

FusionSolar Smart PV Solution

Continuously being Leader in Smart PV Scenario

Bifacial for Huawei PV Utility Scale Solution

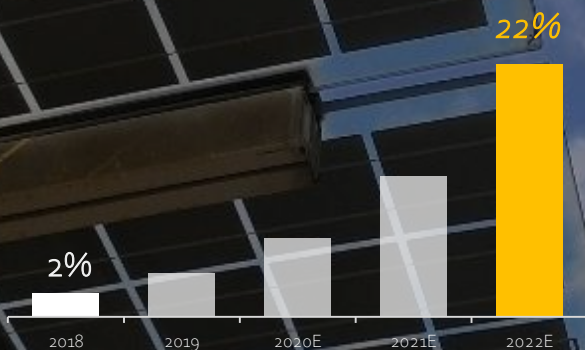


Technique Improvement is Driving Solar Industry

Bifacial Modules

22%^{@2022}

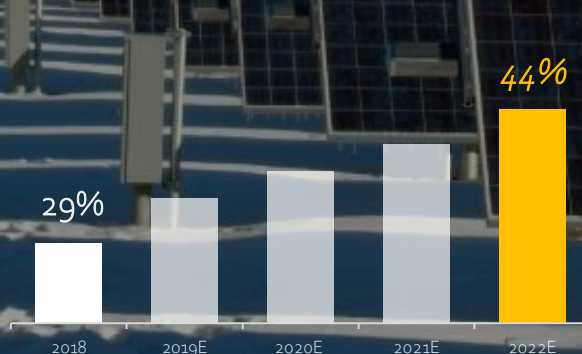
Market Share in PV



Tracking System

44%^{@2022}

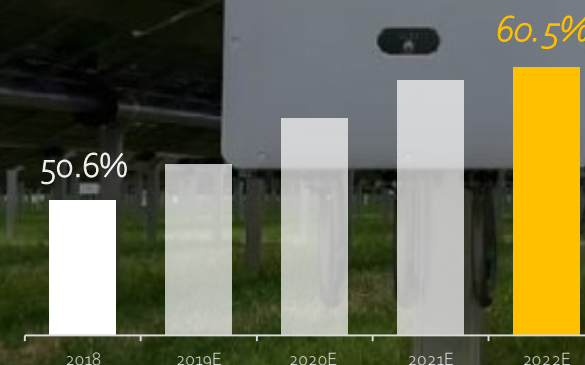
Market Share in Utility



String Inverter

60.5%^{@2022}

Market Share in Utility

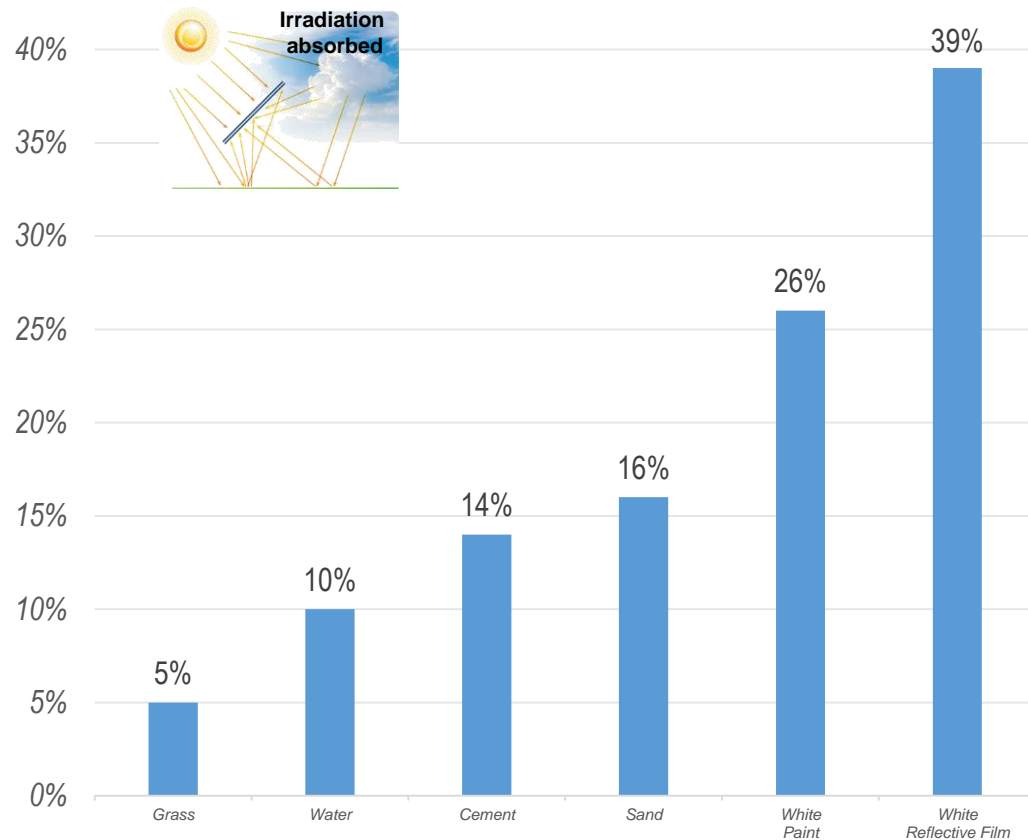


Why Bifacial, Grid Parity is the Driving Force of Bifacial Solution

Rearside Power Gain

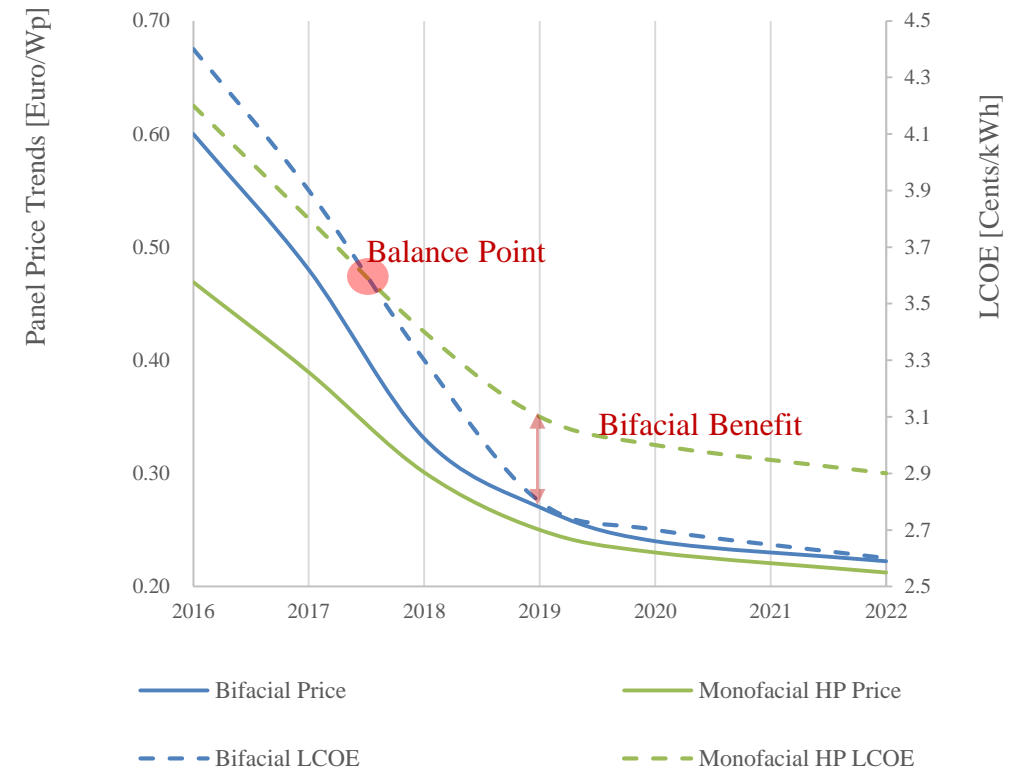
For Utility 5~16%

Total Yields Enhancement, Note: BiFi = 0.9



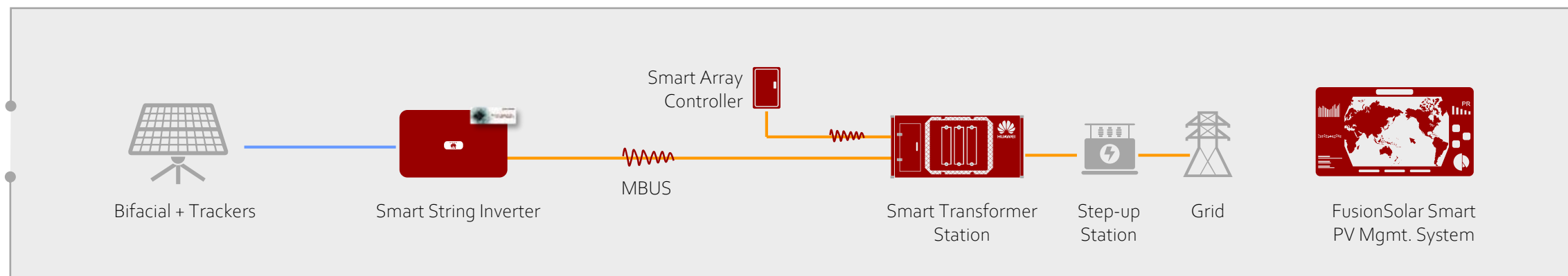
The Price Gap of Bifacial has broken through the Balance Point

