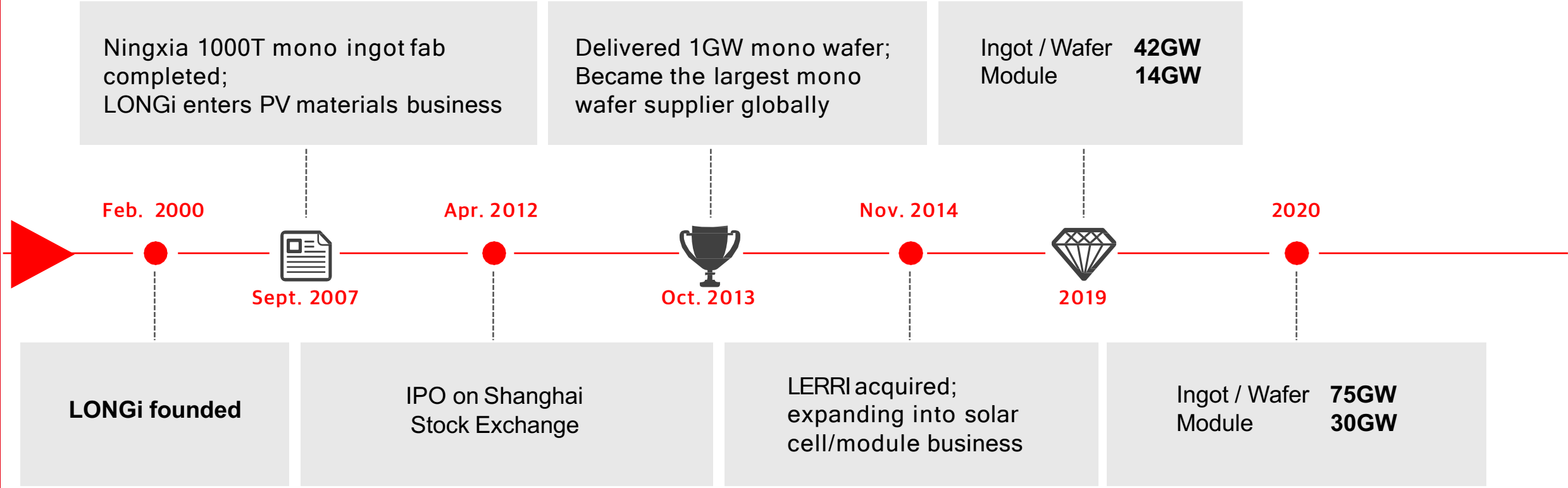
BIFACIAL SYSTEMS IN BRAZIL

Alan Akamatsu *06/24/2020*

LONGi

LONGi Milestone

Dedicated in Mono **20 years**



Production Capacity

Major module manufacturing factories*

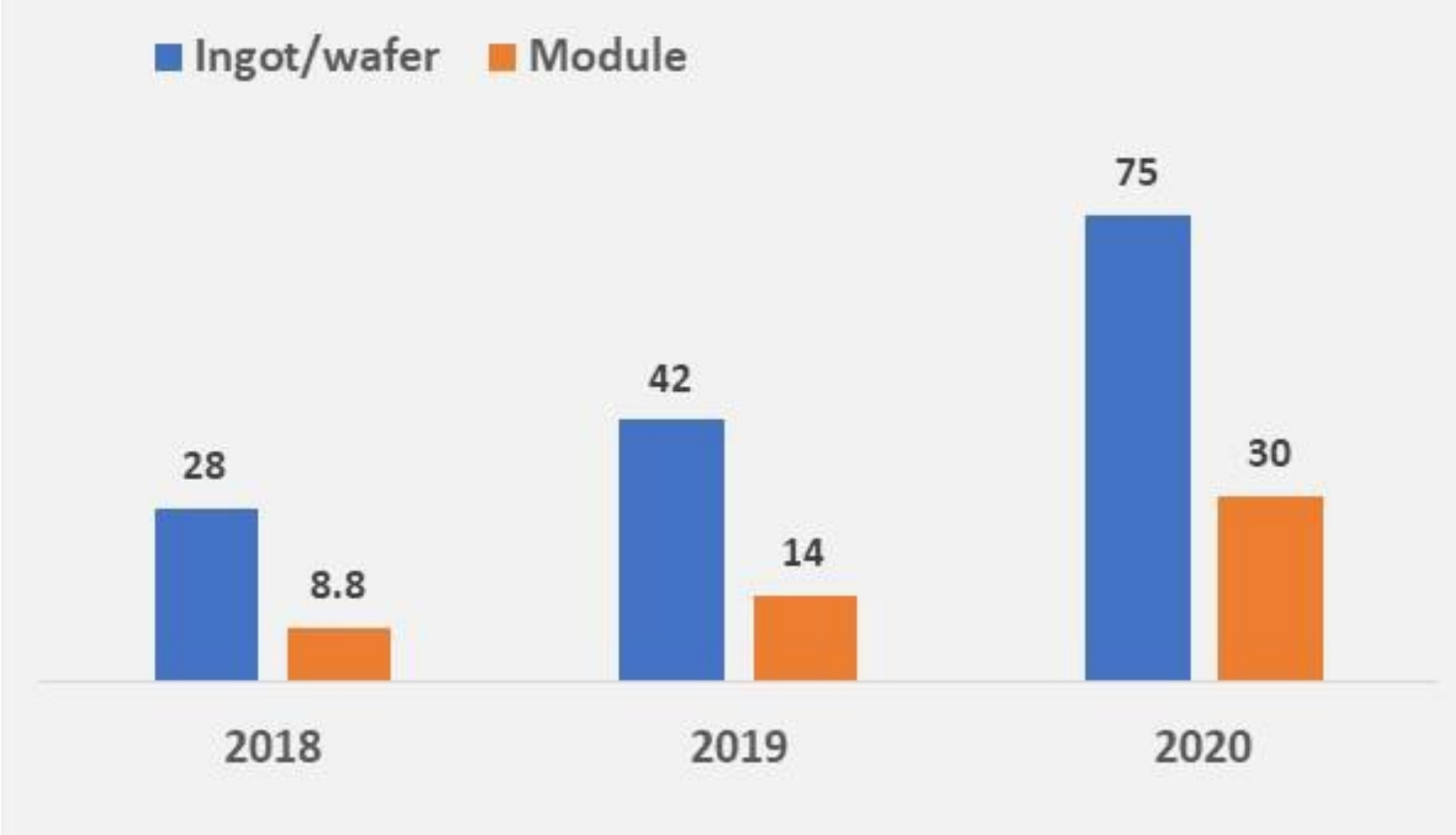
A	Yinchuan	500MW
B	Xi'an	500MW
C	Xianyang	5GW
D	Datong	500MW
E	Quzhou	2.5GW
F	Jiaxing	5GW
G	Chuzhou	10GW
H	Taizhou	7GW
J	Kuching, Malaysia	700MW
I	Vinasolar**	3.8GW

