Soltec

Bifacial PV Tracking

Designing Bifacial PV projects

Soltec

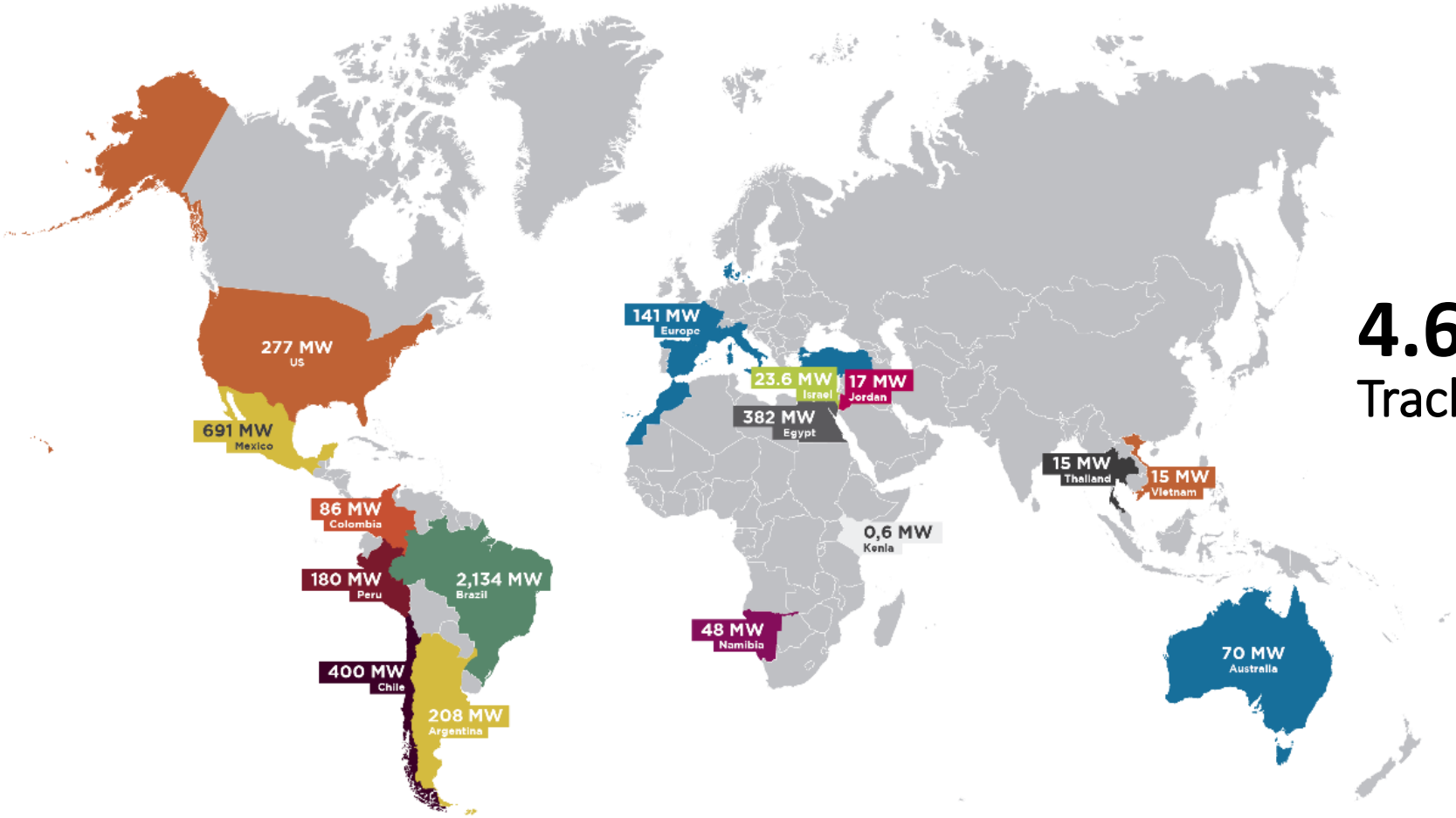
Soltec specializes in the manufacture and supply of **single-axis solar trackers** with global operations and a workforce of **over 750 people** blending experience with innovation.

- ✓ **Top-tier** manufacturer and supplier
- ✓ Tracking Specialist with **14 years history**
- ✓ Specialist in **customer experience** and innovation
- ✓ Investor in **growth and people**
- ✓ **Global supplier** with **regional operations**

14 Years
Company History

1+ GW
Annual Sales

Top 3
Global Tracker Supplier (2017)



4.6+ GW
Track-record

Soltec bifacial: evolution

2015

Soltec produced **the first solar tracker specifically designed for bifacial modules** installed in a utility scale solar plant, La Silla.

2017

Soltec launchs SF7 Bifacial Single-Axis Tracker

- Higher mounting height
- Shadow-free backside
- Wide-aisle reflecting surfaces

2018

Soltec leads with world's first bifacial tracker evaluation center (BiTEC)

Soltec supplies SF7 Bifacial Single-Axis Tracker to 17 MW PV project in Israel

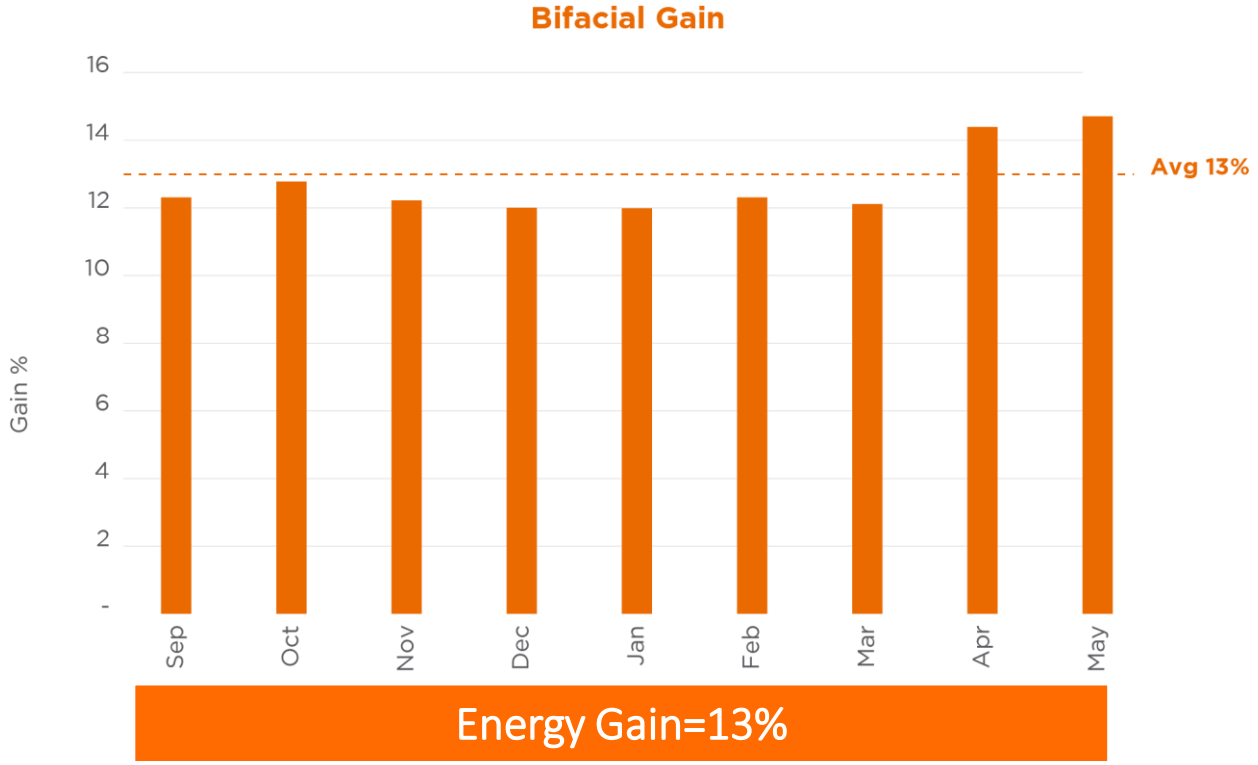
1.1+ GW

SF7 Bifacial contracted for 2019

Case Study: La Silla (Chile, 2015)

Soltec's tracker. PV tracking plant La Silla (Coquimbo).
First bifacial tracker designed, supplied and installed worldwide.

Case Study: La Silla (Chile, 2015)



	Gain=12%	Gain=15%
ΔLCOE	-5.3%	-7.2%
ΔIRR	5.7%	9.1%


GCR=0.33, PV bifacial module

Source: Agnese Di Stefano, Giuseppe Leotta , Fabrizio Bizzarri,Enel Green Power SpA (2017) 'La Silla PV plant as a utility-scale side-by-side test for innovative modules technologies'. 33rd European Photovoltaic Solar Energy Conference and Exhibition.