Panel Price Trends & Corresponding LCOE



Using the Spain Output to evaluate the LCOE

FusionSolar 6.0 Smart PV Solution Overview



1 Digital Integration with Tracker

2 Suitable for Bifacial Module

3 SUN2000-185KTL-H1 for Bifacial

4 No Fuse, 9 MPPTs, IP66...

5 String-level monitoring 0.5% Accuracy

6 MBUS Supports Remote Transmission

7 6.3MW Array Design without AC Box
Smart Transformer Station STS-6000K-H1

8 Smart PV Mgt. System

9 Smart I-V Curve Diagnosis 3.0

Benefits

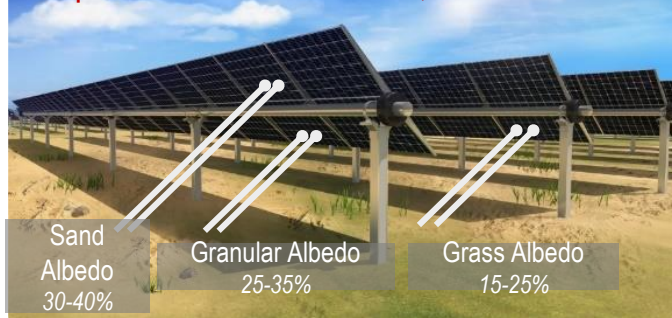
- Best match for bifacial module, increase system yields
- o-touch maintenance, Saving OPEX during entire lifecycle
- Smart I-V curve 3.0, better match bifacial module and more efficient O&M
- Optimized 6.3 MVA standard array, No AC box, lower cost
- MBUS suitable for larger array design