Product Series	Supply Capacity in 2020
Hi-MO 3	3.0GW
Hi-MO 4	21.5GW

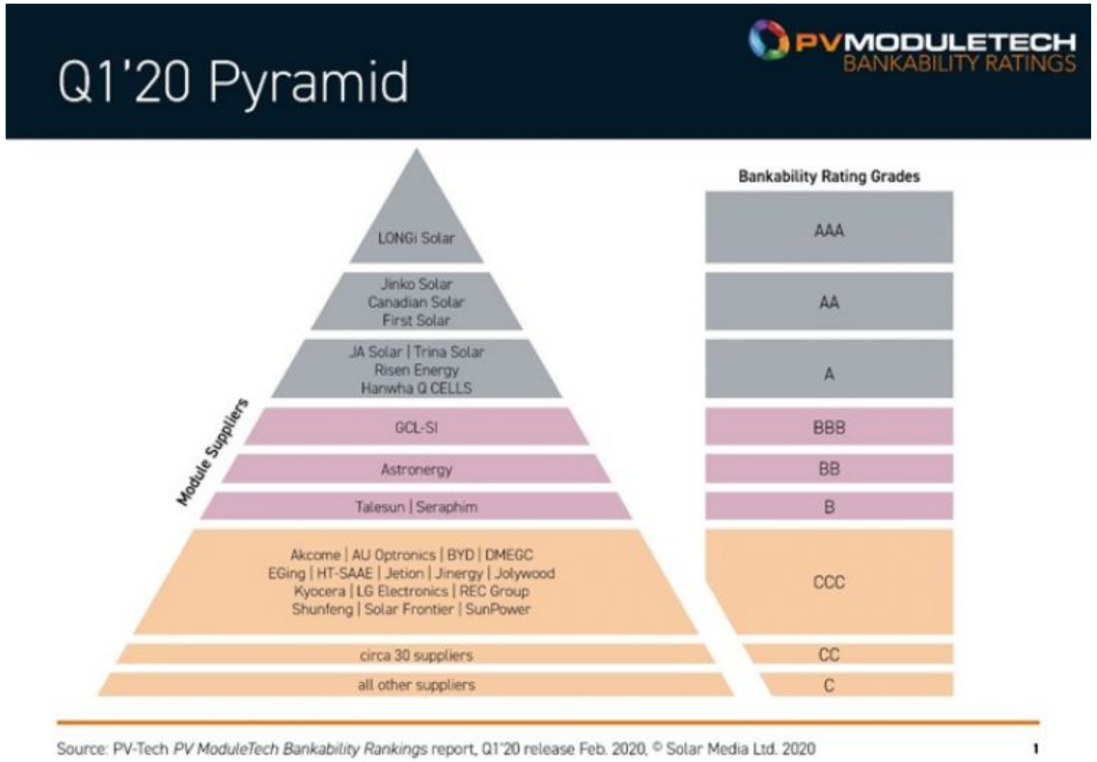
* *Capacity at the end of 2020*

** *Annualized foundry capacity for LONGi at the end of 2020*

LONGi Manufacturing Capacity (GW)



LONGi is One of Most Bankable Brand

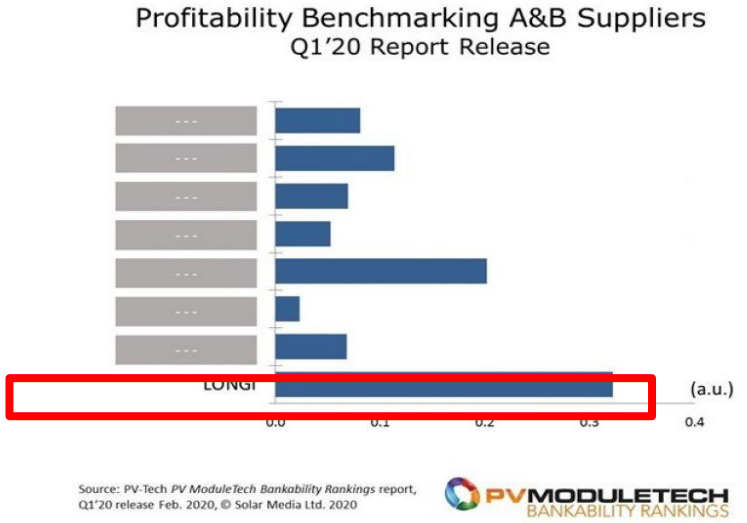


Source: PV-Tech.org

PV ModuleTech Bankability Rating:

- **AAA: LONGi**
- AA: 4
- A: 3
- BBB/BB/B: 7

Total module suppliers: a few hundred



Propelling the transformation

Leadership

Industry leading financial health

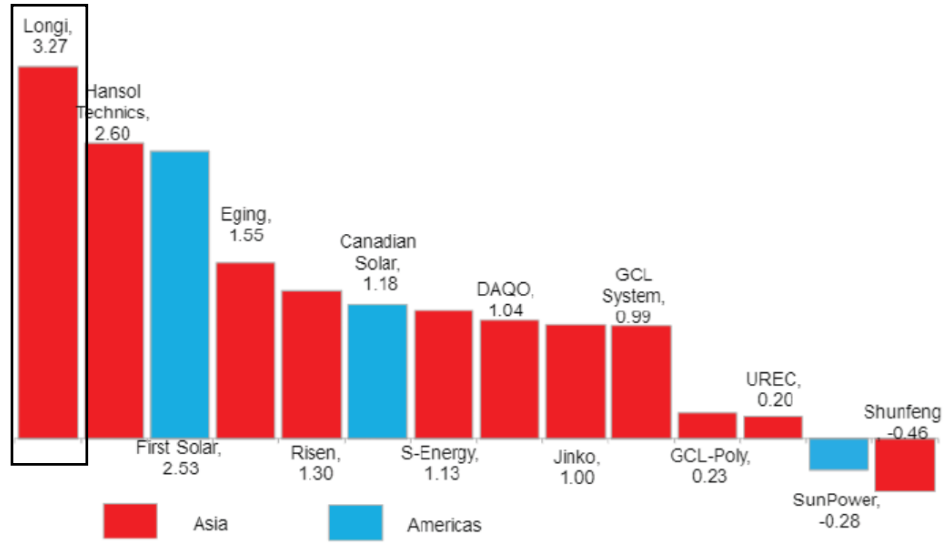
Table 3: Photovoltaic module manufacturers meeting BloombergNEF's tier 1 criteria as of 2Q 2020

Firm/ brand	Annual module capacity, MW/year	Firm/ brand	Annual module capacity, MW/year
ZNShine	3,500	Jolywood*	3,000
Wuxi Suntech*	4,500	Jinneng/ Jinergy	2,700
Waaree*	2,000	Jinko*	16,000
Vietnam Sunergy (VSUN Solar)*	1,500	Jetion	2,500
Ulica Solar	800	JA Solar*	15,000
Trina Solar*	10,500	Hyundai*	600
Talesun*	6,200	HT-SAAE*	1,500
Swelect	140	Hengdian DMEGC	1,000
SunPower/ Maxeon*	2,800	Heliene*	390
Sumec/ Phono Solar*	2,000	Hanwha Q-Cells*	10,700
Sharp	210	Goldi Solar	500
Seraphim / SEG*	5,000	First Solar*	6,200
S-Energy	530	Eging	5,200
Risen Energy	11,100	Chint/Astronergy*	4,200
Recom Solar	730	Canadian Solar	13,000
Neo Solar Power/ URE	1,800	BYD	2,400
Longi*	20,000	Boviet*	1,000
LG Electronics*	2,400	Adani/Mundra*	1,500
Leapton Energy	600	**Total**	**163,700**

*Source: BloombergNEF Note: Methodology here. Note: * denotes a company for which technical due diligence reports are available from PVEL. Contact Tara.Doyle@pvel.com for details.*

This quarter, BNEF is displaying the Tier 1 list in reverse alphabetical order.

