GCLSI 2021 ~ 2023 Product Roadmap

Global Product Management

Aug.8th, 2020
Revision: A

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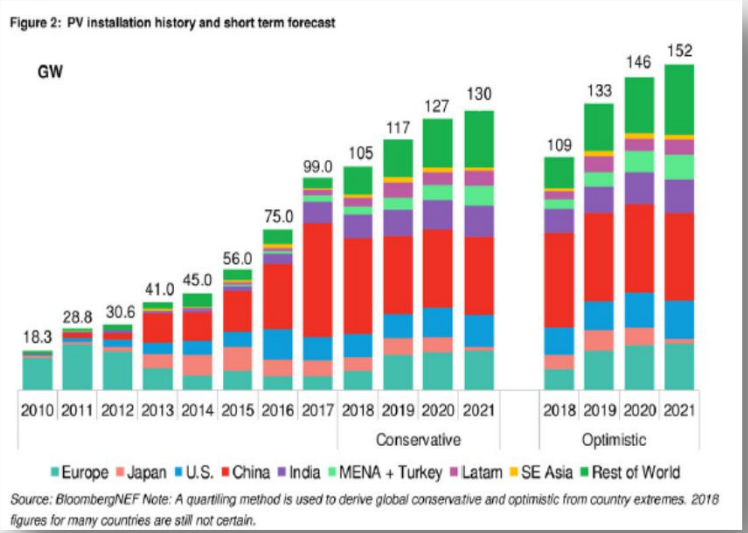
4 182 or 210?

Market Environment

PV market overall environment

- "Looking forward to the second half of 2020, driven by multiple parties such as bidding, parity, and household use, the domestic photovoltaic market will achieve recovery growth and is expected to usher in a climax of installation in the fourth quarter of this year.
- The global photovoltaic market demand is also expected to improve, but we still need to pay close attention to changes in the international epidemic and the uncertainty it brings to the global economy.

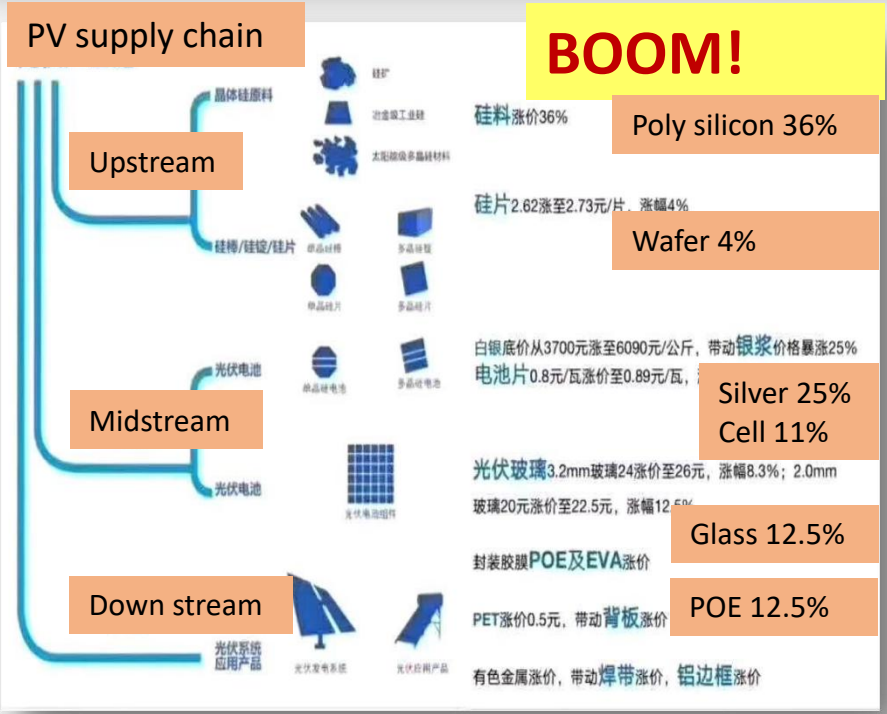


- Impacted by pandemic coronavirus, 2020 Global PV market outlook will be shrinkage of 10%~20%

PV material cost continuously go up and Module price down

PV supply chain

BOOM!