Bifacial: New vision for a PV plant design

Monofacial tracking PV plant Vs. Bifacial tracking PV plan

+ Energy production kWh/kWp **Vs.** Smaller plant − KWp for = kWh

	Same peak power	Same production
Peak power	50 MWp	43,85 MWp
Module units	=	↓12%
Module price	↑ 10%	↓ 4%
Tracker units and price	=	↓ 12%
DC-AC-MV	↑ 10%	=
Labour structure	=	↓12%
Civil Works	=	↓ 12%
Labour DC	=	↓ 12%
kWh/year	↑ 14%	=
Final price	↑ 6%	↓ 7%

- Lower GCR
- Less structure
- Less cable
- Better price for installation

Case: Albedo: 40%, GCR: 0.33 → Bifacial Gain: 14%

BiTEC (Livermore, California)

The mission of Soltec's **Bifacial Tracker Evaluation Center (BiTEC)** is to perform rigorous assessment of installation and control parameter influences on bifacial tracking performance compared to other bifacial PV applications.

- Modules: performance comparison
- Tracking systems vs. fix-tilt systems
- Albedo from different soil types
- Influence of pitch (GCR)
- Influence of tracker height
- Interferences losses: shading influence

$$E_{bifacial} = E_{monofacial} \times (1 + \boldsymbol{Bifacial\ Ratio} \times \boldsymbol{bifaciality})$$

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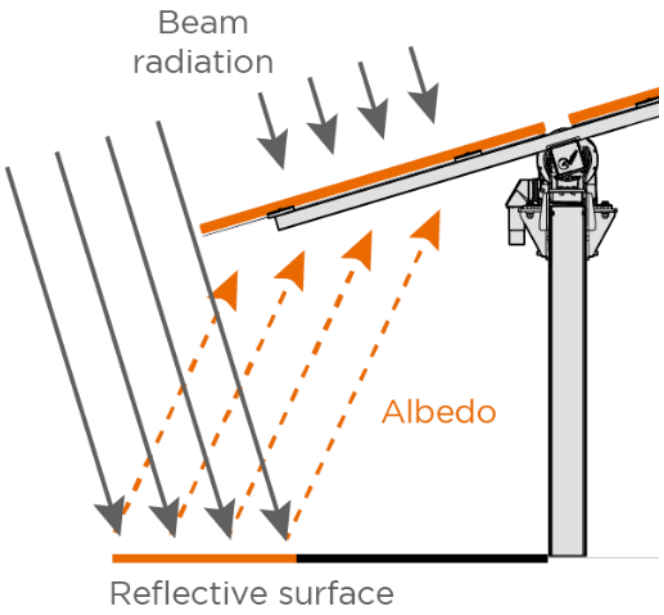
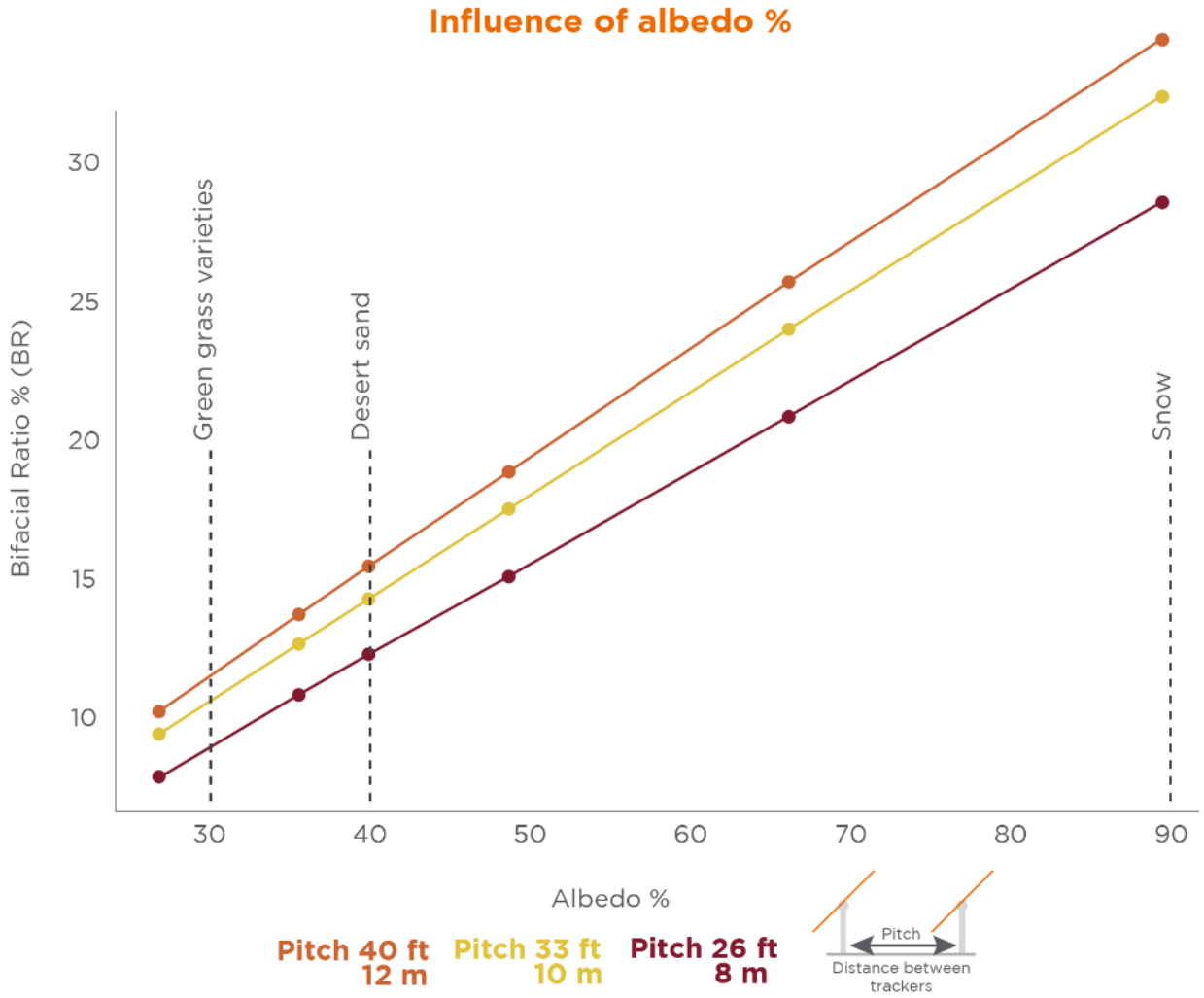
Maximizing energy gain

Albedo: Soil surface (Bifacial Ratio)

- ✓ Surface´s size between rows of trackers determinates the reflected surface.
- ✓ Approximately linear





$$E_{bifacial} = E_{monofacial} \times (1 + \boldsymbol{Bifacial\ Ratio} \times \boldsymbol{bifaciality})$$

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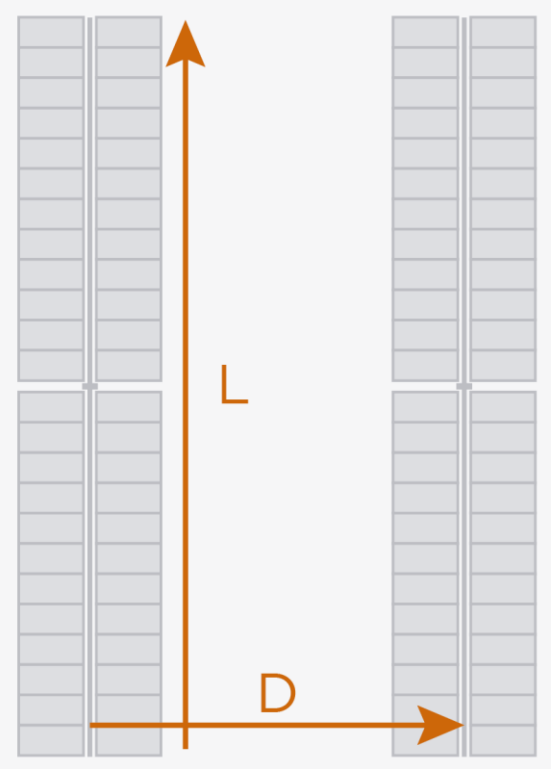
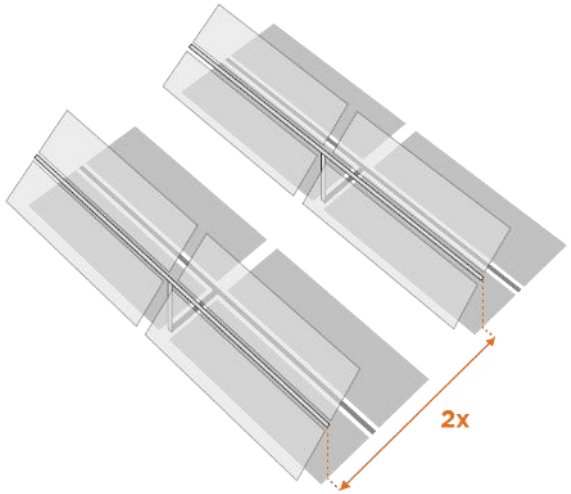
Maximizing energy gain