Figure 11: Altman-Z scores of quoted pure-play PV makers, 1Q 2020 or full-year 2019



Source: BloombergNEF

Consistent Investment in R&D

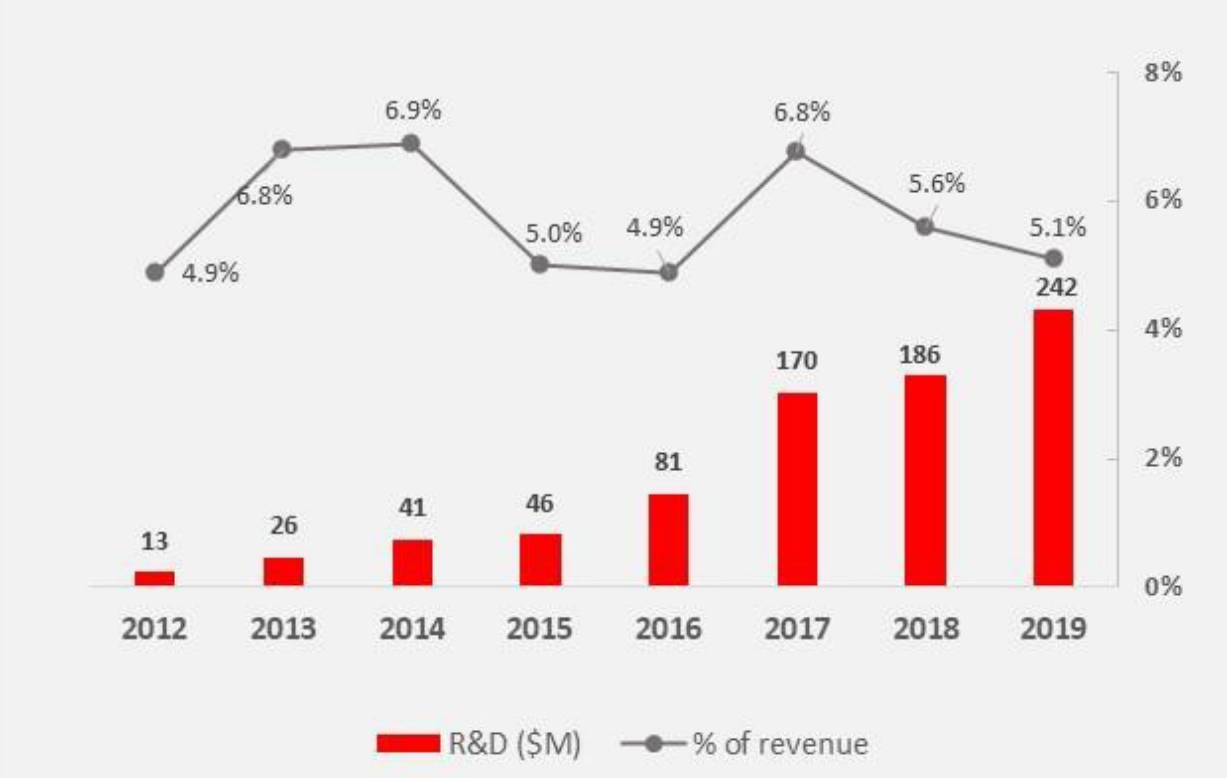
> $800M

2012-2019 accumulated

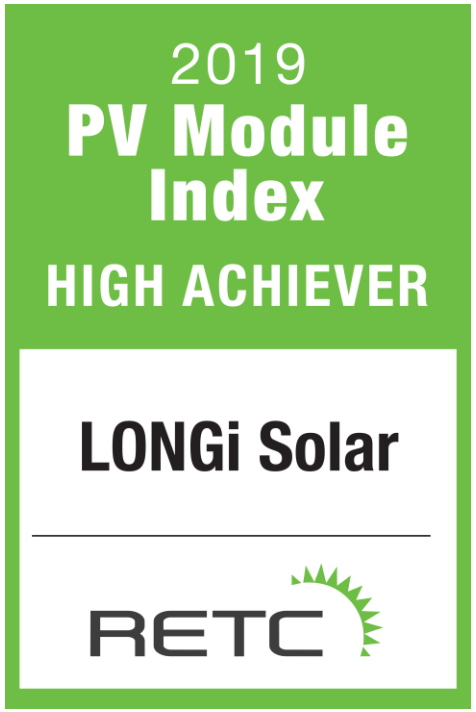
R&D spending **5-7%**
(of revenue)

702 patents awarded

630 staff member(R&D)



High Quality and Reliability



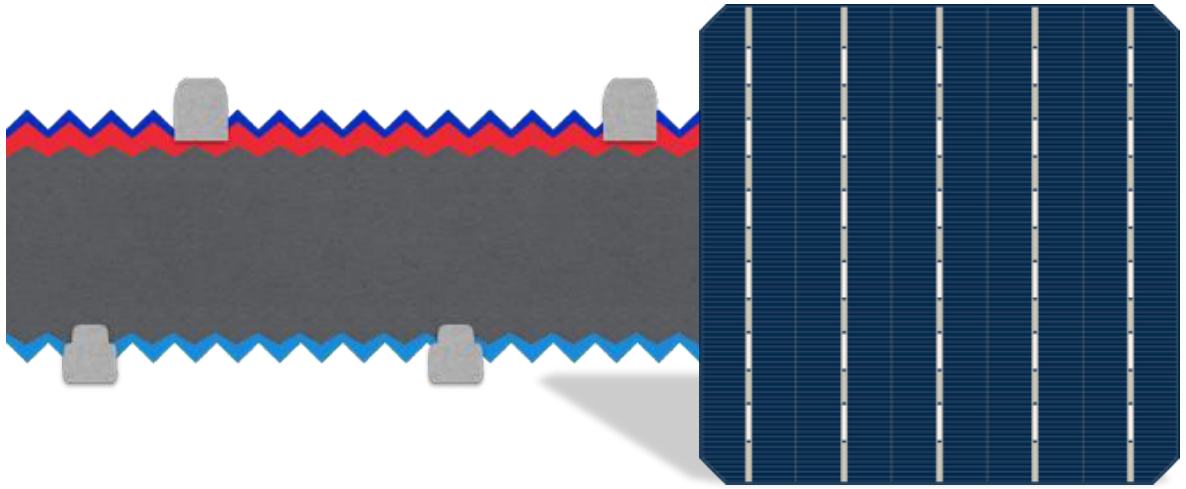
LONGi Solar is 1 of 2 Overall High Achievers in RETC's inaugural PV Module Index;

LONGi Solar has been named Top Performer in 4 consecutive years in PVEL's PV Module Reliability Scorecard