Upstream

Poly silicon 36%

Wafer 4%

Midstream

Silver 25%

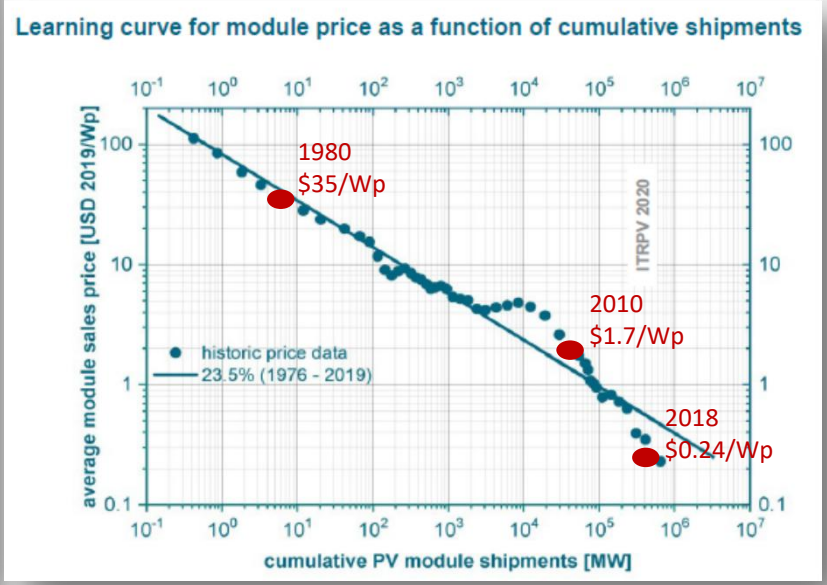
Cell 11%

Glass 12.5%

Down stream

POE 12.5%

PV learning curve and cost reduction

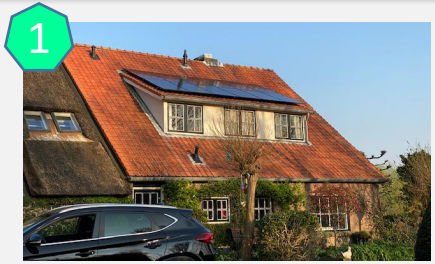


Source: ITRPV 2020

- It is obvious that the cost reduction in the PV production process have to result in price reduction.

2021 Product Application

- Different products have different market applications.



√ = application

Module	Power	Residential Rooftop	Industrial/Commercial	Power Station
158.75-60c	340w	√	√	
166-60c	380w	√	√	
158.75-72c	410w		√	
166-72c	450w		√	√
210-50c	490w			√ - larger power station
182-72c	540w			√ - larger power station
182-78c	590w			√ - larger power station
210-60c	590w			√ - larger power station

2021 Product Roadmap

High Power
High Efficiency

72-cell as example

Above 500W

Above 440W

Above 400W

Below 400W

>500W big size module

350~355
All Black
60-cells shingled
(158.75 Mono)

440~460
M8/72XXX
(166 Mono)

420~430
Shingled
(158.75 Mono)

410/415
M3/72XXX
(158.75 Mono)

440 / 460
M8/72XXX
(166 mono)

400 / 410
M3/72DHXXX
(158.75)

385 / 395
P3/72XXX
(158.75 Cast mono)

P6/72XXX
(157 Poly)

M6/72XXX
(158.75 Mono)