↑ Pitch => ↑ Reflected Area

↓ GCR => ↑ Bifacial Energy

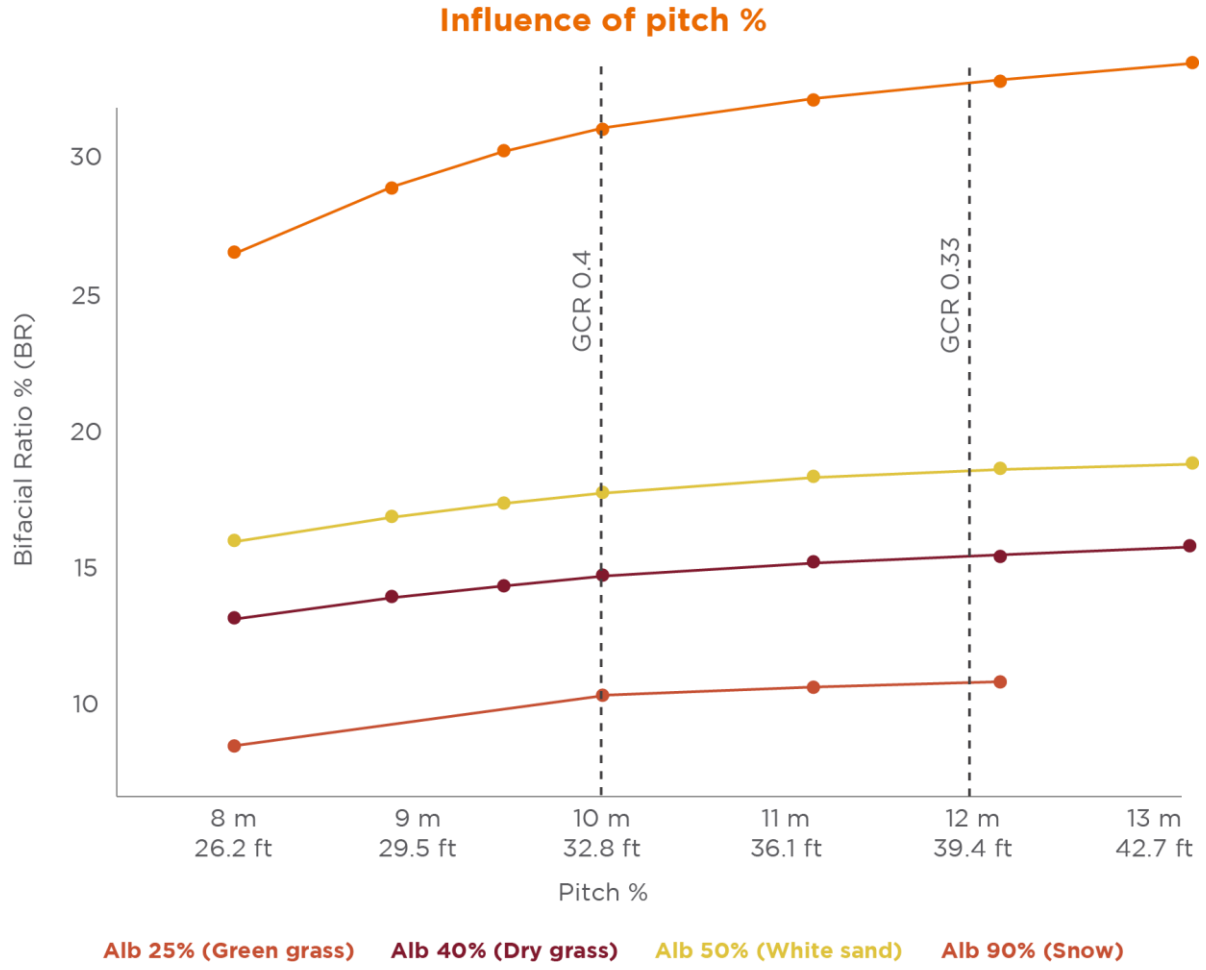
Pitch is relevant: ↑ surface = ↑ energy gain.





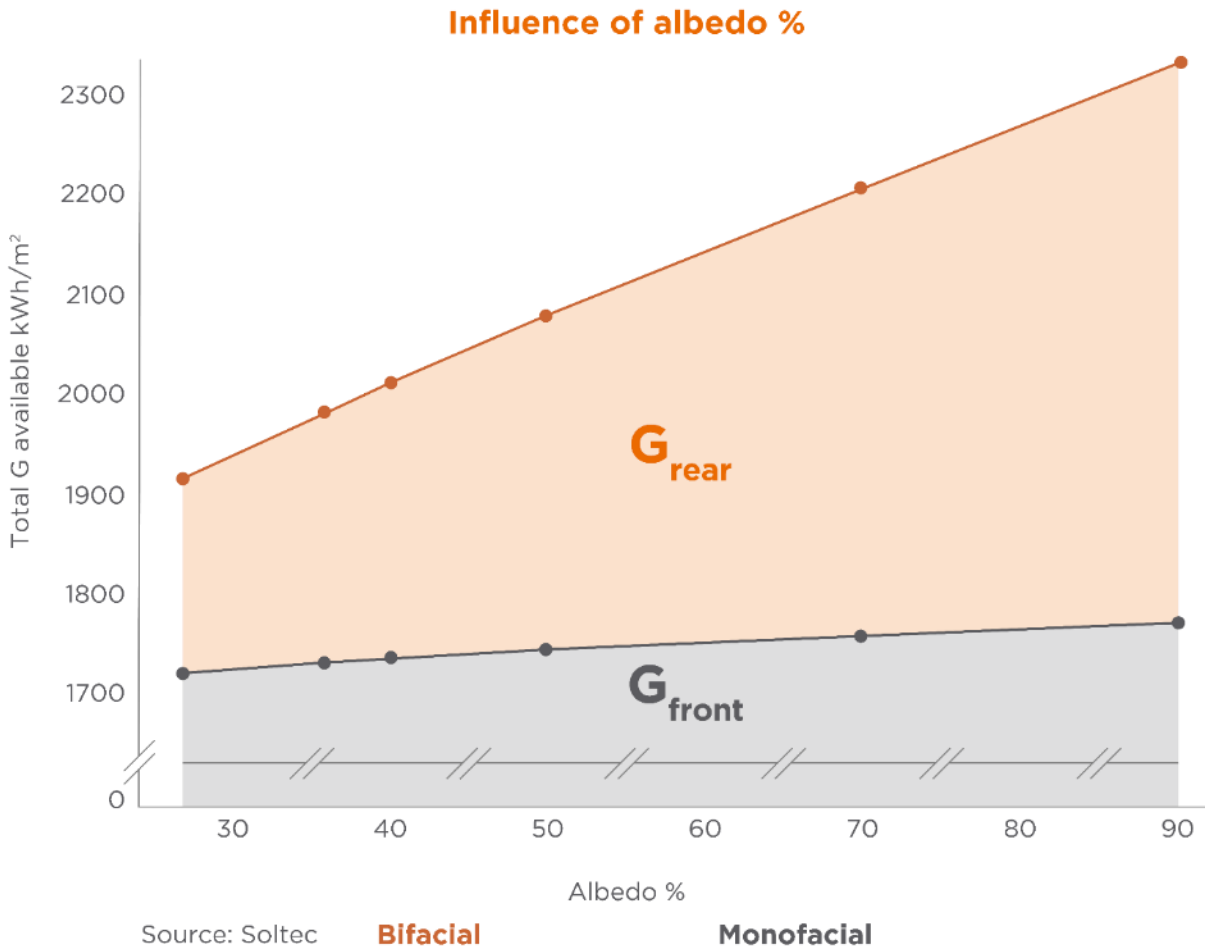
X2 Wider Aisles
Maximize reflected solar energy (albedo) while improve O&M accessibility for modules washing and vegetation control.