Challenges

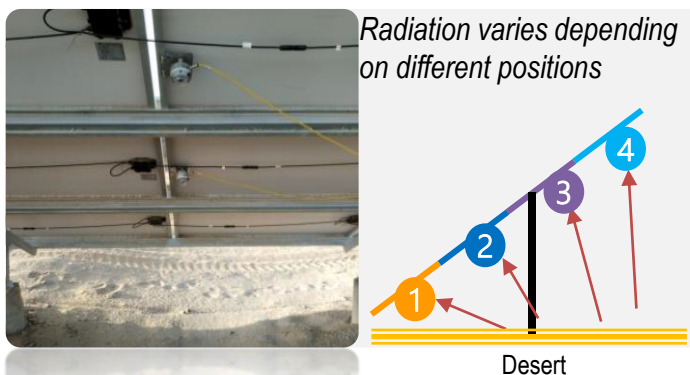
TOP3 Challenges of the Bifacial Solution

Higher Mismatch

Complicated Ground Surface, Different Albedo

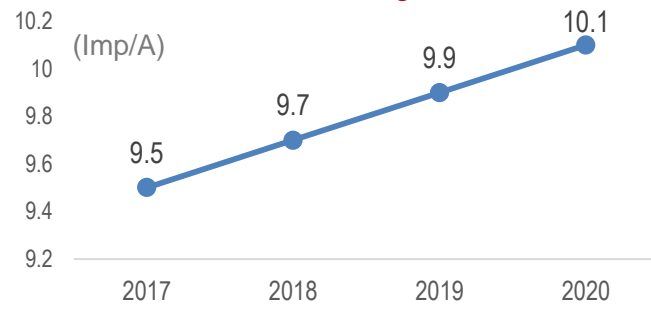


Different Height, Different Irradiation on the Rear

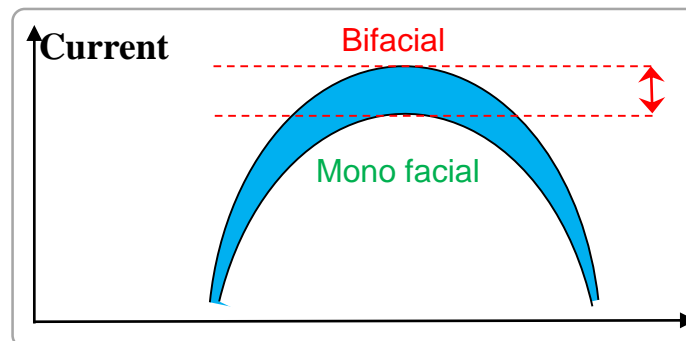


More risk of restricting power

Max. Current increasing for Bidacial



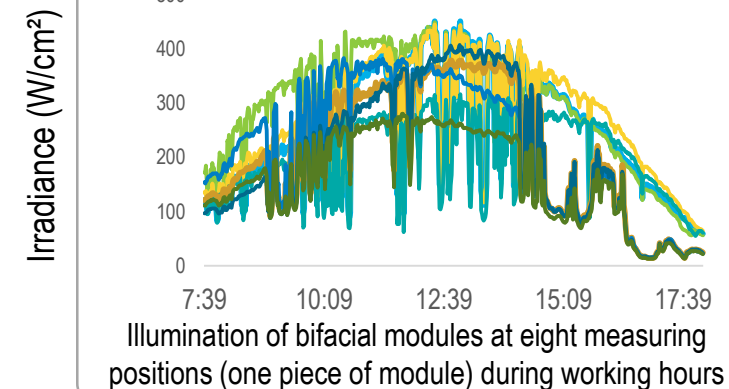
More risk of Restricting power for bifacial



More Difficult to Detect Fault

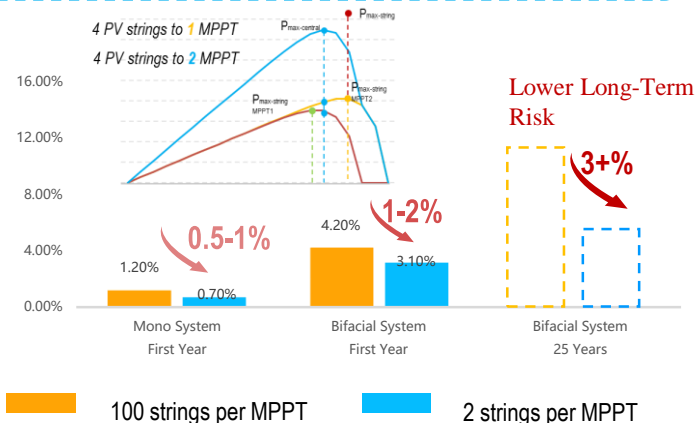
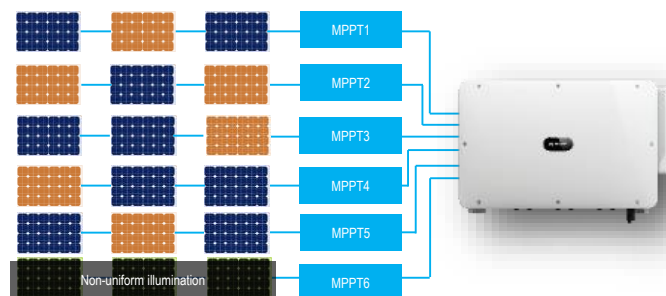
The large uncertainty and uneven output of bifacial will make error by regular Inspection method