Cell w/ M6 wafer

(166mm)

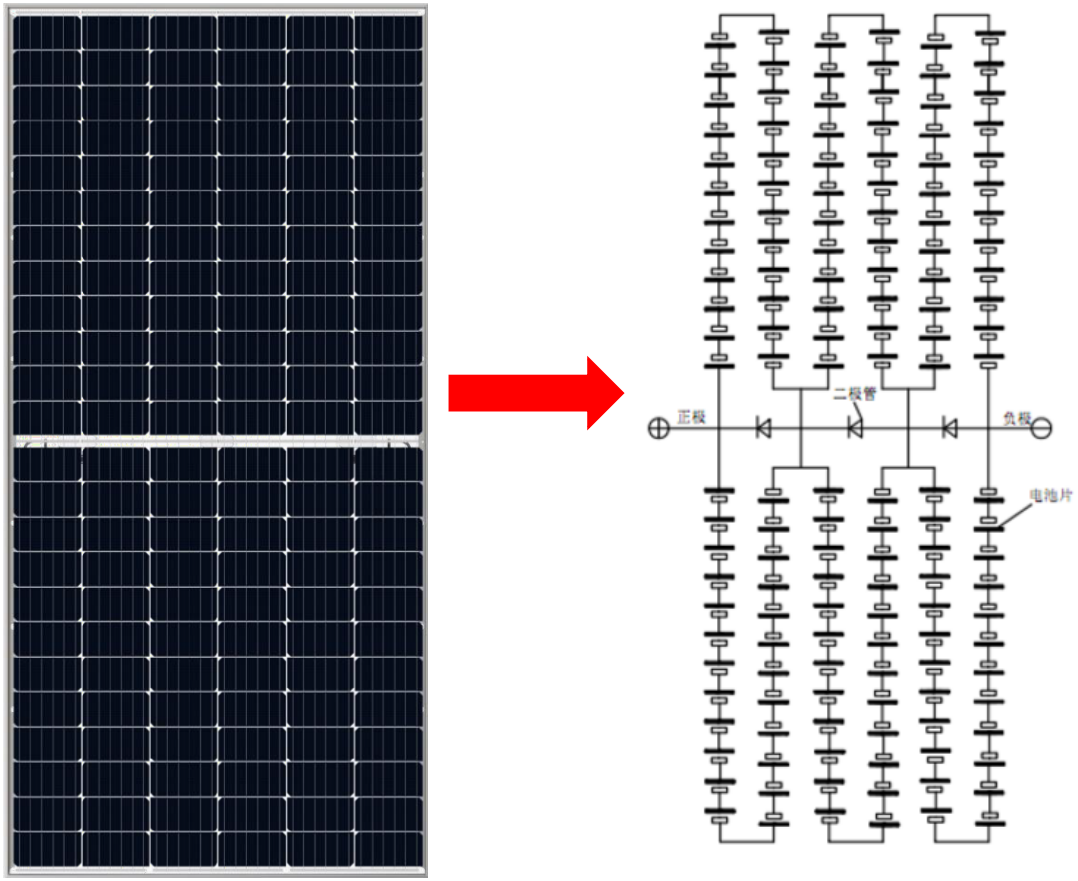
Bifacial PERCcell structure



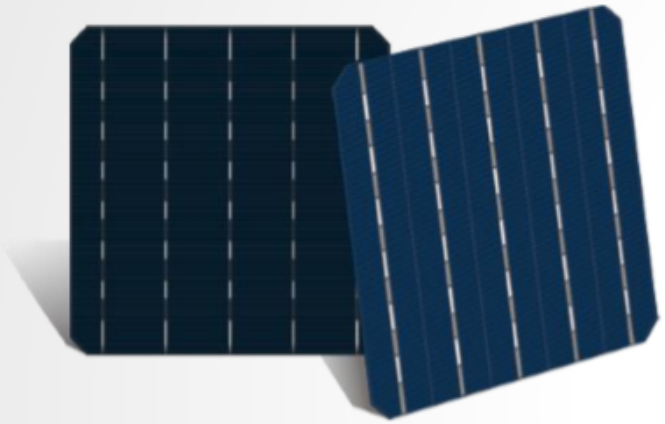
Hi-MO 4

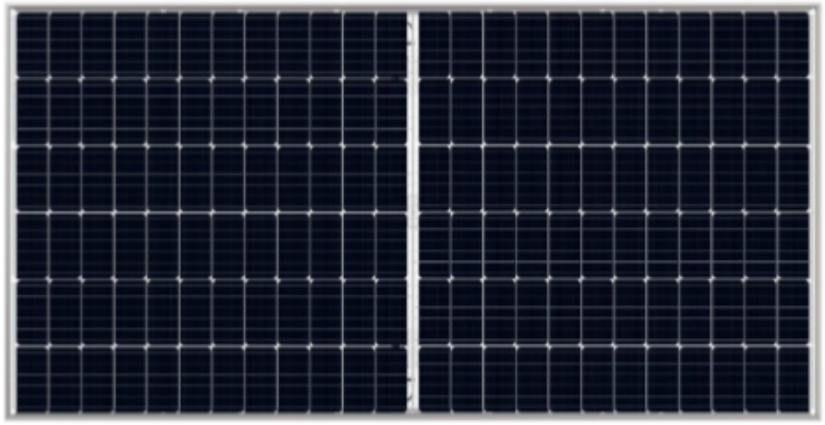
Half – cut Mono/Bifacial Perc with M6 wafer

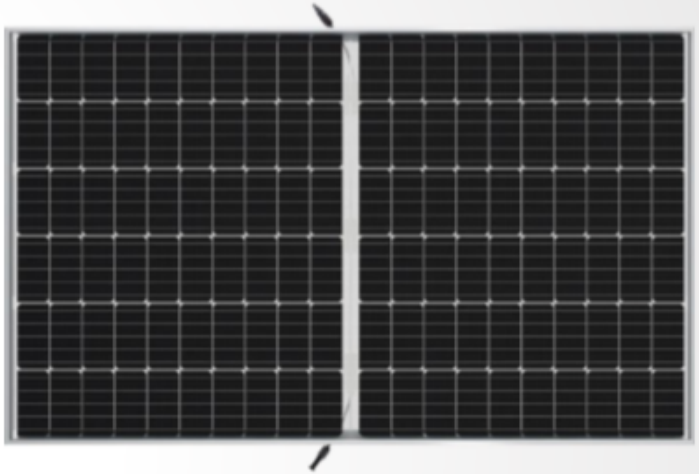
LONGi Hi-MO 4 series products are monocrystalline bifacial modules using the new **M6 (166mm) silicon wafer** that delivers the highest power in the modules. LONGi's advanced R&D technology led the upgrade of silicon wafer size from M2 to M6, and ushers in the era of the 166mm standard. LONGi M6 silicon wafer technology enhances the power of the modules, with front side power up to **450W**. The results are BOS savings and the lowest LCOE for the photovoltaic project.