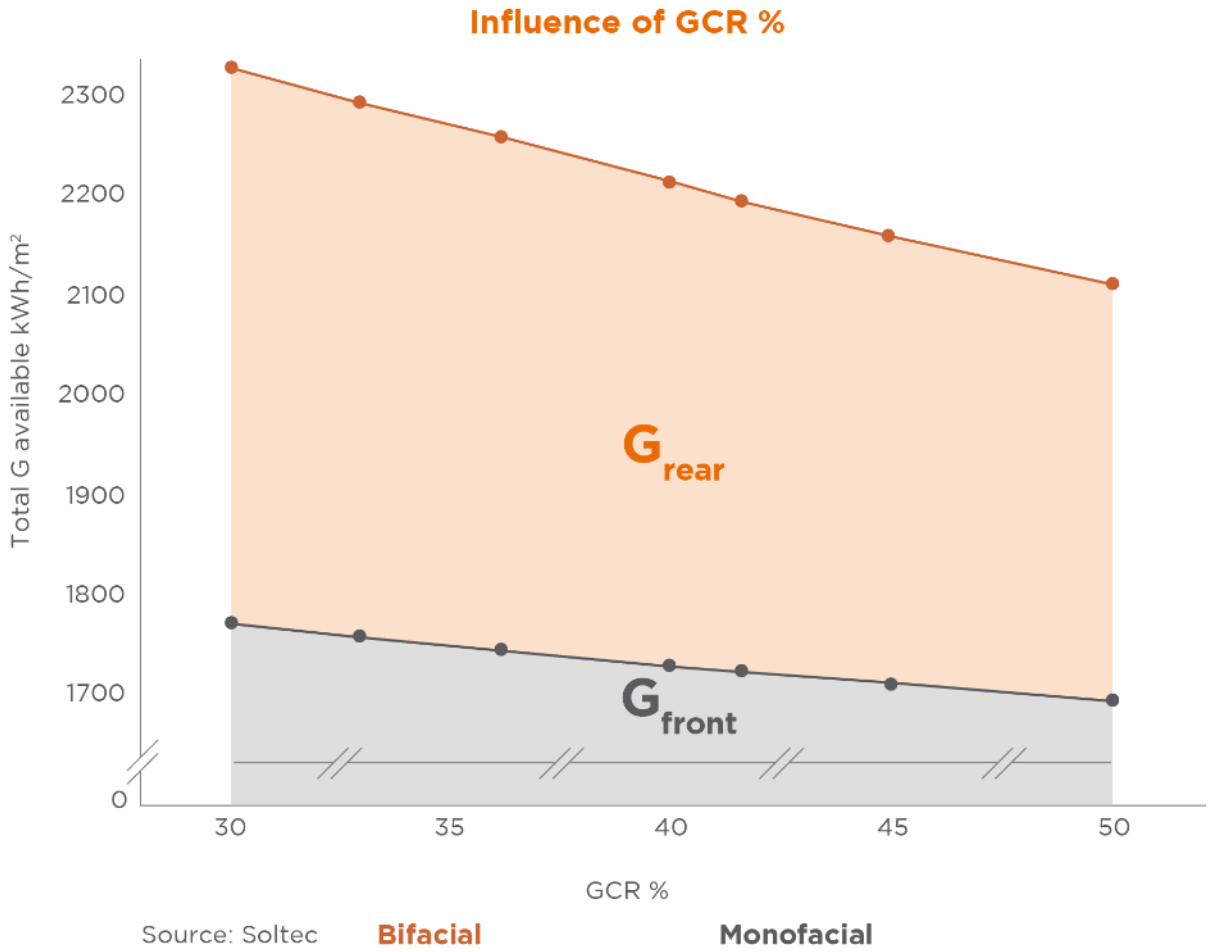
GCR: Ground Coverage Ratio (tracker width/pitch)



Comparing energy gain

Available Energy Irradiation = G front+ G rear

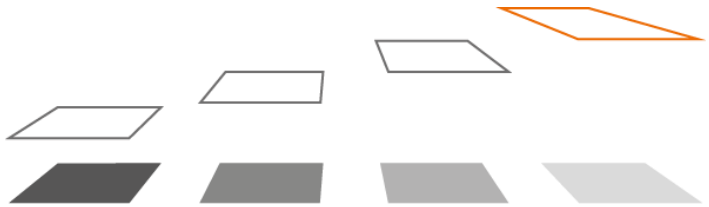




Comparing energy gain

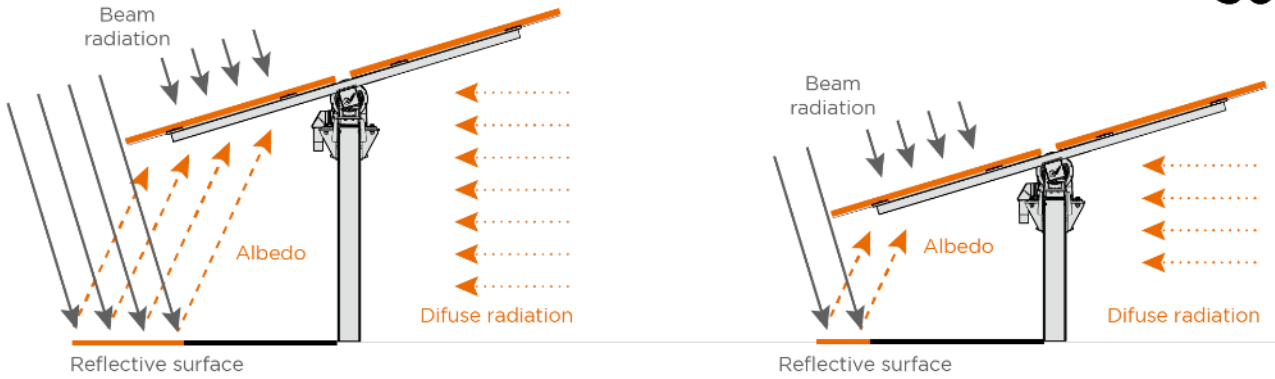
View factor: Height of the tracker

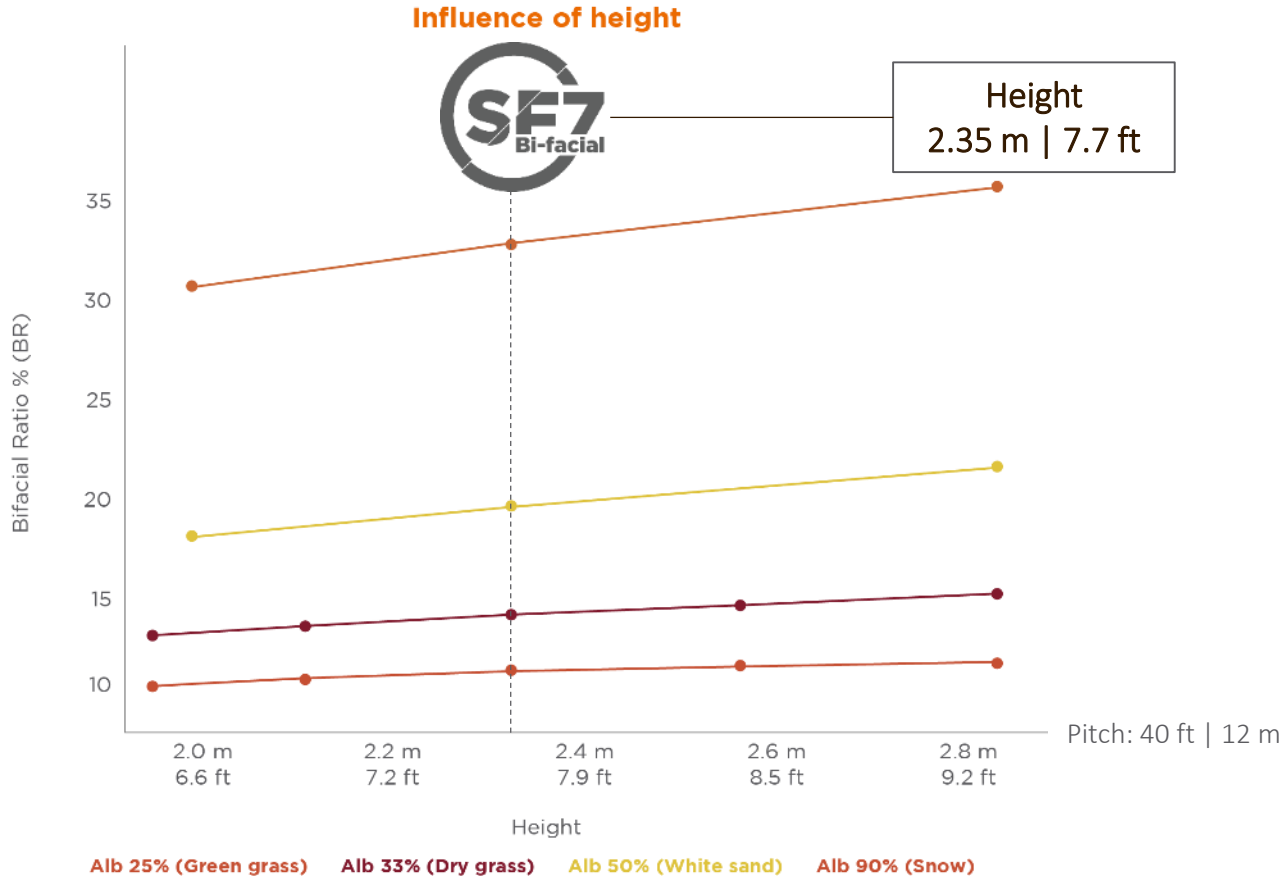
- ✓ The height of the structure is directly correlated with:
  - ✓ The area that reflects
  - ✓ Diffuse input
- ✓ The higher, the more gain energy.