RMS of current increased From **2%** (in monofacial module) to **5~15%** (in bifacial module)

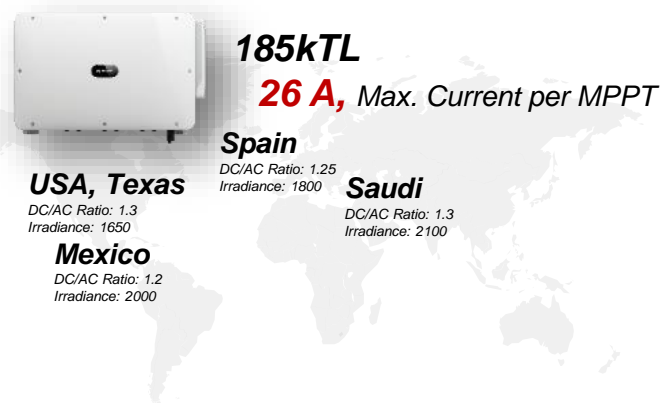


Huawei Solution for the Challenge of the Bifacial

Multi MPPT



Upgrade 26A Current for each MPPT



Global experimental data to prove Maximum Input Current of **25+ A** best fitting for bifacial modules system design

IV Curve 3.0



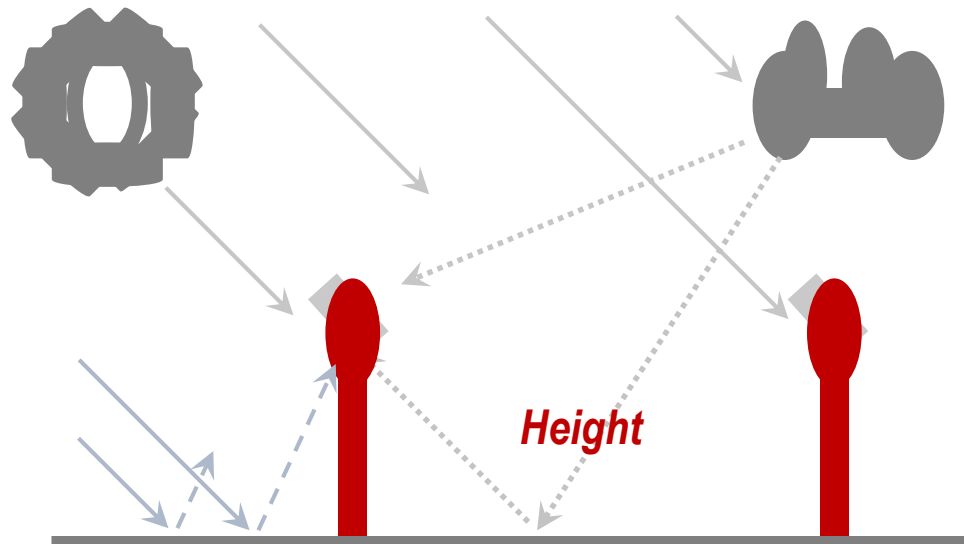
- **Bifacial&2in1 Supported**
- Complex terrain Adaptability
- Irradiation & Panel Temp. self Prediction
- Scanning & Diagnosis <20min/100MW
- Reports Automatic Generation

• **Design Considerations**

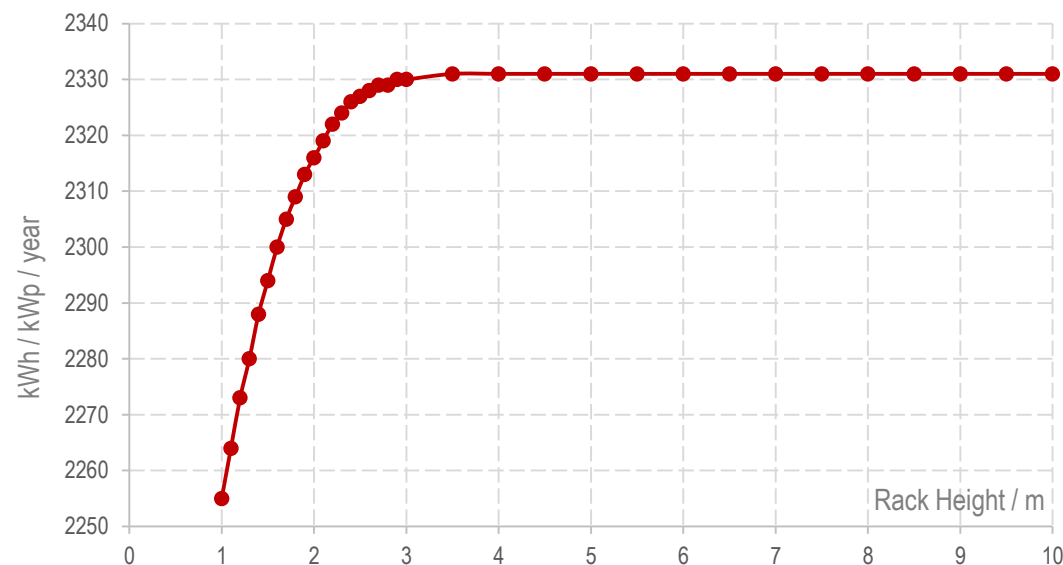
The Influence of Rack Height Designed on System Yields

Influence of rack height on Yields

- Increase in height mainly allows more beam radiations onto the ground surface, receiving more reflected radiations.
- Increase in height also allows more reflected radiations from neighboring rack rows.
- However, the longer optical path, the weaker reflected when too higher rack designed.
- Meanwhile, Increase in height also cause more cost in rack.