OBAOR
一带一路
One Belt And One Road

Product

Low end

Mainstream

High end

2021 Mainstream Products

2021 Product Roadmap: Standard Products (mono-facial)

1 Mono PERC

1) Wafer Size: 158.75 G1

Mono-facial
- 72c Main Power

From 405~415

Mono-facial
- 60c Main Power

From 340~350

2 Cast Mono

2) Wafer Size: 166 M6

Mono-facial
- 72c Main Power

From 445-460W

Mono-facial
- 60c Main Power

From 370-385W

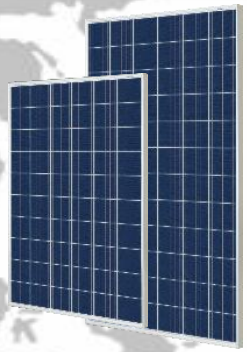
1) Wafer Size: 158.75 G1

Mono-facial
- 72c Main Power

From 380~390

For CF project

3 Poly



1) Wafer Size: 157 M2

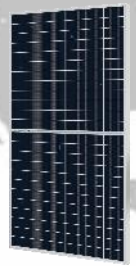
Mono-facial
- 72c Main Power

From 330-350W
- 60c Main Power

From 275-290W

2021 Product Roadmap: Standard Products(Bi-facial)

1 Bifacial Module Double Glass



Bifacial factor avg. 70%

1) Mono PERC: 158.75 / 166

- 72c Main Power

158.75 : 405~415 W
166 : 445-460 W

2) Cast Mono PERC: 158.75

- 72c Main Power

From 380-390 W

2 Bifacial Module Transparent Back Sheet

Bifacial factor avg.70%

1) Mono PERC: 158.75 / 166

- 72c Main Power

158.75 : 405~415 W
166 : 445-460 W

DUPONT transparent back sheet with 30 years warranty

3 Shingled Module Mono-facial

1) Wafer Size: 158.75

- 72c Main Power

From 420~430W

- 60c Main Power

From 350~360W

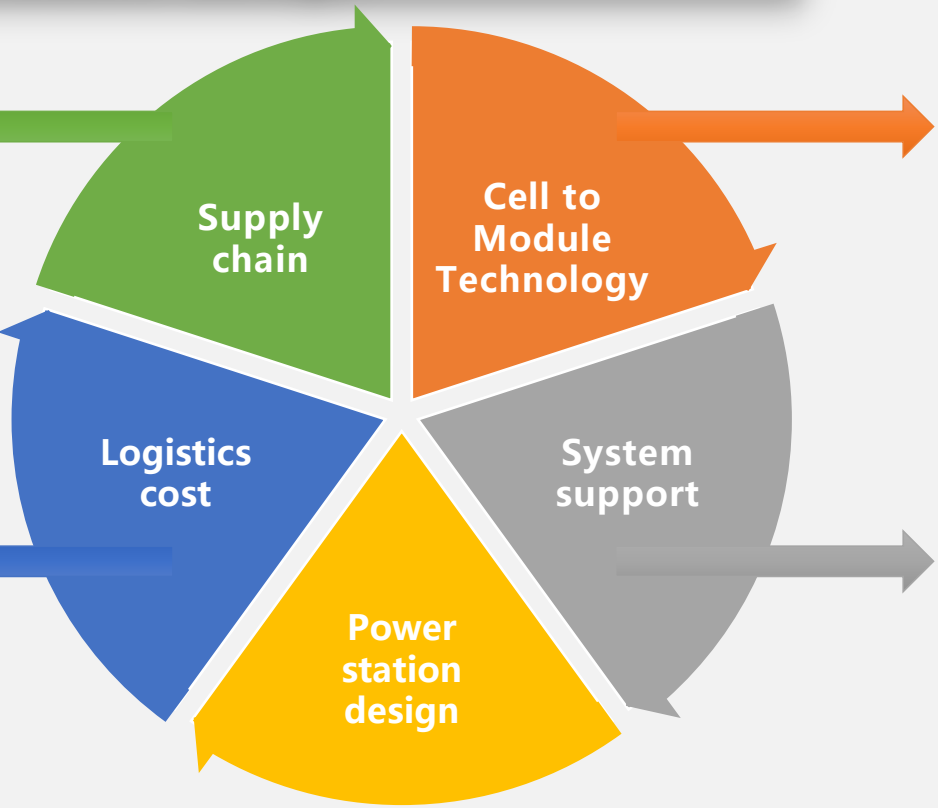
- 60c All Black

From 350~360W

182 or 210 ?

Key factors of module design

Glass width<1.3m



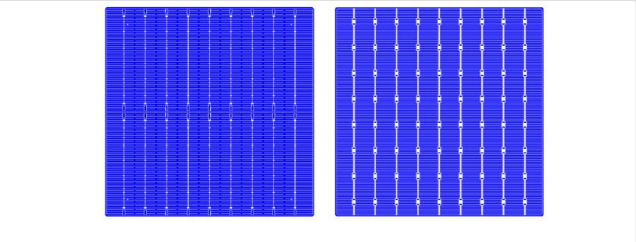
- High density module tech
- High cell tech

40’ high container indoor height 2.58m

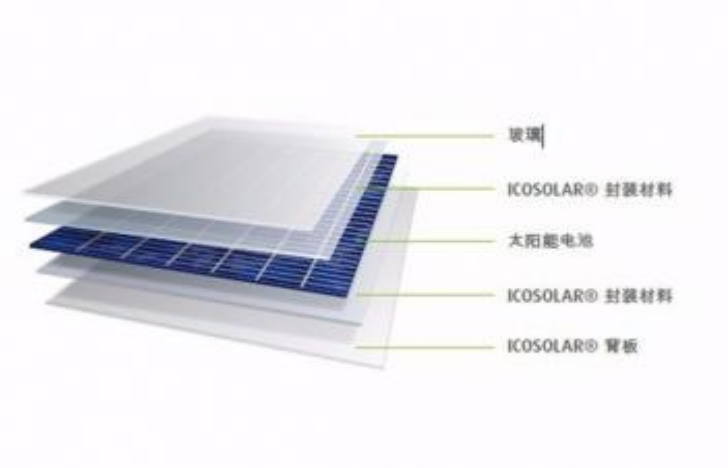
- Inverter
- Mounting system support

Cell efficiency and glass width availability

- From the perspective of cell efficiency, from the past learning curve for improving the efficiency of amorphous silicon and crystalline silicon cells, the smaller the cell area, the more stable the cell process, and the overall average efficiency of small-area cells is higher than that of larger-area cells. The efficiency of 182 cells are predicted higher than that of the 210 cell, and the larger the cell area, the greater the risk of crack, empty-welding and micro-crack.