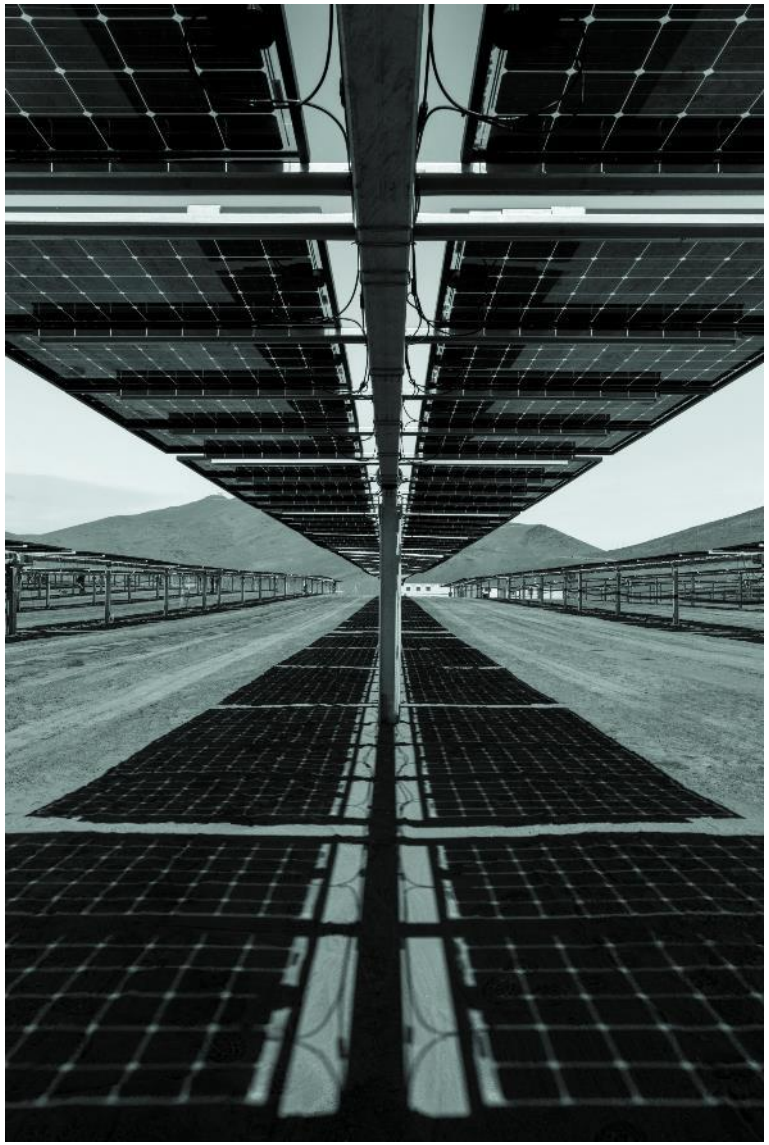


Taller Tracker

Bifacial performance is increased by height of installation, reducing shadow intensity projection.







Shading = interference

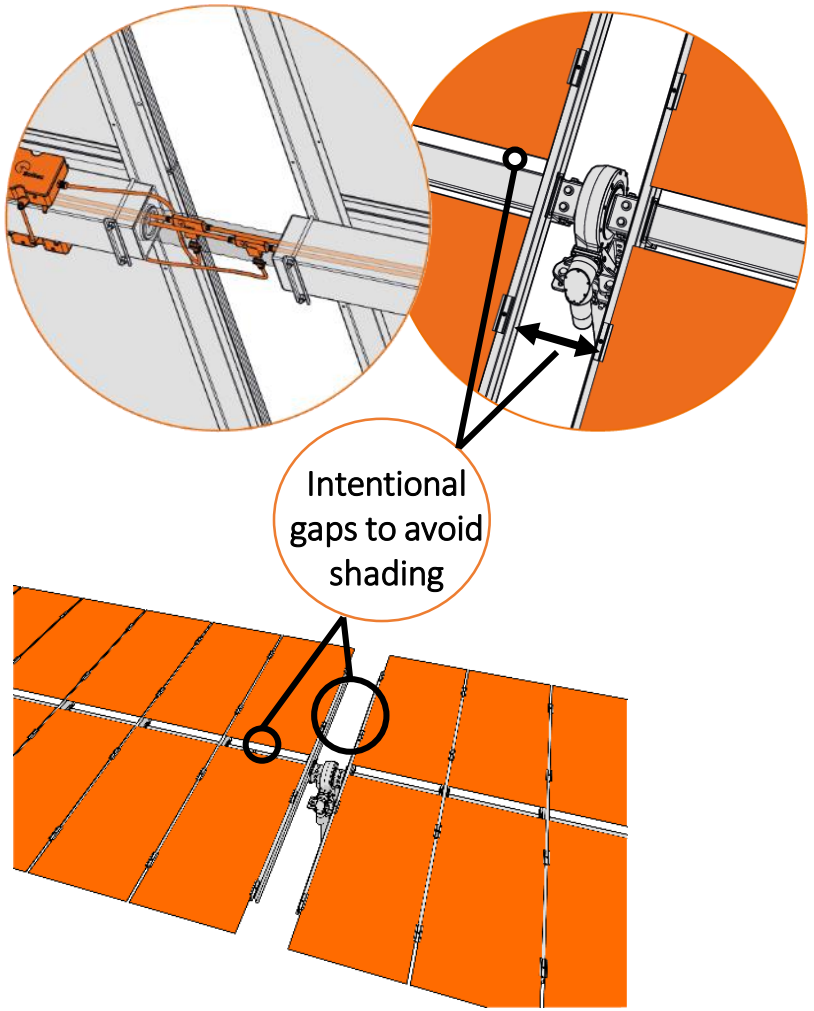
Bifacial = new concept

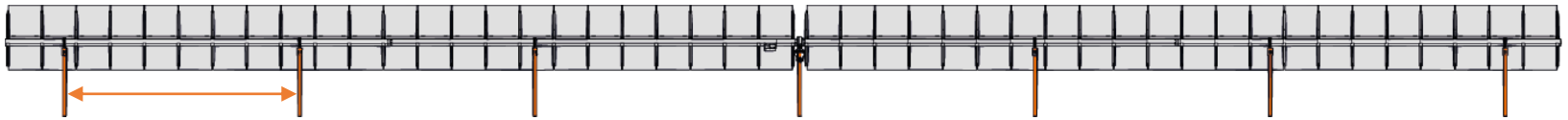
All objects cast a shadow.

Shading = losses

Minimizing the number of objects shading:

- ✓ No rear shading from torque tube→ **5% less interferences**
- ✓ 7 piles/90 modules → **46%** fewer piles/MW
- ✓ No hanging wires → **81%** fewer wiring → StringRunner
- ✓ No dampers





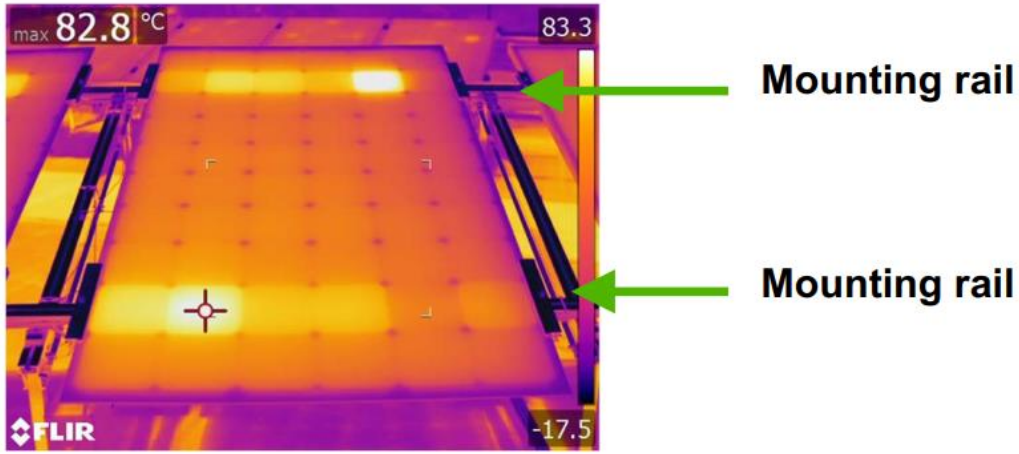
DC Harness by Soltec: https://www.youtube.com/watch?v=MMxD0hLR5IM

