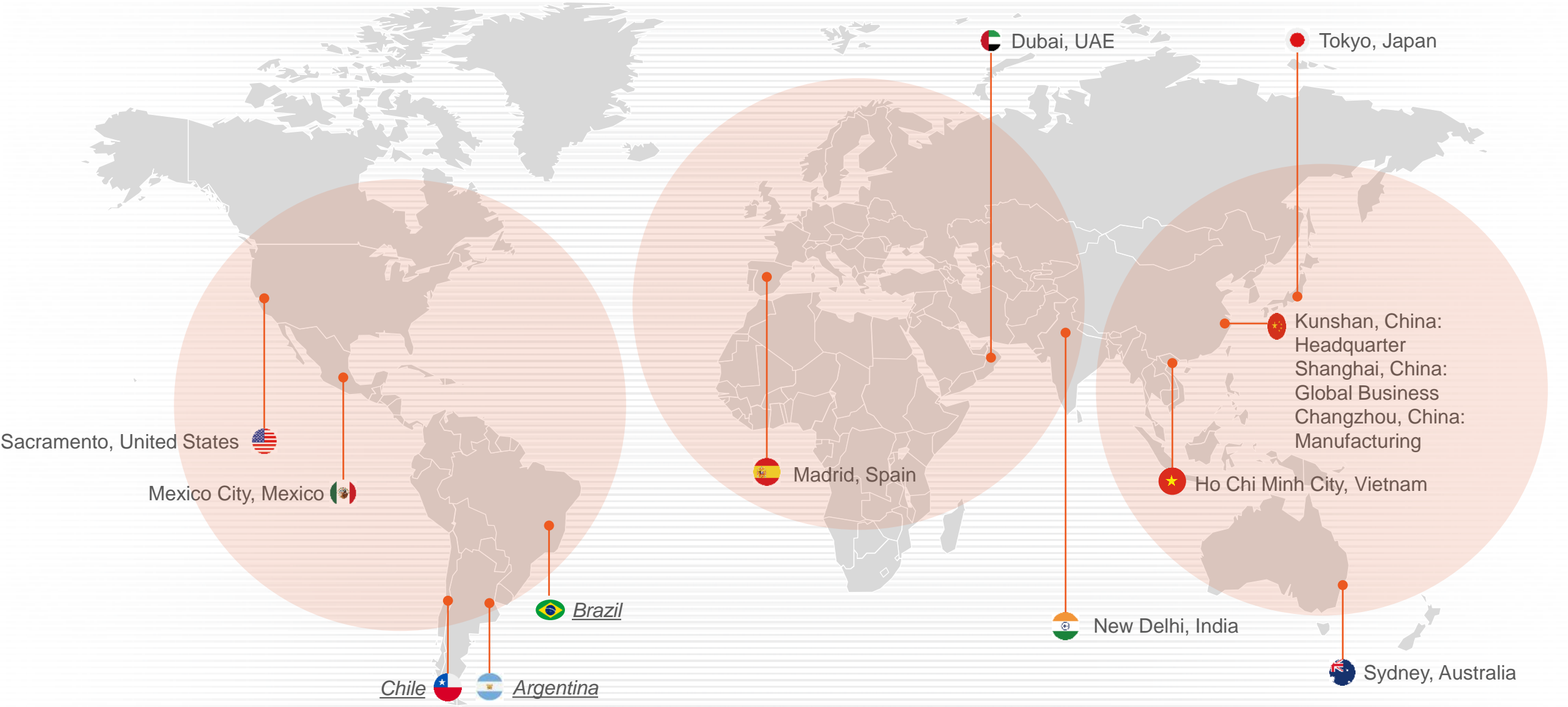




TRACKER + BIFACIAL MODULE BEST COMPATIBILITY LATAM MARKET



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**Business
Development +
Commercial**



**Engineering
Department**



**Project
Management +
Site Supporting**



Integrated Pre And After Sales Services

Lower Costs
More Energy Generation
Better Design



A large-scale photograph of a solar farm with rows of solar panels stretching into the distance under a blue sky with scattered clouds. A thick, curved orange and white graphic line separates the image from the text area on the right.

INDEX

- 1. Tracker Solutions
- 2. Wind Tunnel Tests
- 3. New Module Homologation
- 4. AI Controller
- 5. Layout Optimization
- 6. Structural Calculations
- 7. Conclusions

1

TRACKER SOLUTIONS





Brazil | 90MW | SkyLine



Mexico | 167MW | SkySmart

SKYLINE

1 in Portrait
1 GW Global



SKYSMART

2 in Portrait
1.2 GW Global



SKYLINE

1 in Portrait



- Independent Row, Up to 90 modules per tracker
- Customized design per project, based upon wind tunnel tests
- Industry record of 20% slope adaptability.
- Self-powered directly by the string. Battery only back-up.
- Long Range, low-power consumption wireless communication.