LONGi Breaks World Record







Cell Efficiency
24.06%

72-Cell Module Power
500.5W

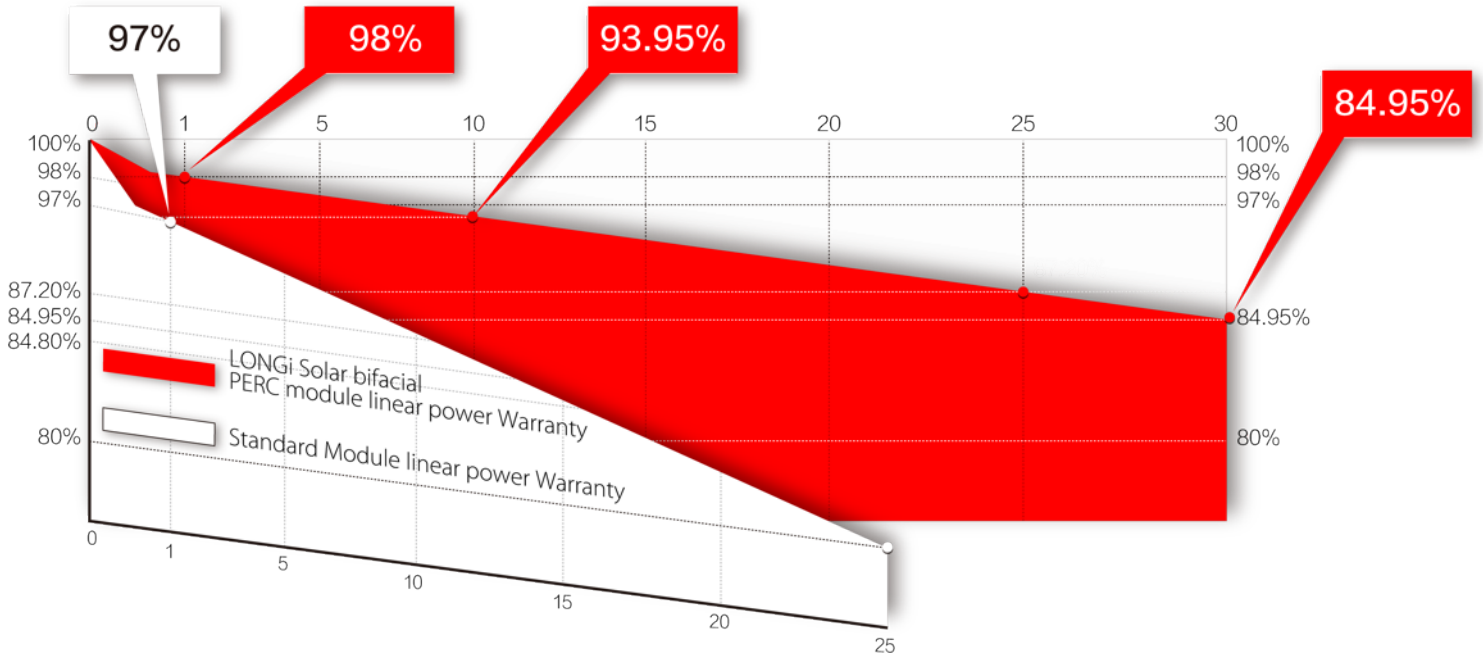
Module Efficiency
22.38%

Jan. 2019

May 2019

Jan. 2020

Bifacial Module Power Degradation Warranty



WARRANTY

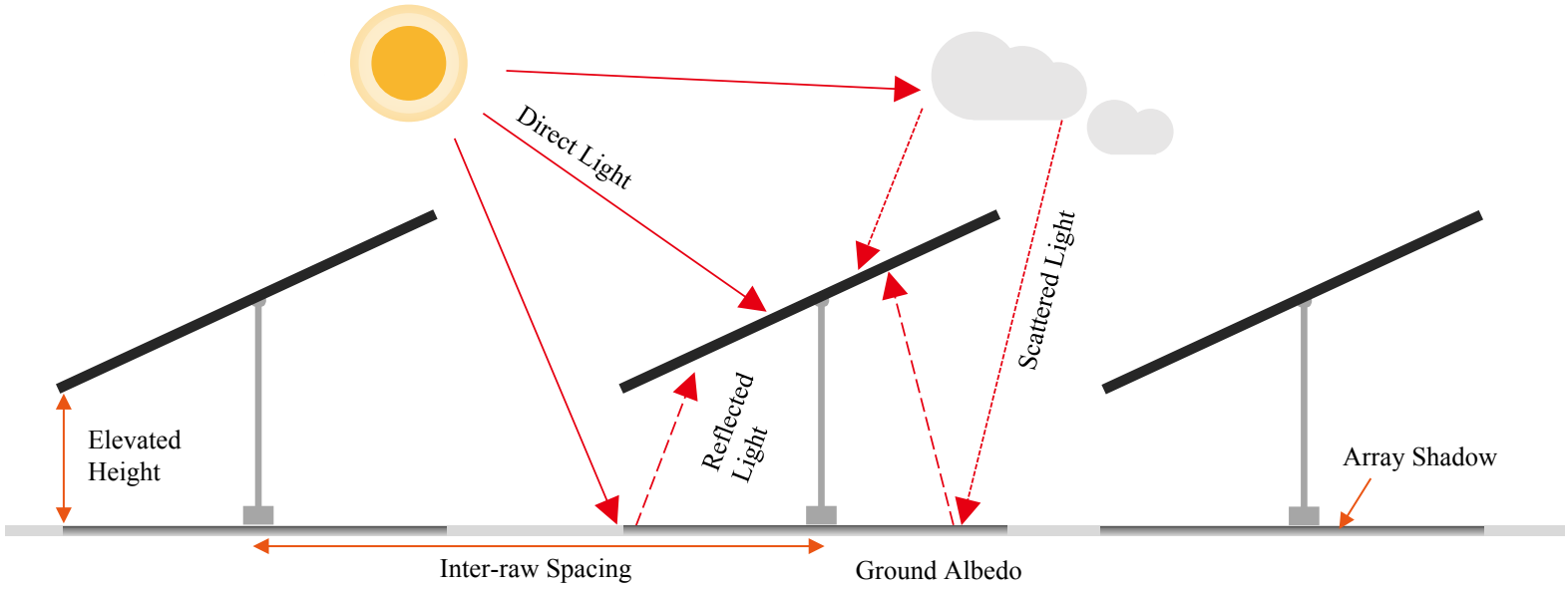
12Y	MATERIAL& CRAFTWORK
10Y	POWER-OUTPUT >93.95%
30Y	POWER-OUTPUT >84.95%

- 12-year product warranty
- 1st year power degradation <2%, 0.45% annually through 30 years