Bifacial: higher current

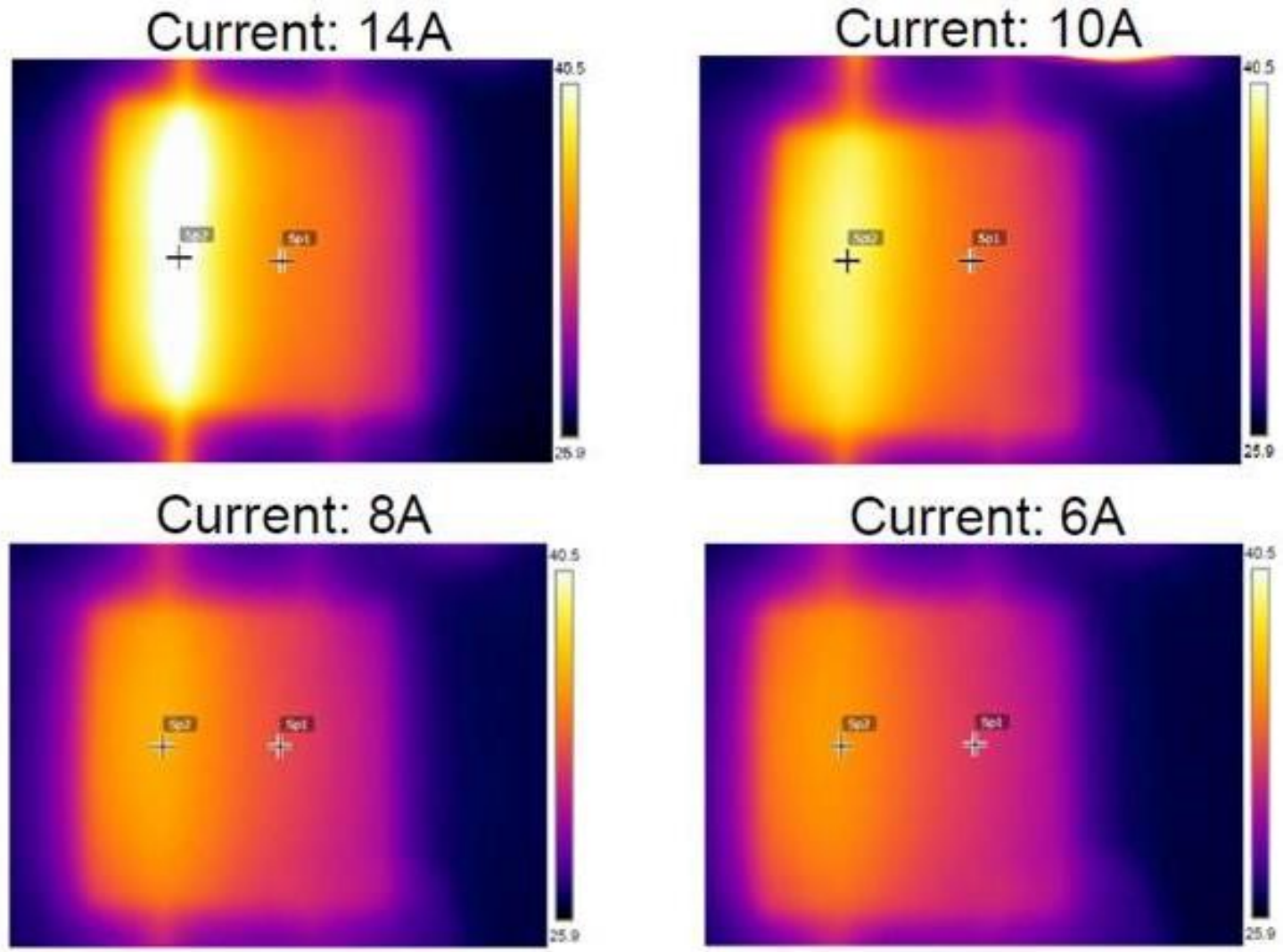
$$P_{Front} + PRear > PMonofacial$$

$$I_{Front} + IRear > IMonofacial$$

$$TBifacial > TMonofacial\ ?$$



Source: TÜV Rheinland



Source: TÜV Rheinland

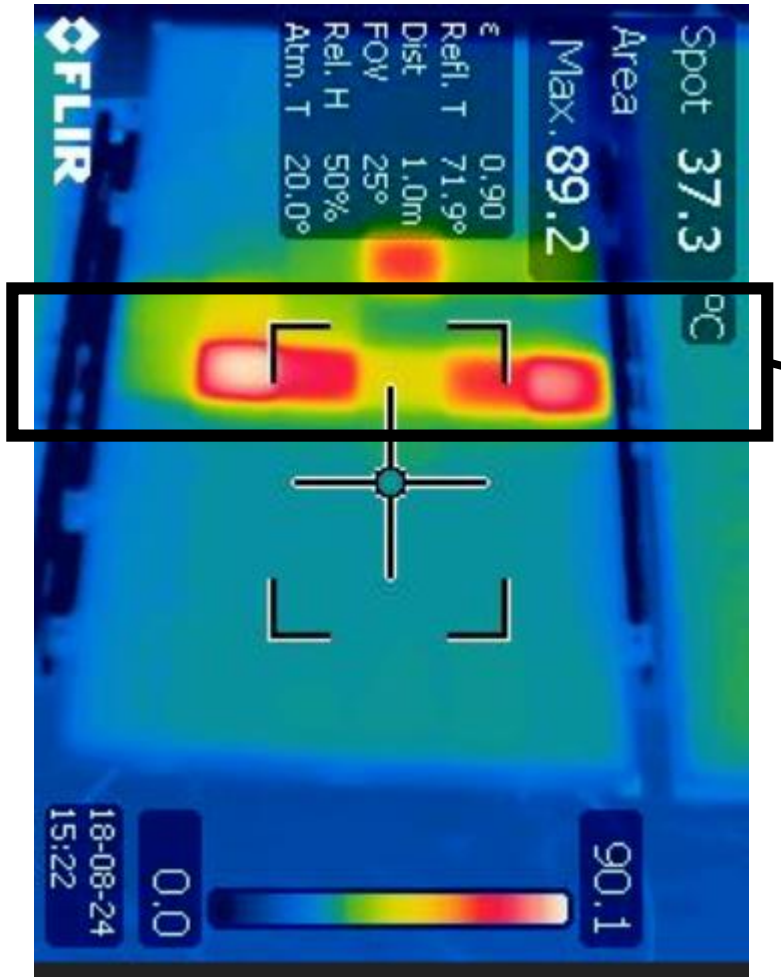
Localized temperature Non-Uniformity under current application