- Glass size width: it is known that the width of 182-72 cells glass is 1129mm. According to the supply chain information, the glass can be supplied in batches in 2021/Q1 The size is less than 1.3m.

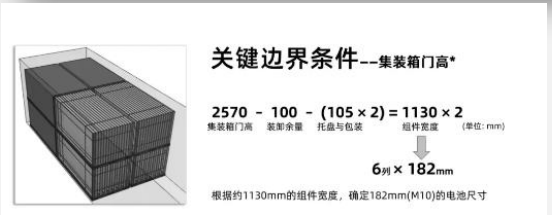


High container door height constrain

- From the product power point of view, the power of 182-72 module is 30W~40W higher than that of 210-50 module;

  From the perspective of packaging and transportation, for a 40-foot high container, there are as many pieces of 182-72 cells module as 210-50 cells, but because the power of 180-72cells module is 30W~40W higher than that of 210-50cells module, it means, A 40-foot high cabinet can put **18kW~24kW** more, and 180-72cells can save **6%~8% transportation costs.**

182 module can be stacked in two layers for 40’ high container



How to redesign 210-60cells packing is key factor

- If you change 210-50 cells (5 strings) to 60 cells (6 strings), it is expected to reach 590 watts. Although the power is competitive, the width of the module increases (more than 1.3 meters) and the glass width increases. The purchase of large-size glass is restricted, and the 40’ high container cannot be stacked in 2 layers, and the number of containers will be halved.
- If we put the module in portrait direction, it will increase the topple risk when unloading the modules.
- Therefore, the cost of shipping 210-60 pieces (6 strings - 590 watts) will be doubled.

Wafer Size Migration Improves Module Output

800~1000w/ Module ???

Cell

Mono PERC

72-Cell as example

Ultimate

New tech.

2019

G1

158-72

415

2020

M6

166-72

455

2021~2023

G12

210-50

490

M10

182-72

540

M10

182-78

590

G12

210-60

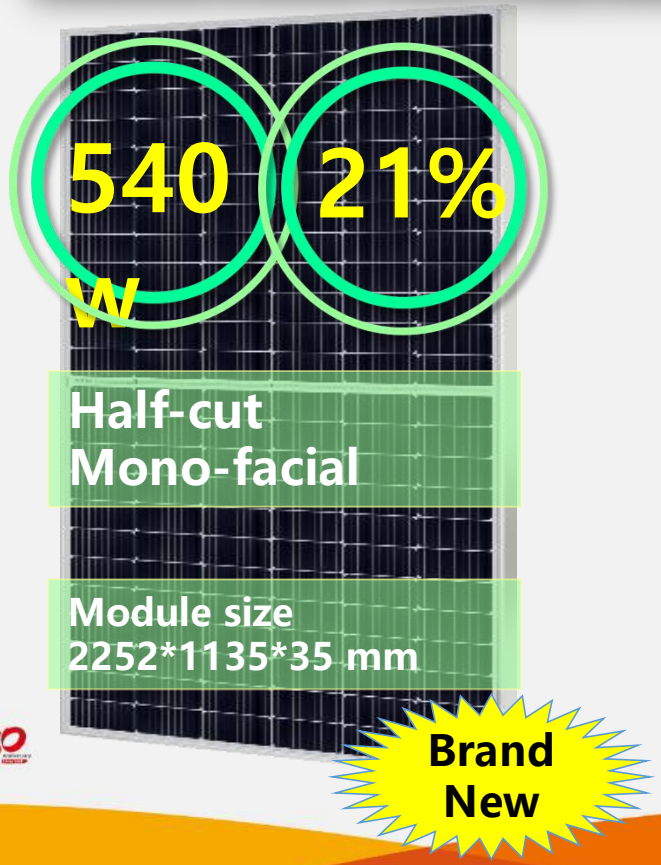
590

Upcoming soon

Large wafer will enable module power output beyond 500W

GCL

2021 New Product:
Mono PERC 182-72c Mono-facial Module



GCL-M10/72H 530-540 W

High Power High Efficiency (up to 21%)