Simulation of Height vs. Yields @Oman

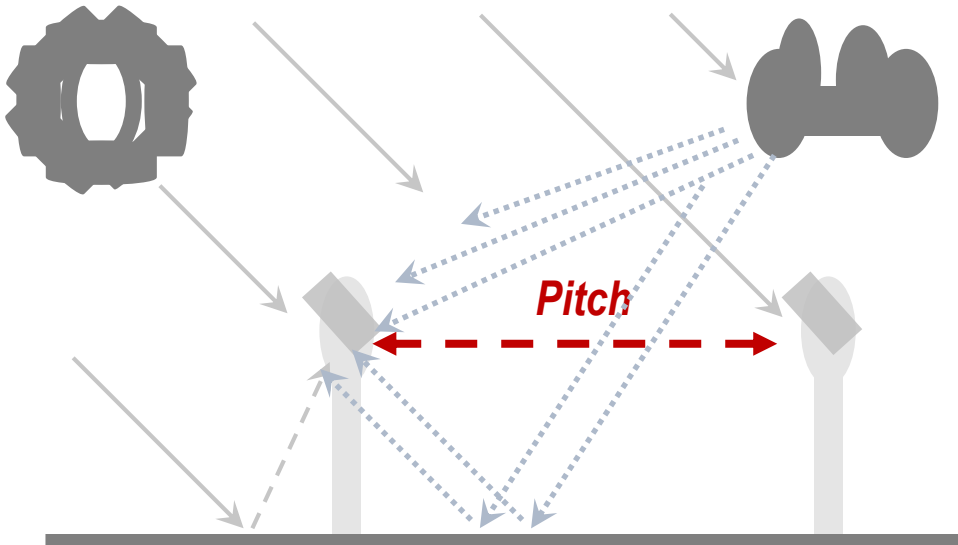


Location	Ibri, Oman / 23.36°N, 56.24°E		
Altitude	282 m	DC/AC Ratio	1.34 (150 kW@50° C)
Temperature	8° C - 46° C	PV Module	400 Wp Bifacial
Pitch	5.5 m	Inverter	SUN2000-185KTL-H0

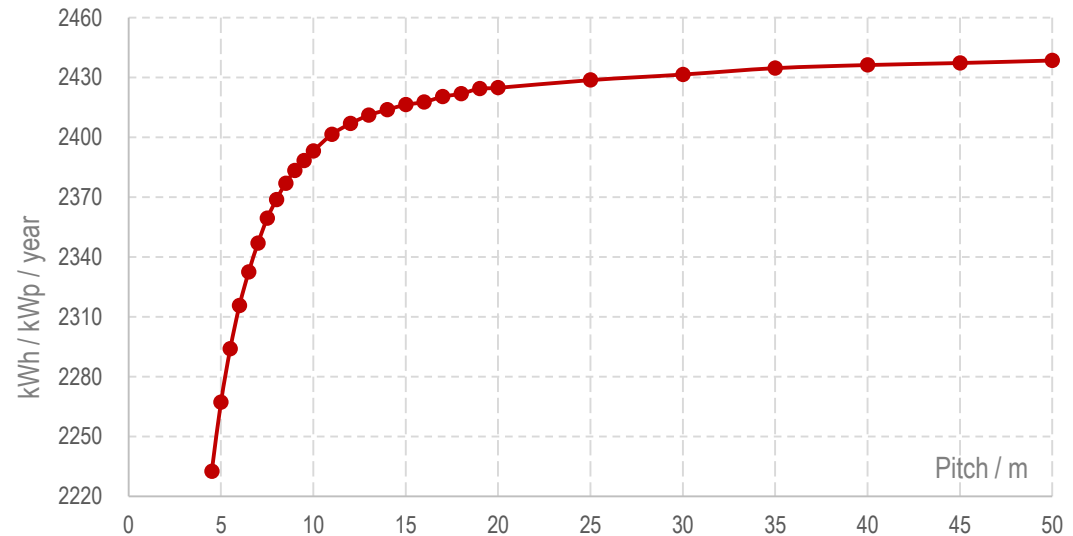
The Influence of Rack Pitch Designed on System Yields

Influence of pitch on Yields & CAPEX

- Bringing increase in diffuse angle range allows more diffuse radiations onto rear-side.
- Bringing increase in ground-reflected area for both beam and diffuse radiations.
- Improving O&M accessibility for modules washing and vegetation control.
- Meanwhile, cost effective balance needed due to limited area.