RACKING SHADES INTERFERENCE

HOTSPOTS – RISK OF PREMATURE DEGRADATION

Torque-tube shading interference

Torque-tube shading in 1P bifacial module configuration



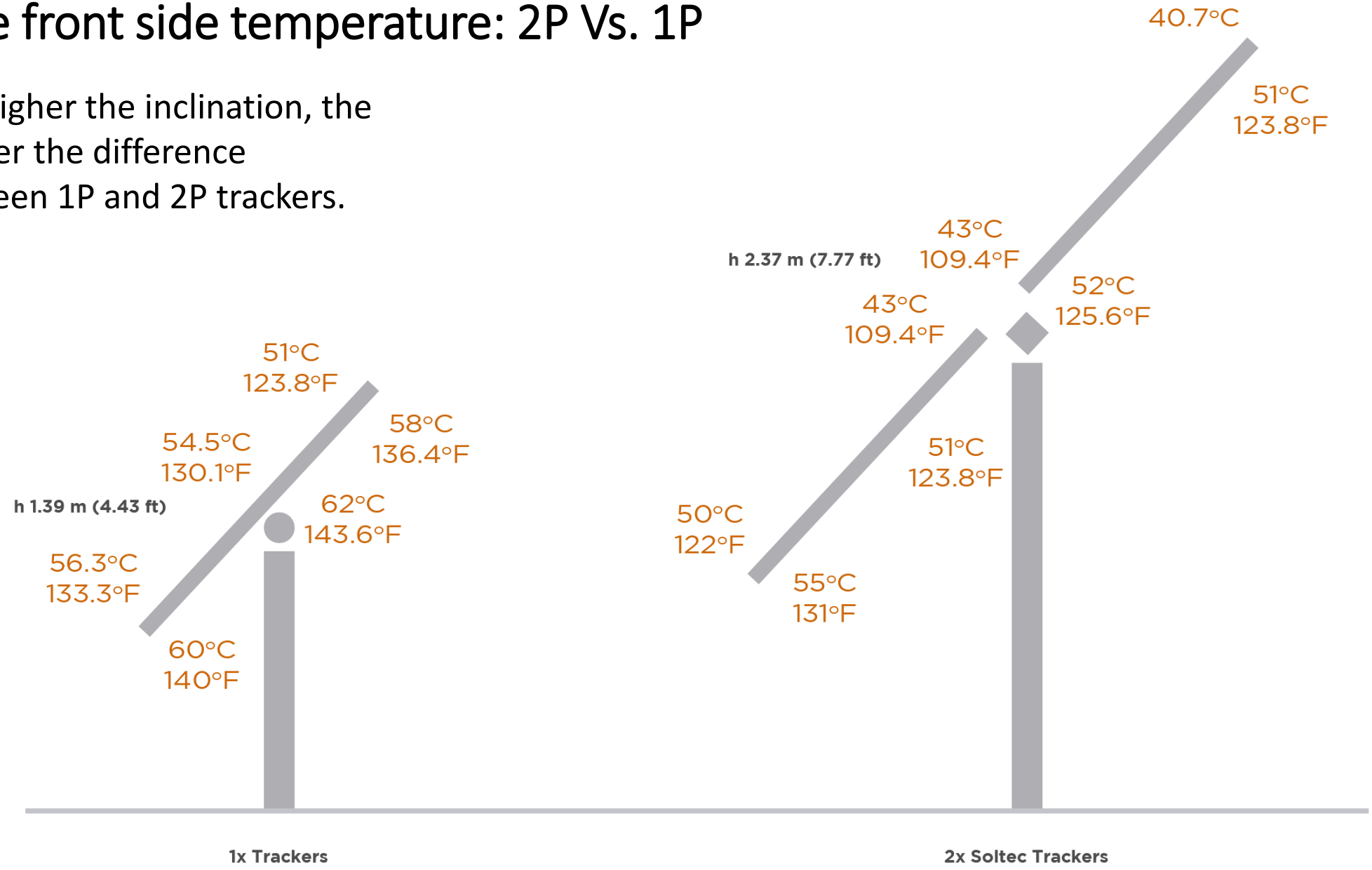
Source: BiTEC, August 2018

"Ray-tracing simulations investigated […] up to 20% loss from center-mounted torque tubes, creating multiple shadows."

Source: University of Arizona, Tucson, AZ, 85705, US; National Renewable Energy Laboratory, Golden, CO, 80401 US; NRG Wise Lighting, Albany, OR 97321, US; Sandia National Laboratories, Albuquerque, NM.

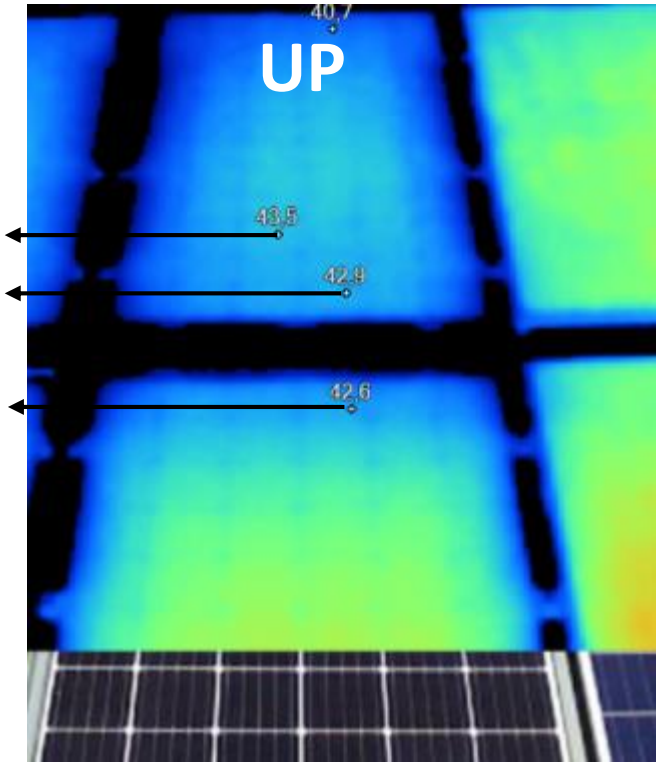
Module front side temperature: 2P Vs. 1P

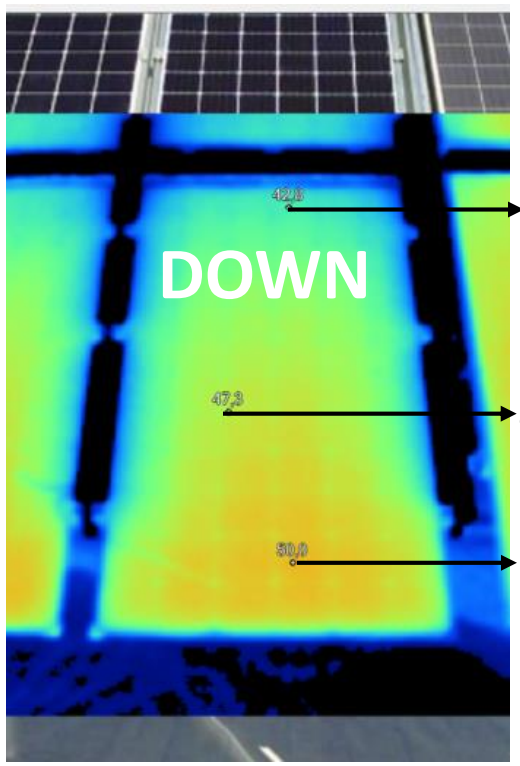
The higher the inclination, the greater the difference between 1P and 2P trackers.



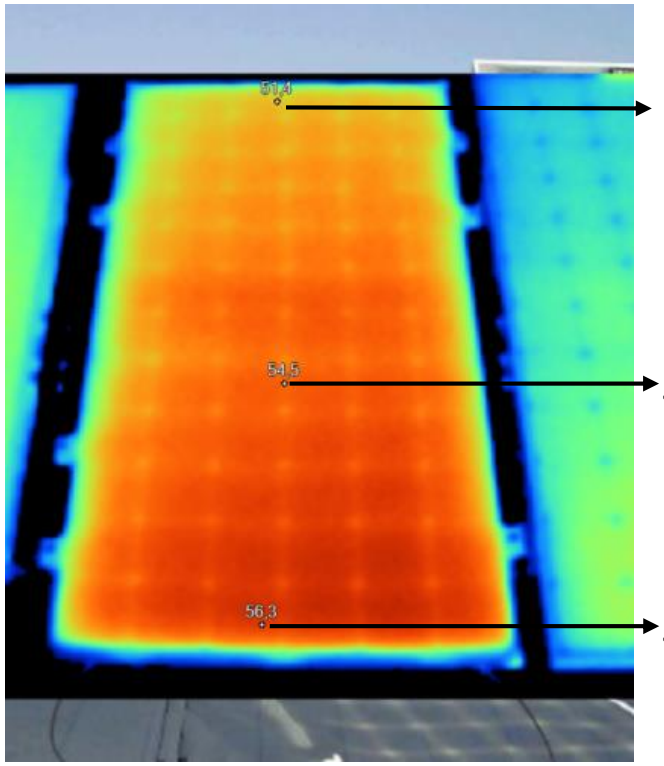
Module front side temperature: 2P Vs. 1P