Mono PERC cell enables high module efficiency

Solid PID Resistance

Ensured by solar cell process optimization and careful module BOM selection

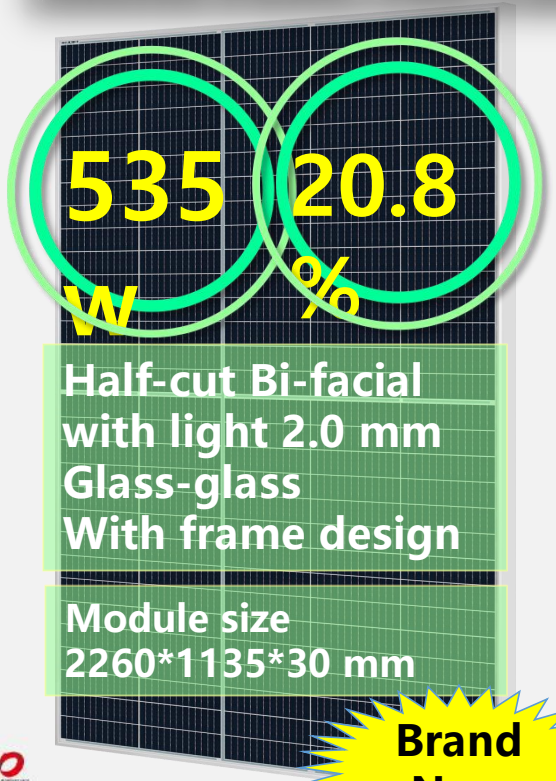
Reduced Hot Spot Risk

With optimized electrical design and lower operation current

Additional Insurance Backed by Swiss RE

* Please refer to GCL for details

2021 New Product:
Mono PERC 182-72c Bi-facial glass-glass module



Half-cut Bi-facial with light 2.0 mm Glass-glass With frame design

Module size 2260*1135*30 mm

Brand New

GCL-M10/72GDF 525-535 W

High Efficiency Front Side (up to 20.8%)

Front side efficiency same as Standard Mono PERC

Up to 25% Additional Gain From Back

Bifacial factor average 70%

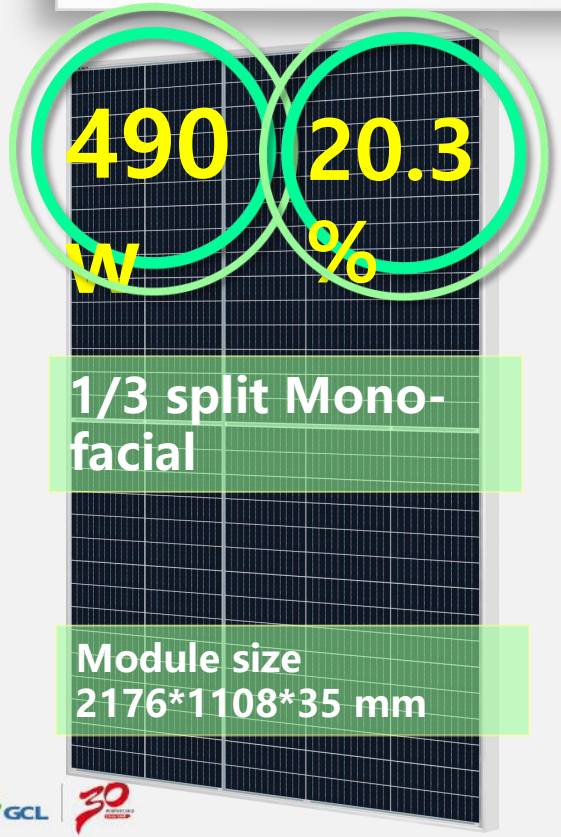
Optional 30mm Frame

Compatible with tracker mounting system

Additional Insurance Backed by Swiss RE

* Please refer to GCL for details

Mono PERC 210-50 cells Mono-facial Module



GCL-M12/50H 485-490 W

High Efficiency (up to 20.3%)