Simulation of Pitch vs. Yields @Oman

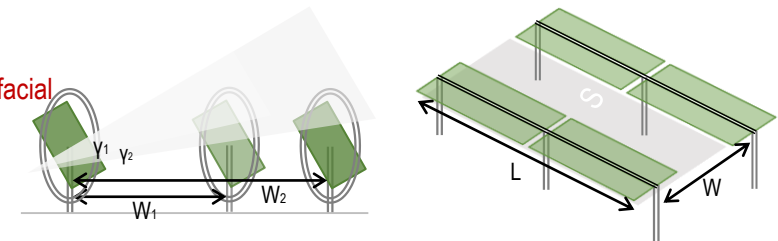


@Ibri, Oman

PV Module = 400 Wp Bifacial

Rack Height = 1.5 m

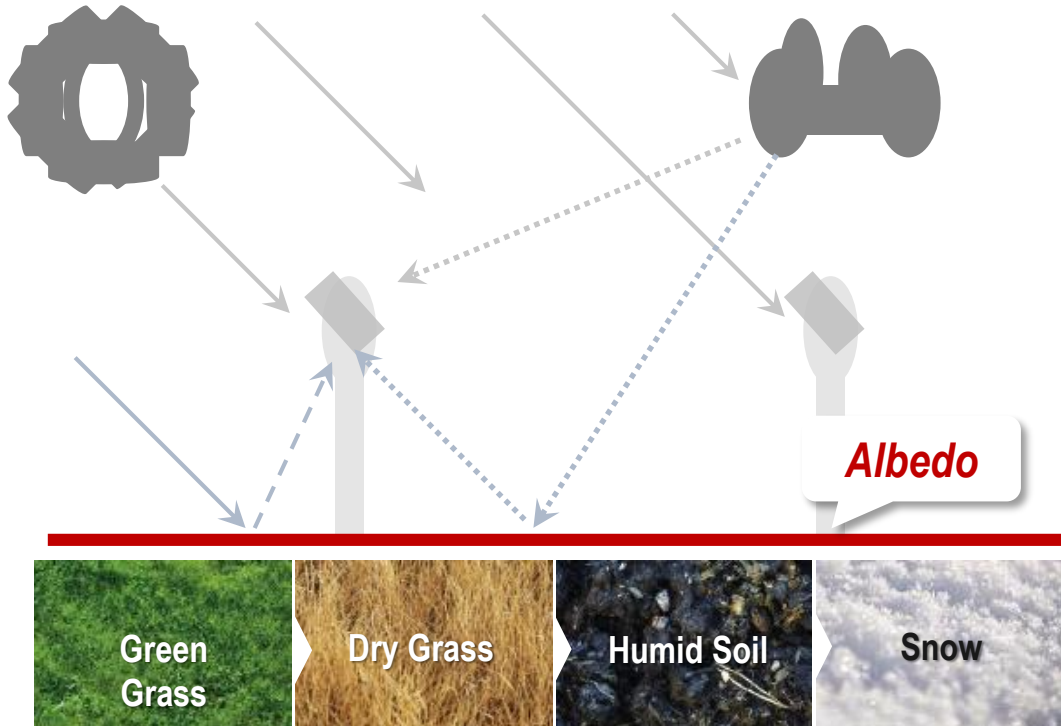
DC/AC Ratio = 1.34



The Influence of Ground Albedo on Energy Gain

Higher Albedo, Higher Energy Gain

Albedo, percentage of radiation reflected by a surface
Mainly effected by **Color**, **Texture**, and varies with **Seasons**