2-in-Portrait module configuration





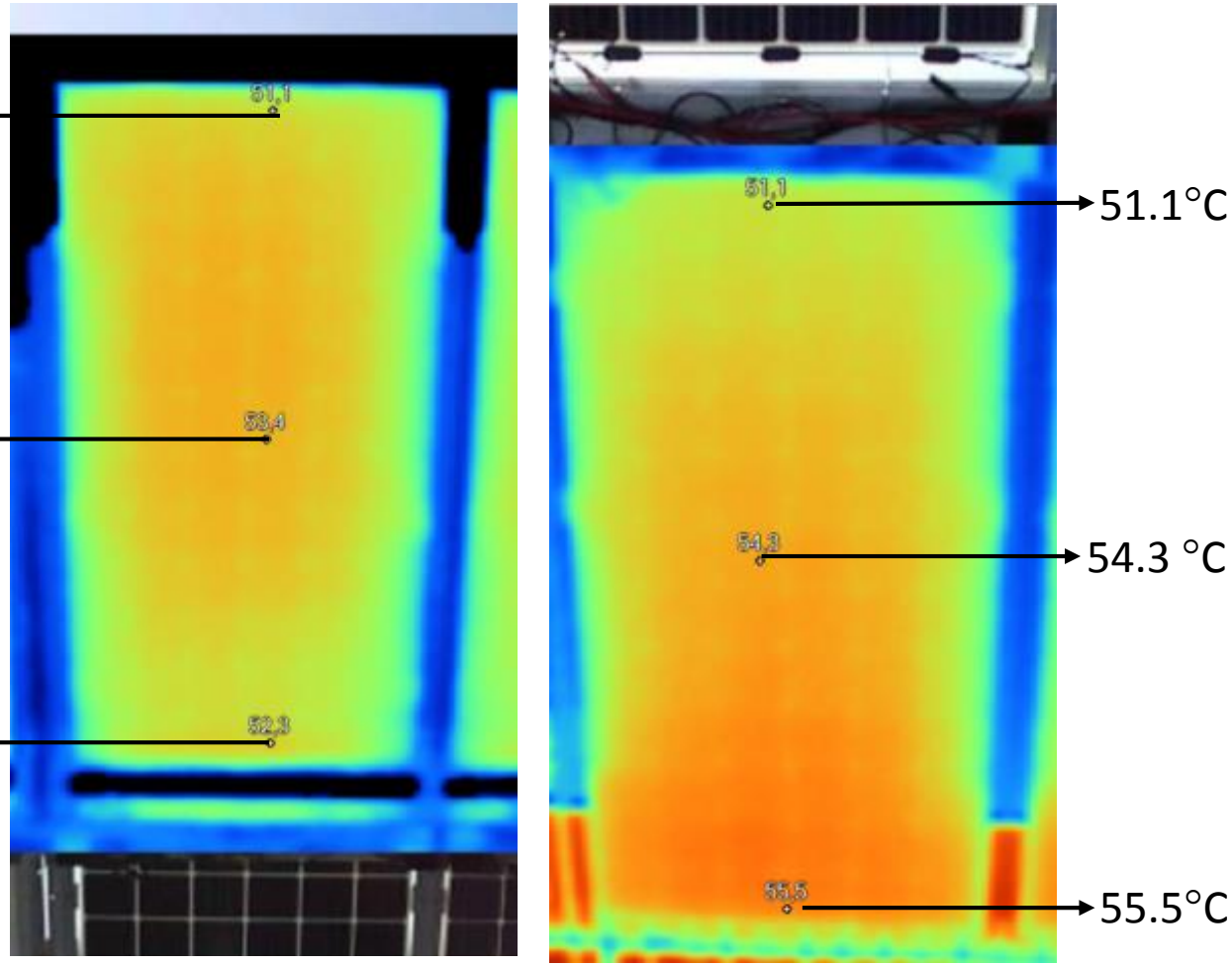
1-in-Portrait module configuration



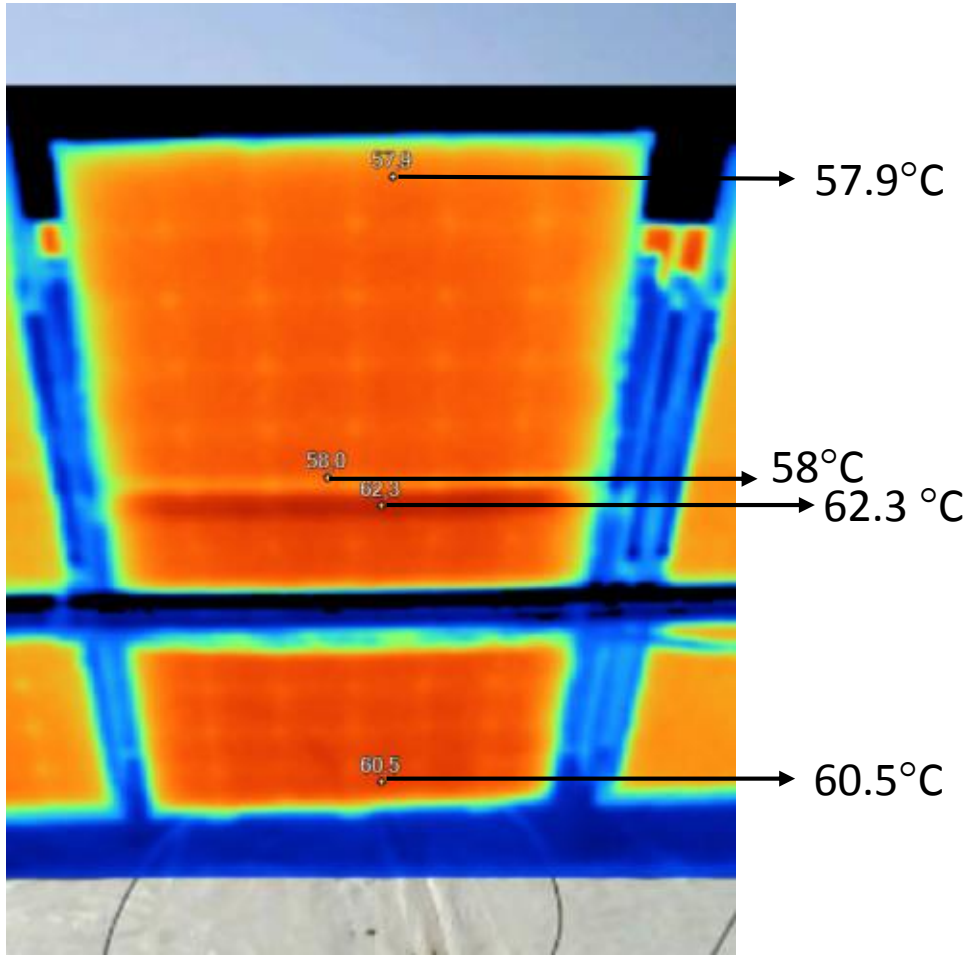
Module JW-D72N, 355 W | Albedo 65% | GCR: 0,4 | Temperature: 31°C / 87.8° F

Module rear side temperature: 2P Vs. 1P

2-in-Portrait module configuration



1-in-Portrait module configuration

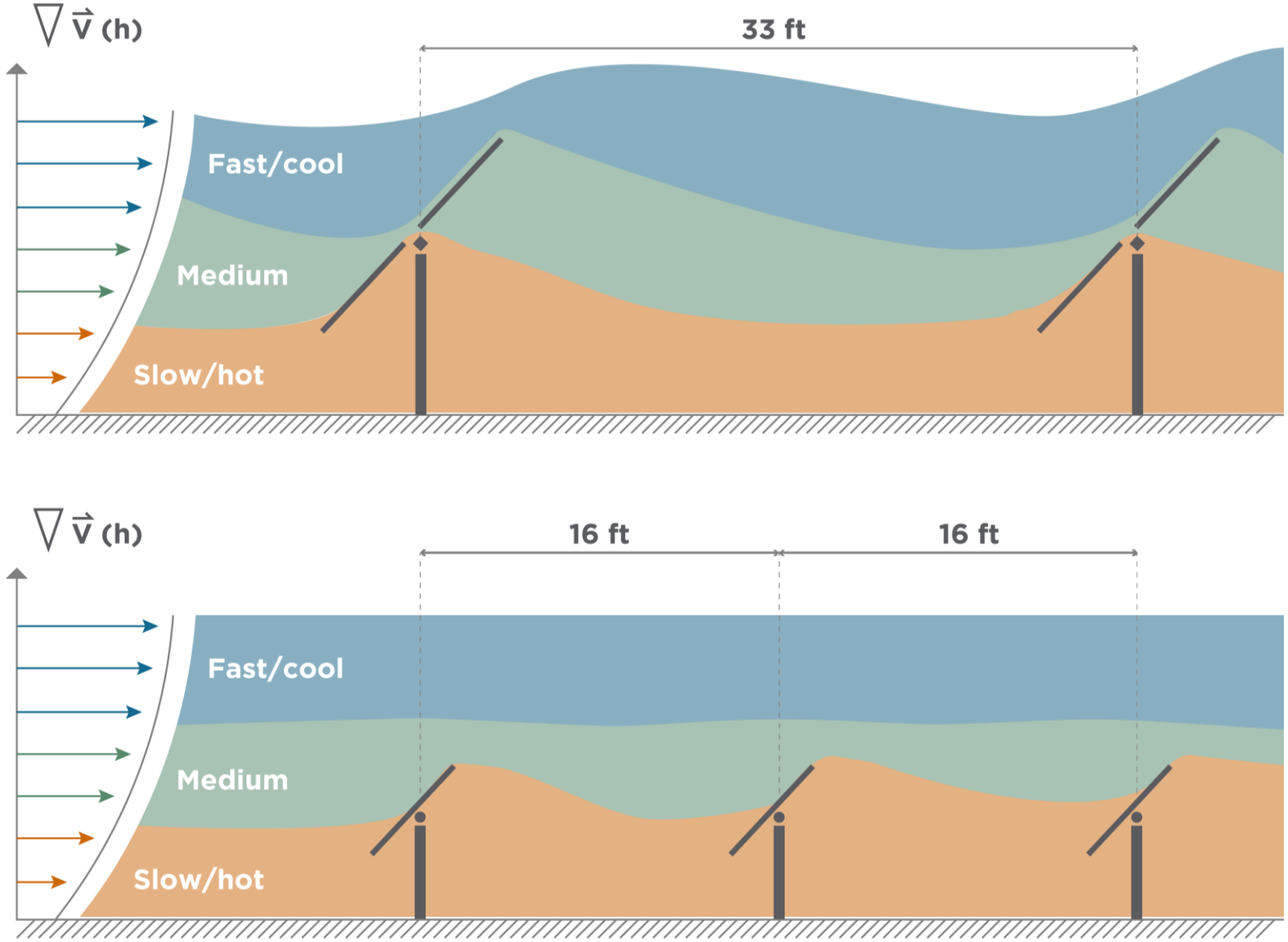


Module JW-D72N, 355 W | Albedo 65% | GCR: 0,4 | Ambient temperature: 31°C / 87.8° F | Wind: 7mph

Tracker Refigeration

- ✓ Higher pitch (2x) eases air flow
- ✓ Torque-tube gap improves the air flow
- ✓ The upper module is cooler

2P Vs 1P tracker refrigeration



THANK YOU

Soltec

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