- Mono PERC cell enables high module efficiency

Solid PID Resistance

- Ensured by solar cell process optimization and careful module BOM selection

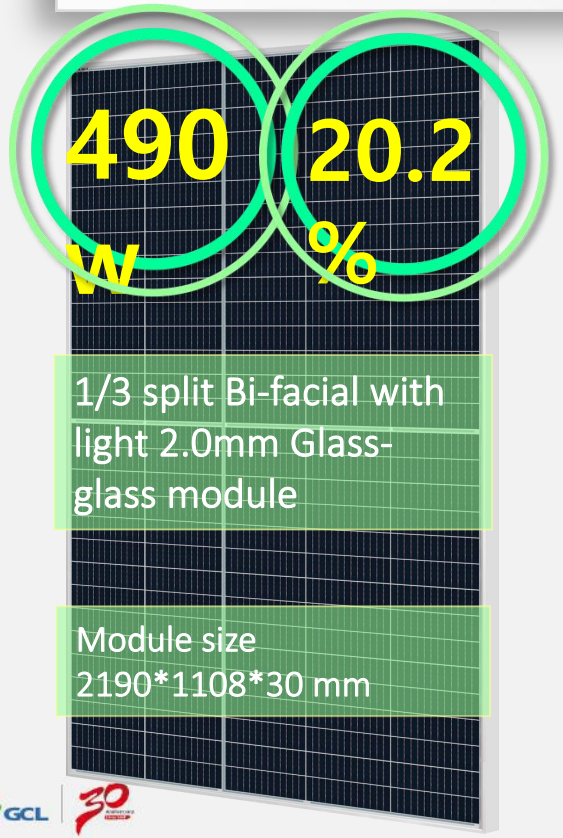
Reduced Hot Spot Risk

- With optimized electrical design and lower operation current

Additional Insurance Backed by Swiss RE

* Please refer to GCL for details

Mono PERC 210-50 cells Bi-facial glass-glass module



GCL-M12/50GDF 480-490 W

High Efficiency Front Side (up to 20.2%)

- Front side efficiency same as Standard Mono PERC

Up to 25% Additional Gain From Back

- Bifacial factor average 70%

Optional 30mm Frame

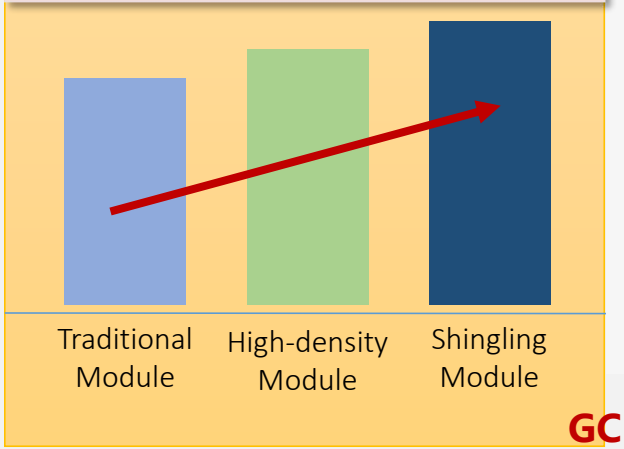
- Compatible with tracker mounting system

Additional Insurance Backed by Swiss RE

* Please refer to GCL for details

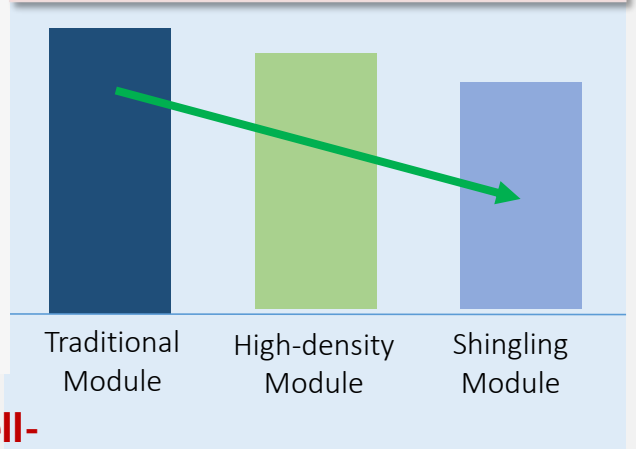
Mono PERC module with the high-density encapsulation technology