Simulation of Albedo vs. Yields

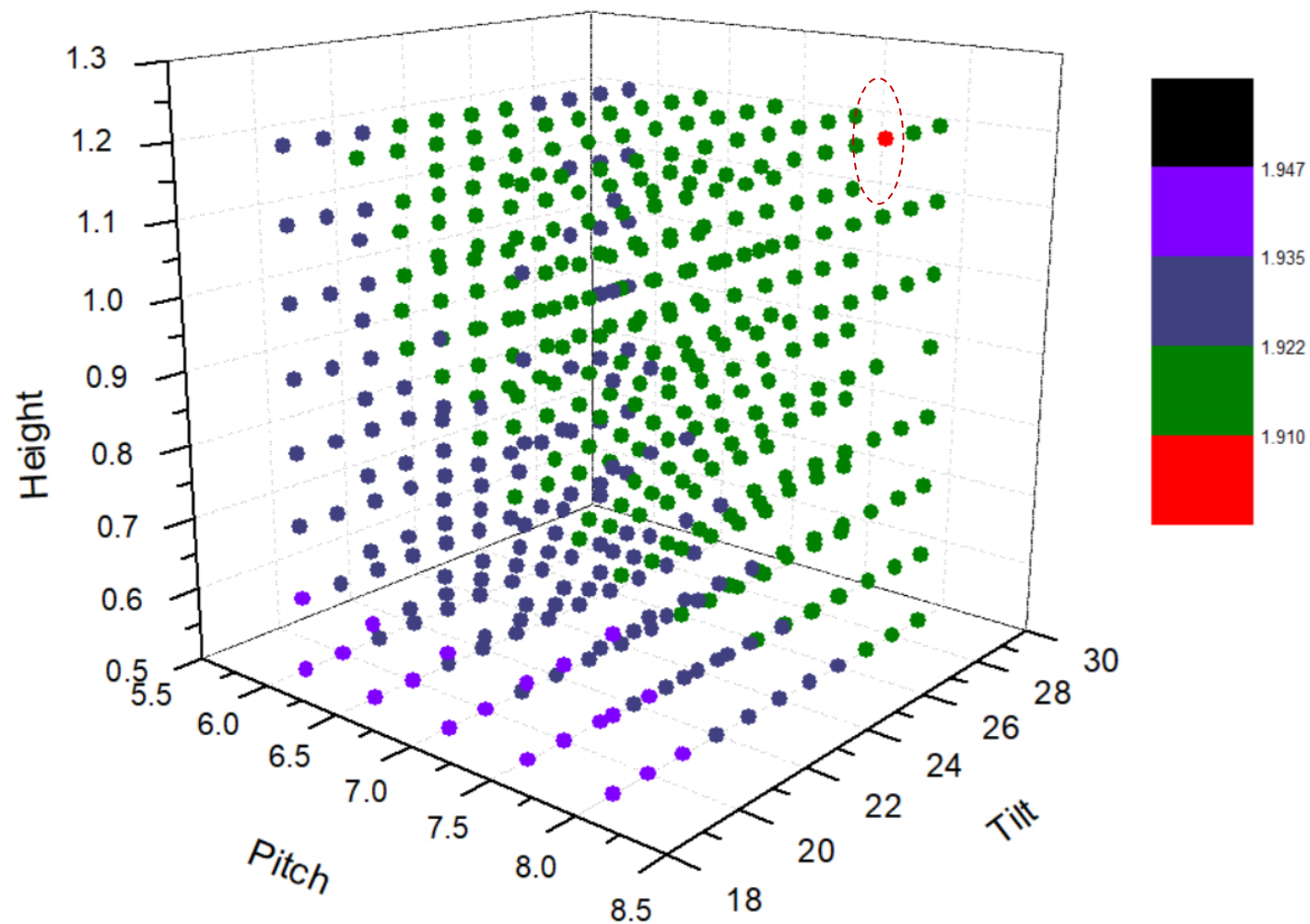


Source: LGE Internal Simulation Results

Surface Types	Albedo	Surface Types	Albedo
Urban Situation	0.14-0.22	Dry Asphalt	0.09-0.15
Grass	0.15-0.25	Wet Asphalt	0.18
Fresh Grass	0.26	Concrete	0.25-0.35
Fresh Snow	0.82	Red Tiles	0.33
Wet Snow	0.55-0.75	Aluminum	0.85

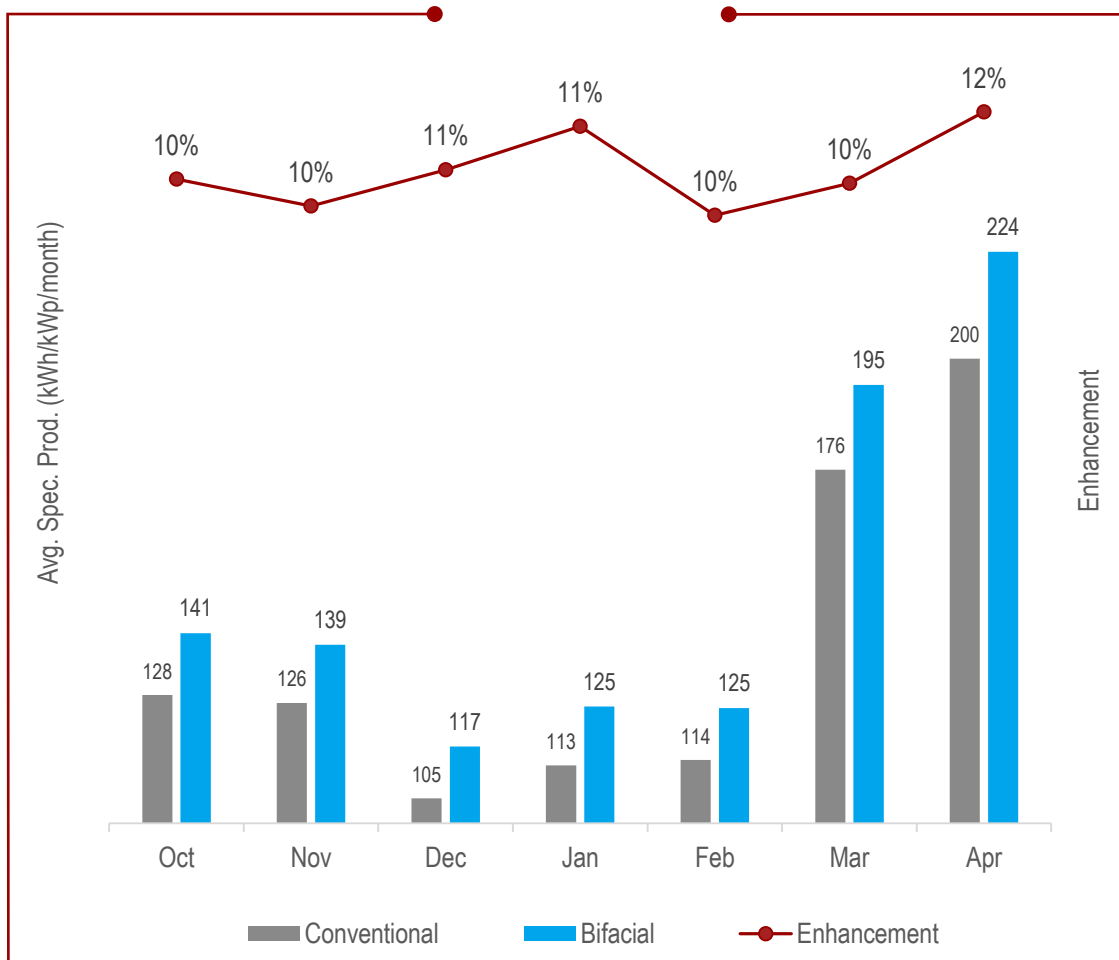
Source: PVSYST Usual Values for Albedo

Designing Optimization Follows the HPT Methodology



Some References

>10% Yields Increased via Bifacial +Tracker +Huawei Smart Inverter VS Mono-facial + Tracker+ Central Inverter