Bifacial Technology for Hi-MO series

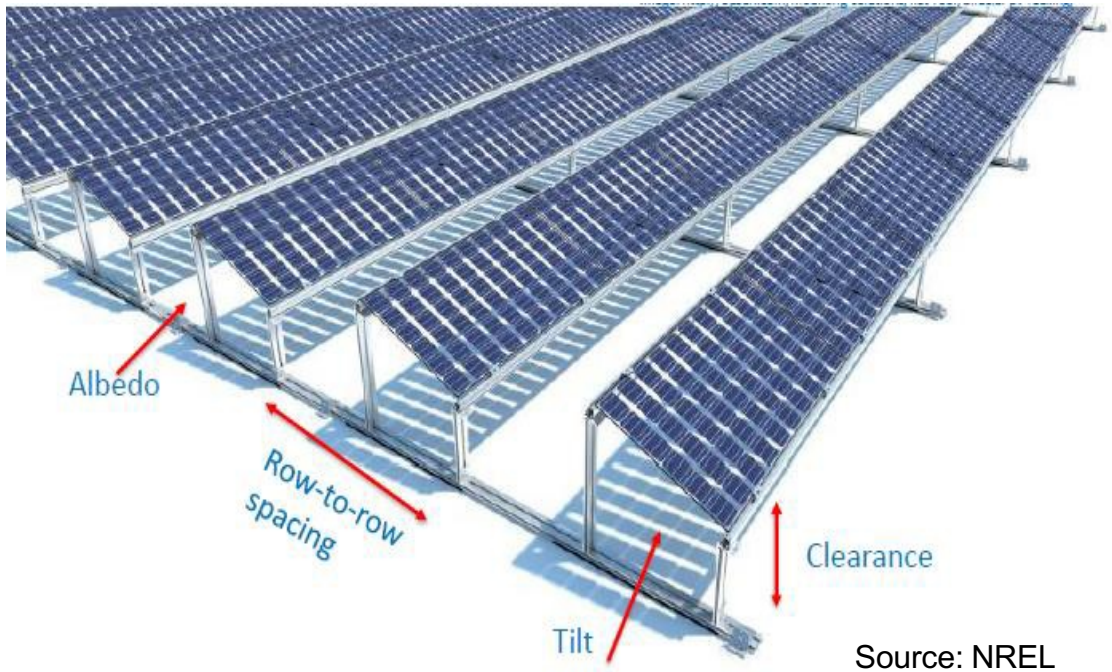
No. 1 in bifacial modules worldwide shipments

The highest cost-performance ratio of bifacial modules is achieved with **P-type mono PERC technology** of which LONGi has led in large-scale commercialization.



System Design with Bifacial Module

Main Parameters to consider:	
Albedo	↗
Clearance/height	↗
Racking	No backside shading
Row spacing (GCR)	↗ (↘)
Inverter DC/AC ratio	↘