Module efficiency

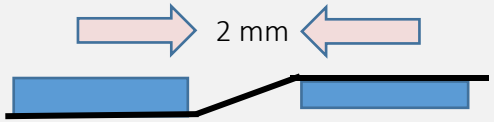


Balance

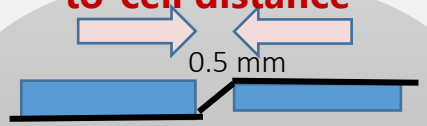
Production yield rate



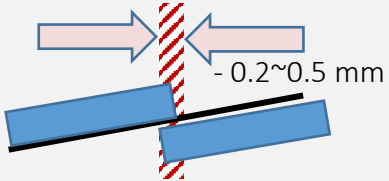
GCL Choose 0.5mm cell-to-cell distance



Traditional Module



High-density Module

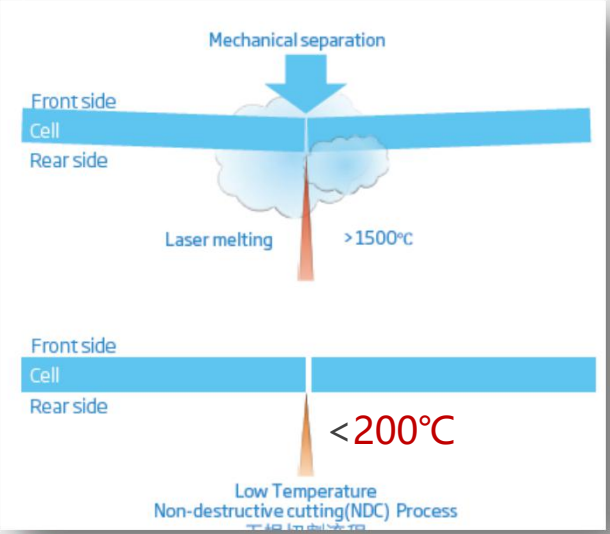


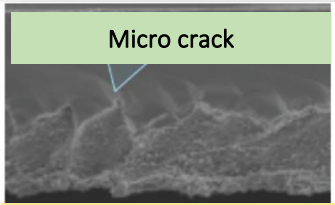
Shingling Module

Mono PERC module with the cell non-destructive cutting technology

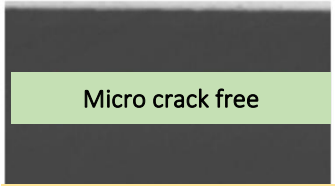
- By means of non-destructive cutting, the cell is cut into pieces without causing additional micro cracks

- Non-destructive cutting temperature is around 200℃.
- Traditional laser melting is above 1500 degree.

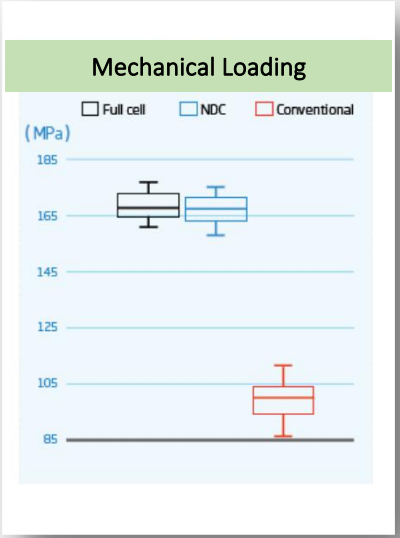




After conventional cutting, the sectional view



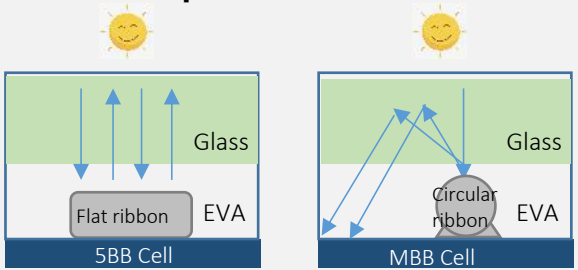
After non-destructive cutting, the sectional view



