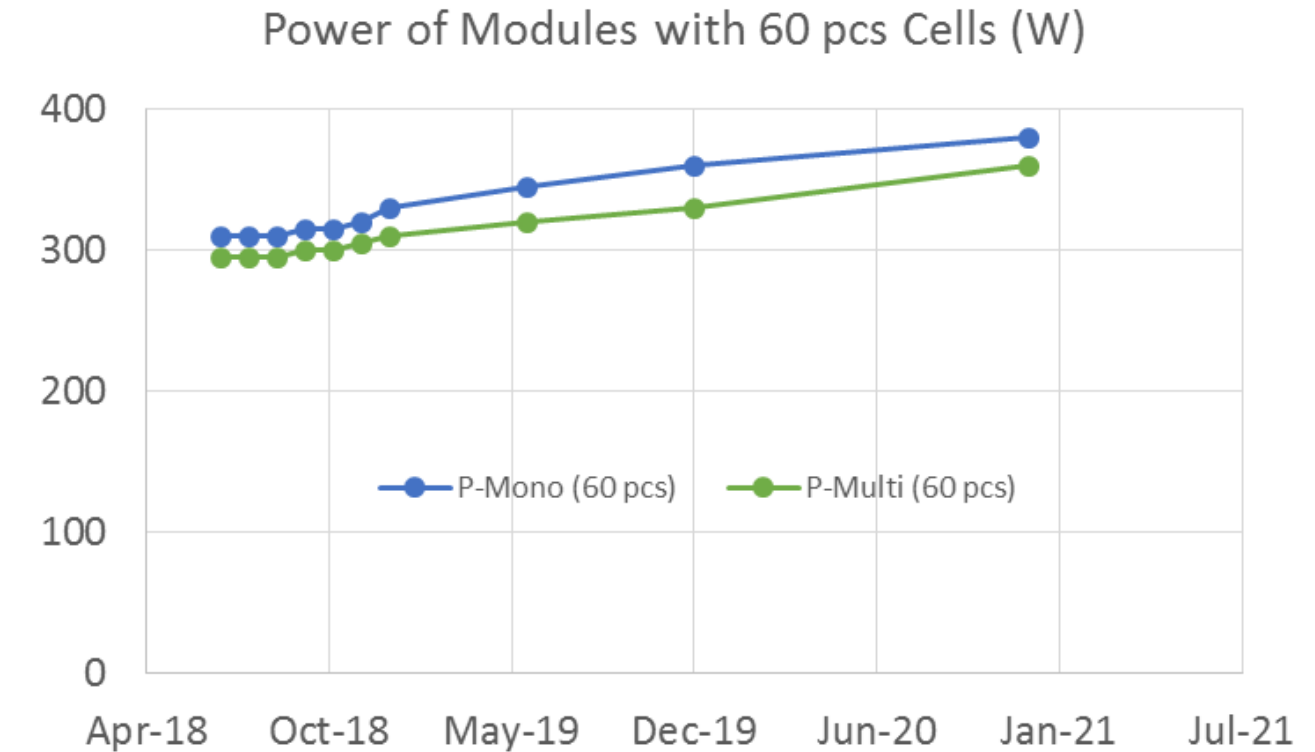
Performance



The conversion efficiency of MWT solar cells is up to 22.5% and it is steadily increasing.



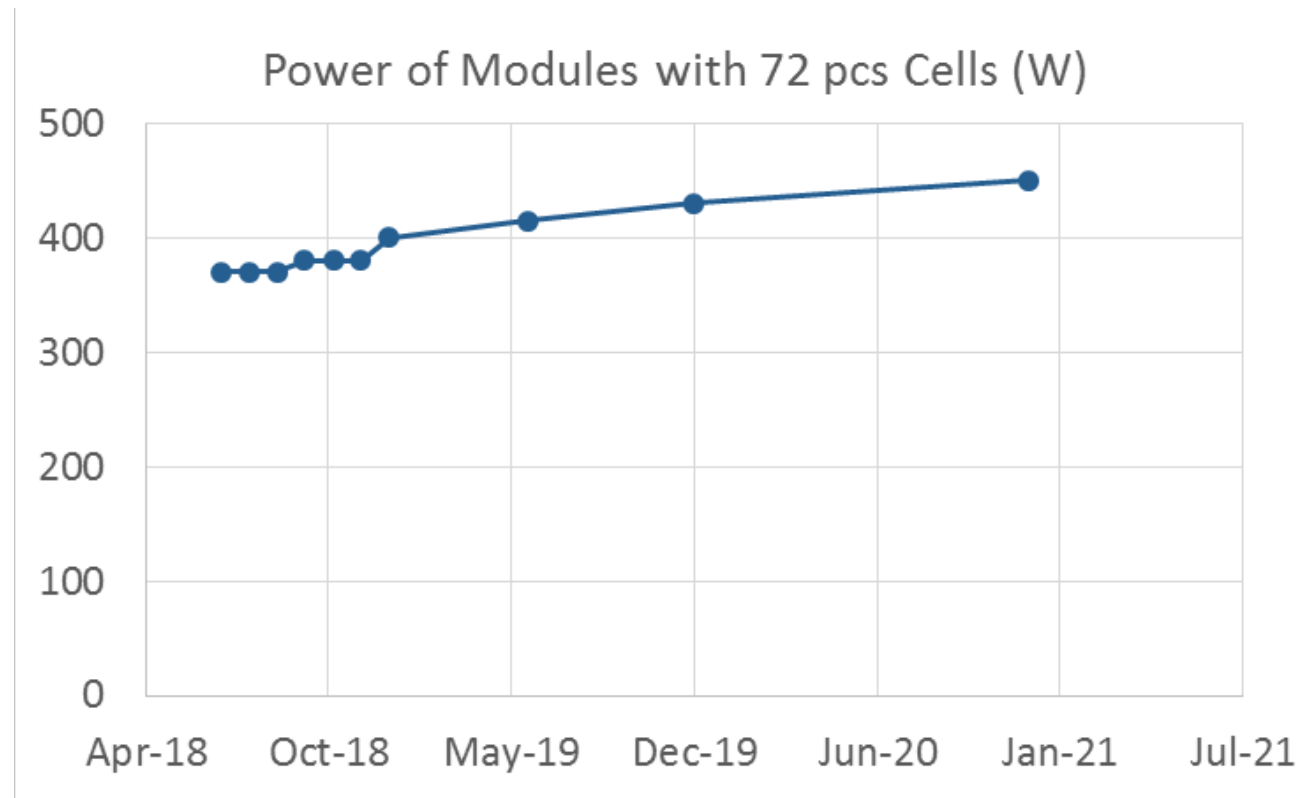
Performance



The power of MWT PV modules is always at the forefront of similar modules(P-type or N-type) in the industry.



Performance



The power of MWT PV modules is always at the forefront of similar modules(P-type or N-type) in the industry.



Our goal is to make **SUNPORT POWER** the PV industry leading player and benchmark enterprise.





THANKS