Bi-facial Modules + Trackers + Huawei inverter

VS

Mono-facial Modules + Trackers + Central inverter

Largest Bifacial Reference Outside China

AI BOOST

Smart I-V Curve Diagnosis



Bifacial + Trackers

- Project: Tlaxcala, Mexico
- Capacity: 220MW, SUN2000-100KTL-H1
- COD: Aug., 2019

Multi-MPPTs
Installation with Trackers

IP65

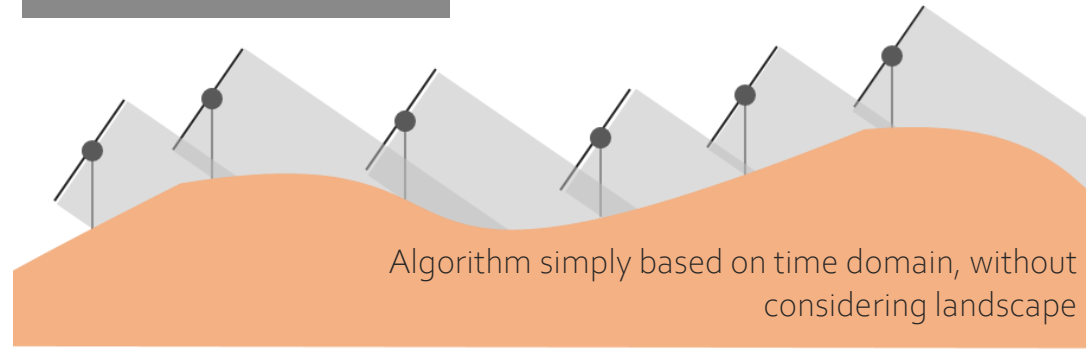


Moving Forward

SDS: Smart DC System

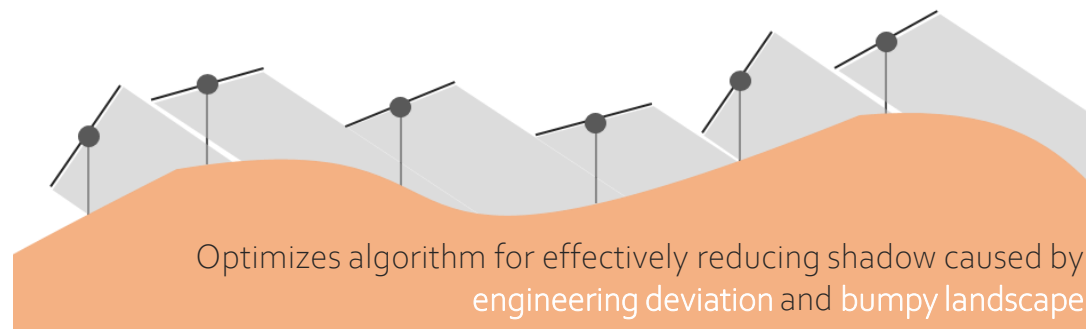
Optimizes Tracking Algorithm in complex scenarios

Traditional Tracking

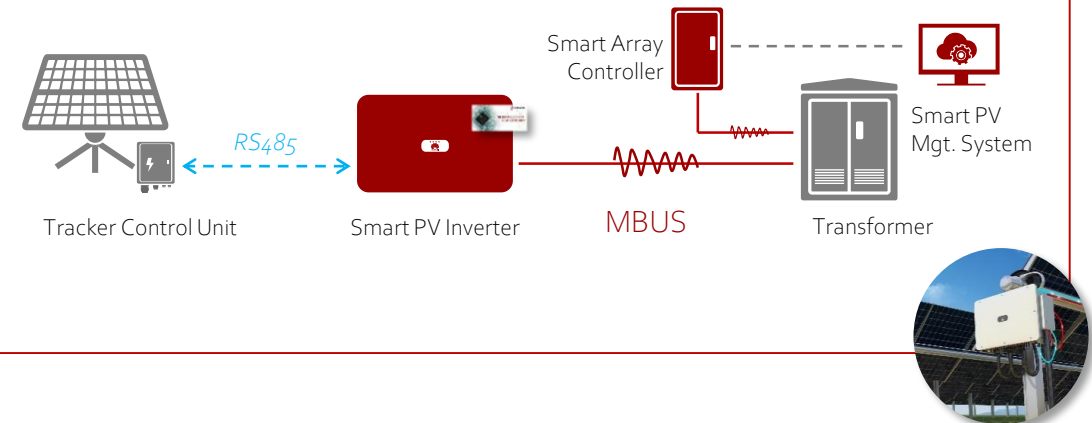


Smart PV Solution

Optimizes algorithm for more capturing more irradiances during **rainy or cloudy** days



Solution Network

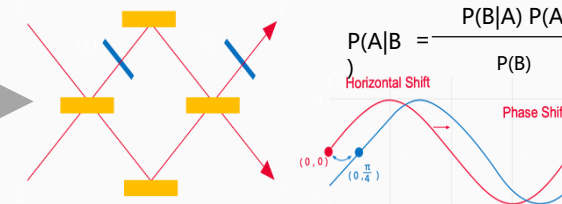


Training Database

Neural Network Training

Model Validation

Environmt.
Astro. Alg.
+ Generation Hist.
Weather.....



THANK YOU!