Mono PERC module with MBB Technology

1 Optical Performance

Power Improvement 1%~1.5%

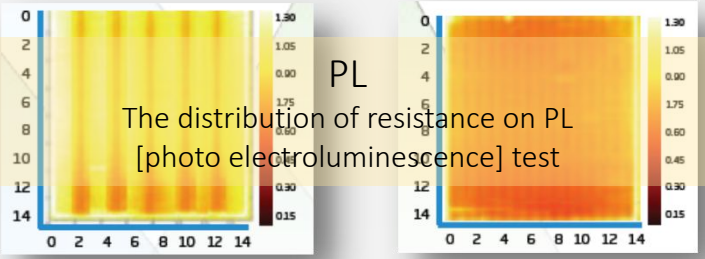


- Shadowing reduction
- Light trapping effect

Module Efficiency Improvement 0.4%~0.6%

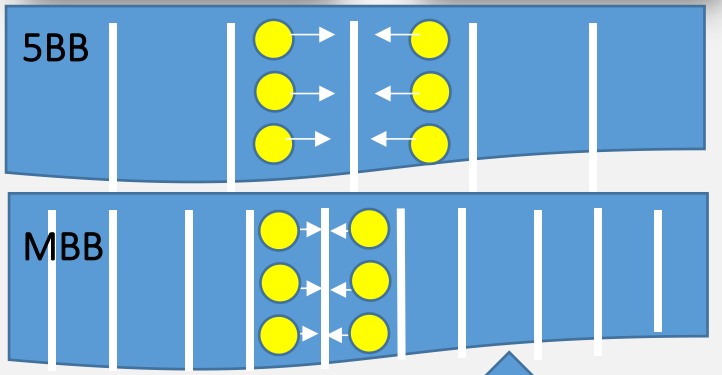
2 Electrical Performance

Power Improvement 1%~1.5%



PL

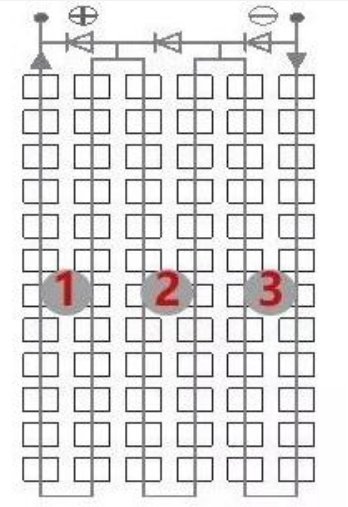
The distribution of resistance on PL [photo electroluminescence] test



- Shorten current path
- Lower cells resistance

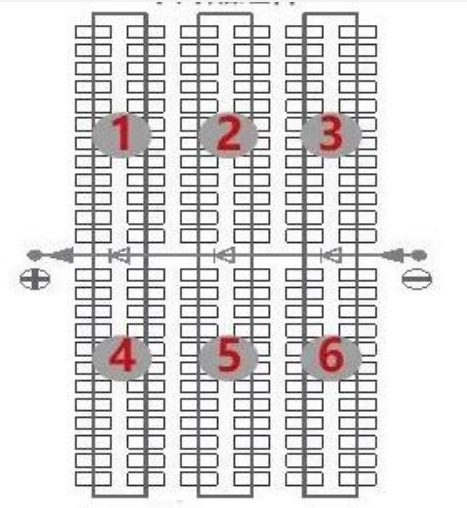
Mono PERC module with half-cut Technology

Full-cell



$P_{Hot\ spot} \approx 1/3P_{Module}$

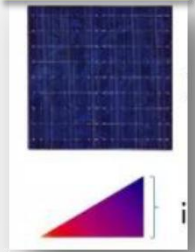
Half-cut



$P_{Hot\ spot} \approx 1/6P_{Module}$

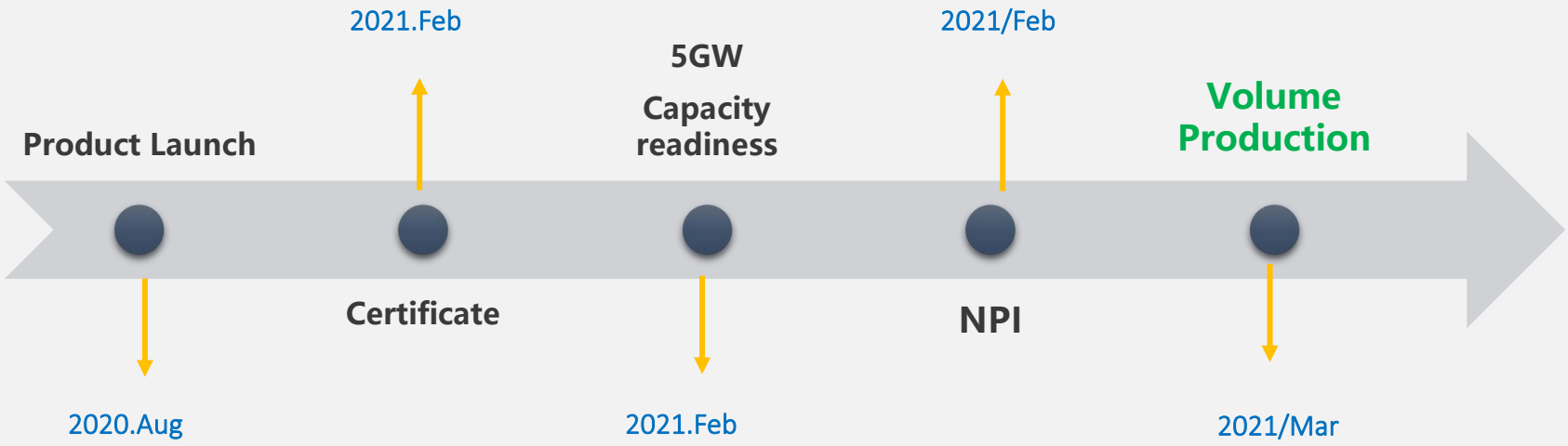
- High generating power, **low risk of hot spot.**
- Lower operating temperature, smaller temperature coefficient (~0.02% lower than full-cell), more power generation (3~4% more than full-cell module)

Full-cell



Half-cut

Module Certificate and Production Plan



Remark, NPI = New product introduction

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