Source: NREL

Backside Energy Yield:
Albedo

Dry Sand
Albedo:
0.2-0.35

Grassland
Albedo:
0.26

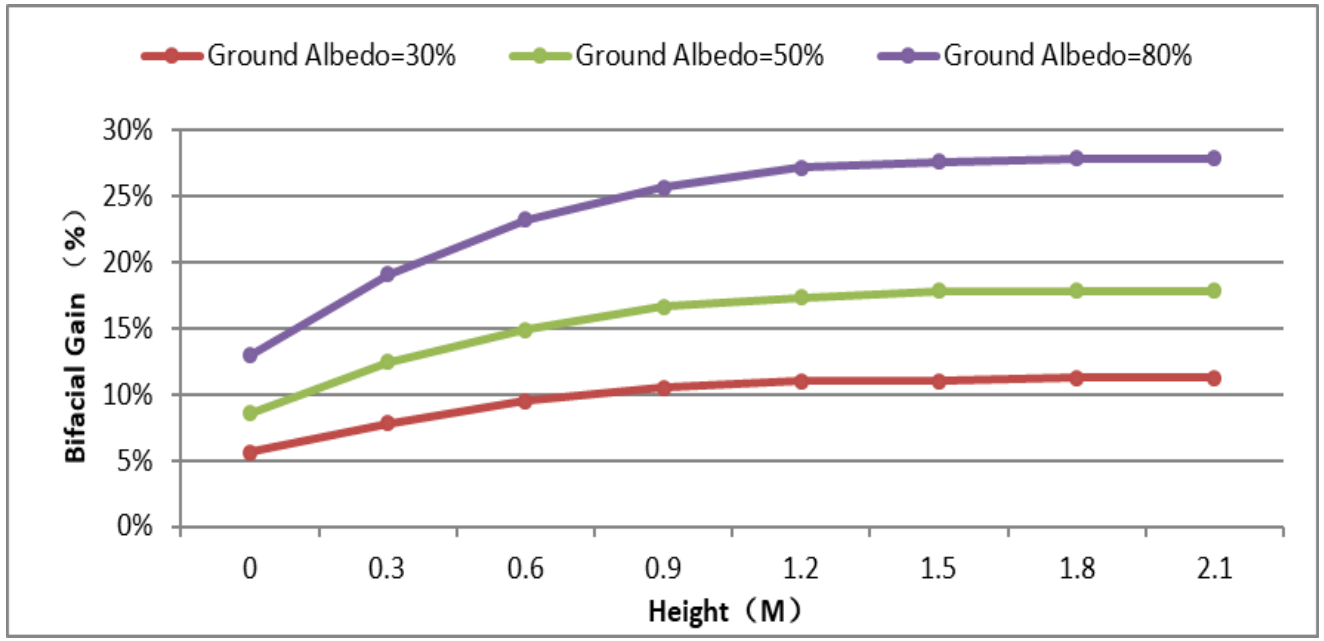
Cement
Albedo:
0.25-0.35

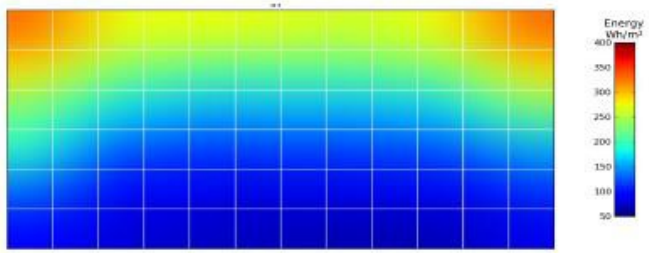
New Snow
Albedo:
0.82

Red Tiles
Albedo:
0.33

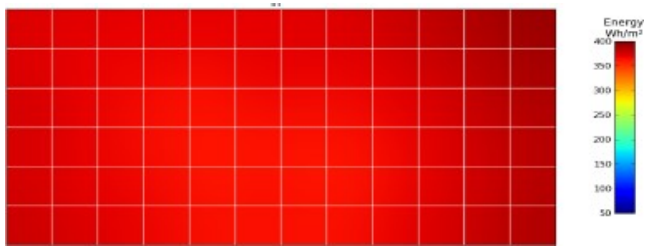
Dry asphalt
Albedo:
0.09-0.15

Backside Energy Yield:
Albedo and Height





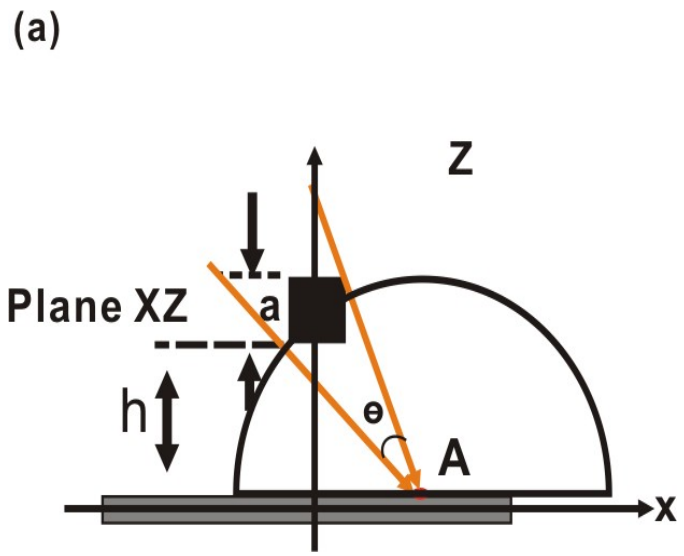
Irradiance at backside - Clearance 8 cm

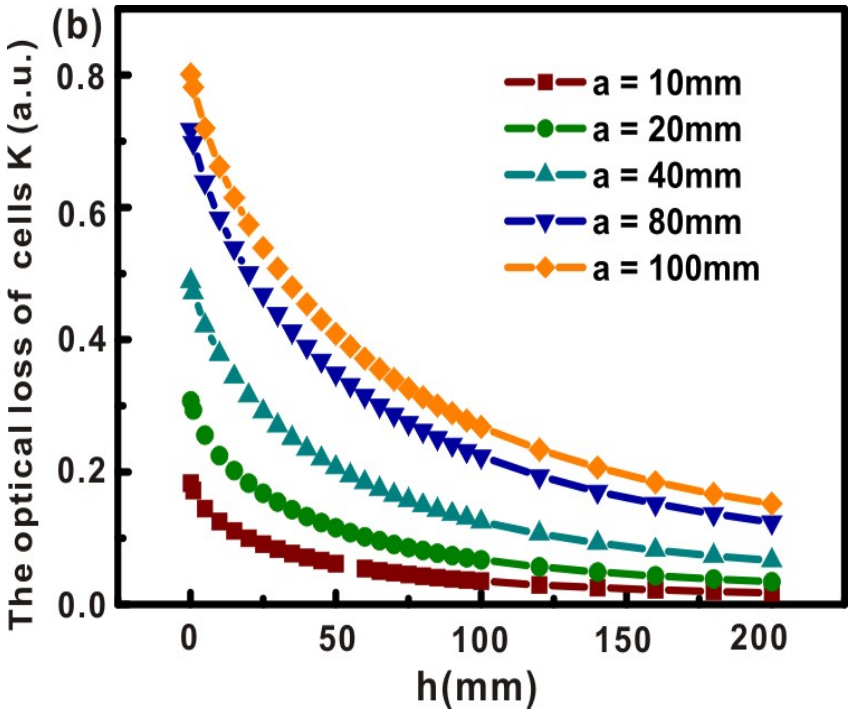


Irradiance at backside - Clearance 108 cm

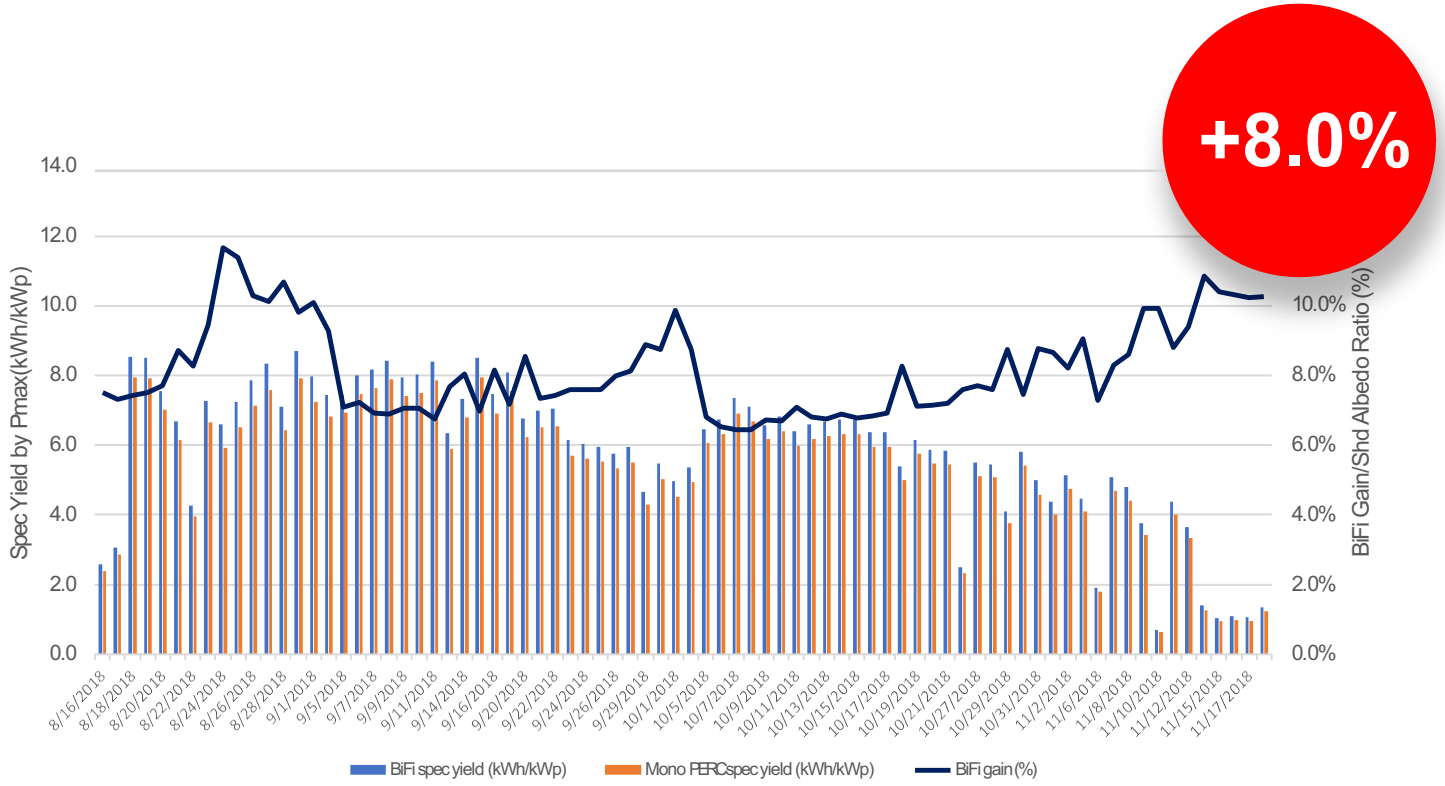
Bifacial System Design:
Shading Impact

Simulation Result of Optical Loss with Rack Clearance and Thickness





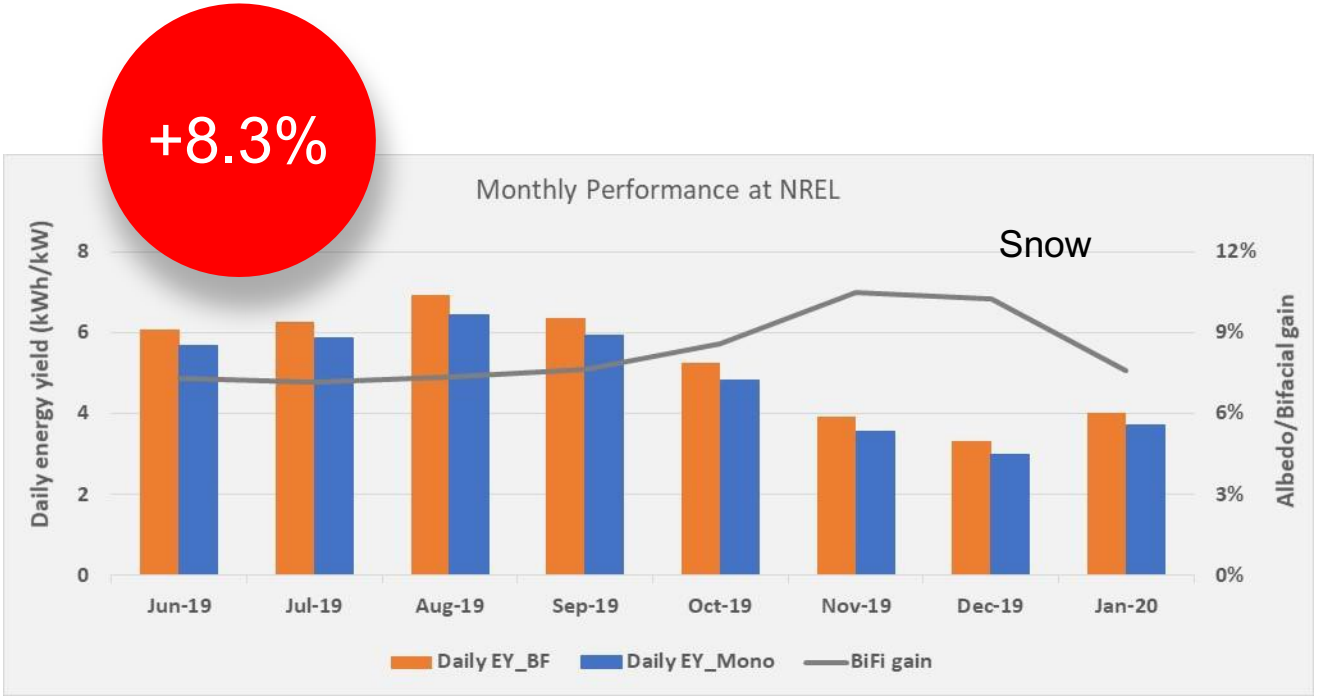
Bifacial Field Performance



Site	Livermore, CA
Sample Size	6 Mono + 6 BiFi
Mounting Type	Single-Axis Tracker
Surface Type	Gravel
Data Resolution	Module-level (via DC Optimizer)

- 6 modules on **SAT** system established and monitored by **3rd party lab RETC/B&V** in California (N37.7,W121.7)

Bifacial Field Performance: NREL



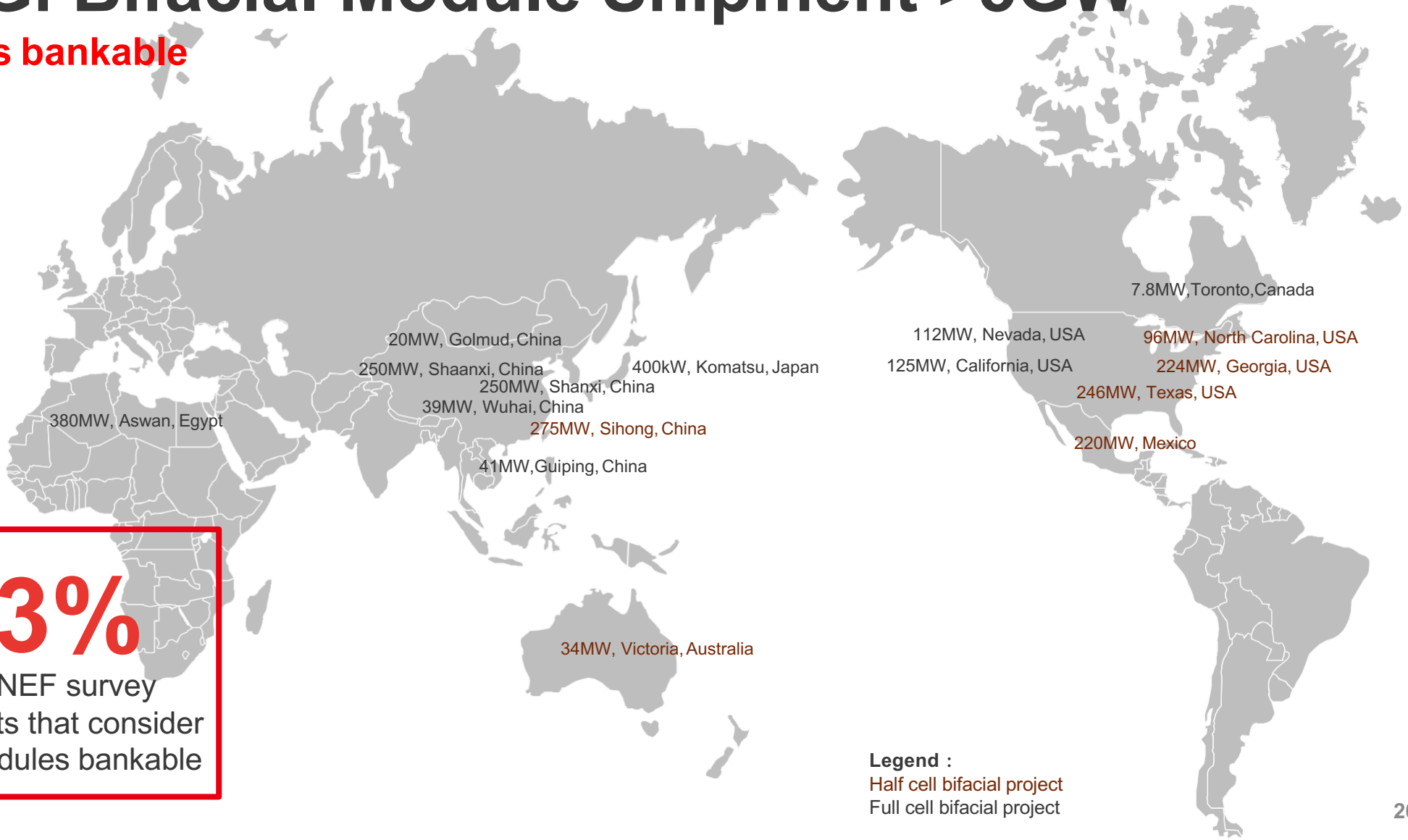
Site	Golden, Colorado
Sample Size	20 module each string
Mounting	SAT, GCR 0.35
Surface Type	Dry land/grass (Albedo ~20%)

- 20 module **SAT** system established and monitored by **NREL** in Colorado (N39.8°, W105.2°)
- Bifacial gain of **8.3%** has been demonstrated with 8 months data acquisition
- Higher bifacial gains with snow in winter months (Oct - Jan)

LONGi

LONGi Bifacial Module Shipment >5GW

Bifacial is bankable



83%

2019 BNEF survey respondents that consider bifacial modules bankable

LONGi

Propelling the transformation