SKYSMART

2 in Portrait

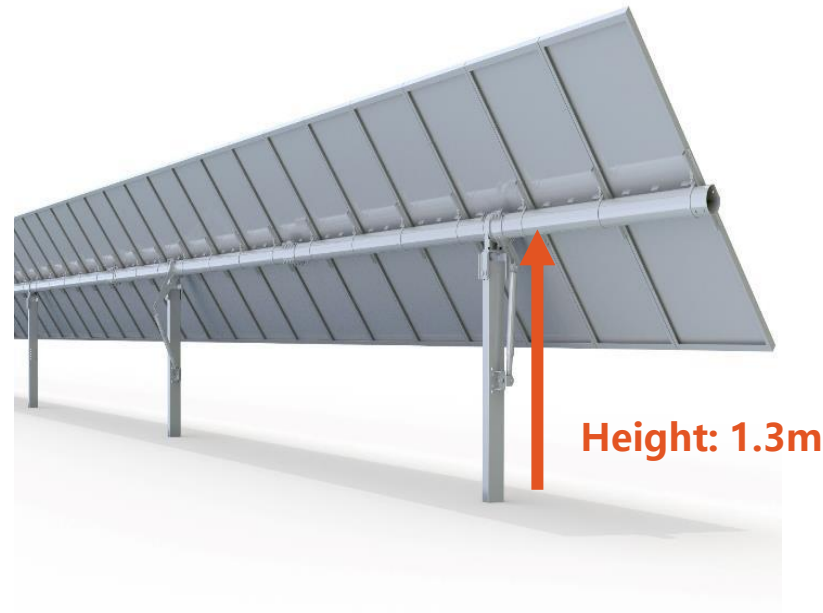
SKYLINE 1 in Portrait



~90m



D-shape Torque
Tube



Height: 1.3m

- Independent Row 1P
- Easier design for high wind speed locations
- **Less TON/MW = lower costs**

SKYSMART 2 in Portrait



~45m



Square Torque Tube



Height: 2.2m

- Independent Row 2P
- Reduction Of Civil Works
- Undulated Terrain Adaptability
- **Fit for bifacial modules**

I BIFACIAL + TRACKER SOLUTION



Oman | 125MW | SkySmart

SKYSMART + Bifacial Module

20-29GW Bifacial

2020 bifacial module shipment
forecast

*Source: BNEF report

- Bifacial PV Modules + Tracker
- Best PV Solution – Standard from 2021 on

SKYLINE 1 in Portrait + Bifacial Module



- 2019 Mexico 118MW
- 2019 Mexico 126MW
- 2019 Oman 575MW
- 2019 China 650 MW

SKYSMART 2 in Portrait + Bifacial Module



- 2019 Canada 32MW
- 2018 Thailand 4.99MW
- 2019 Oman 125MW

II SKYLINE & SKYSMART

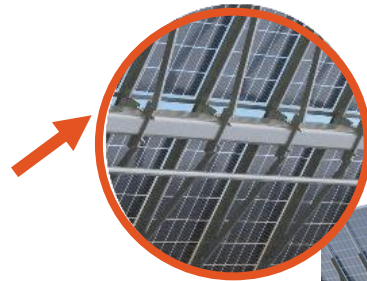
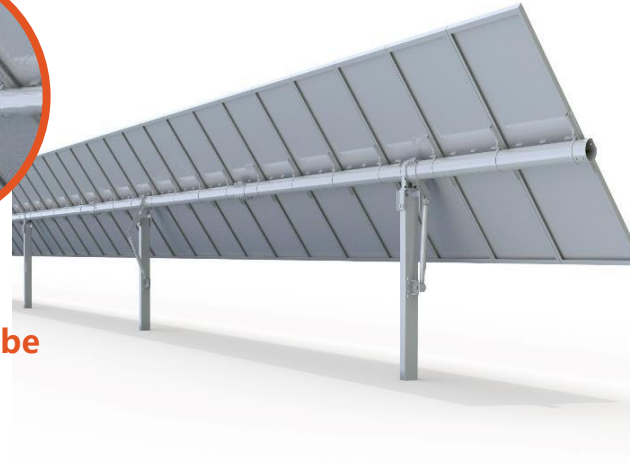
SKYLINE
1 in Portrait



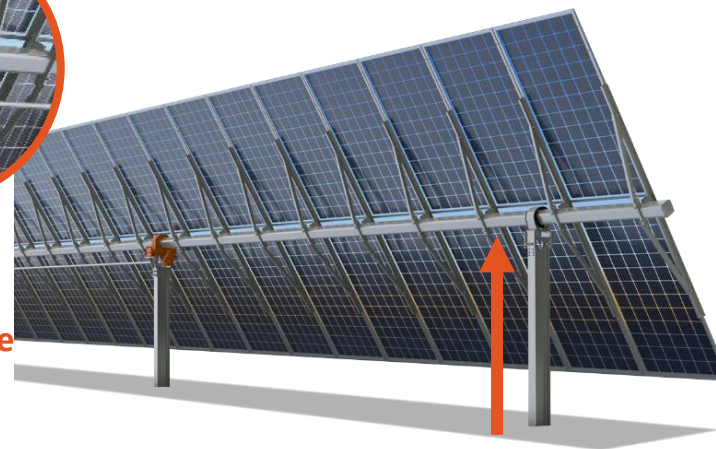
SKYSMART
2 in Portrait



**D-shape
Torque Tube**

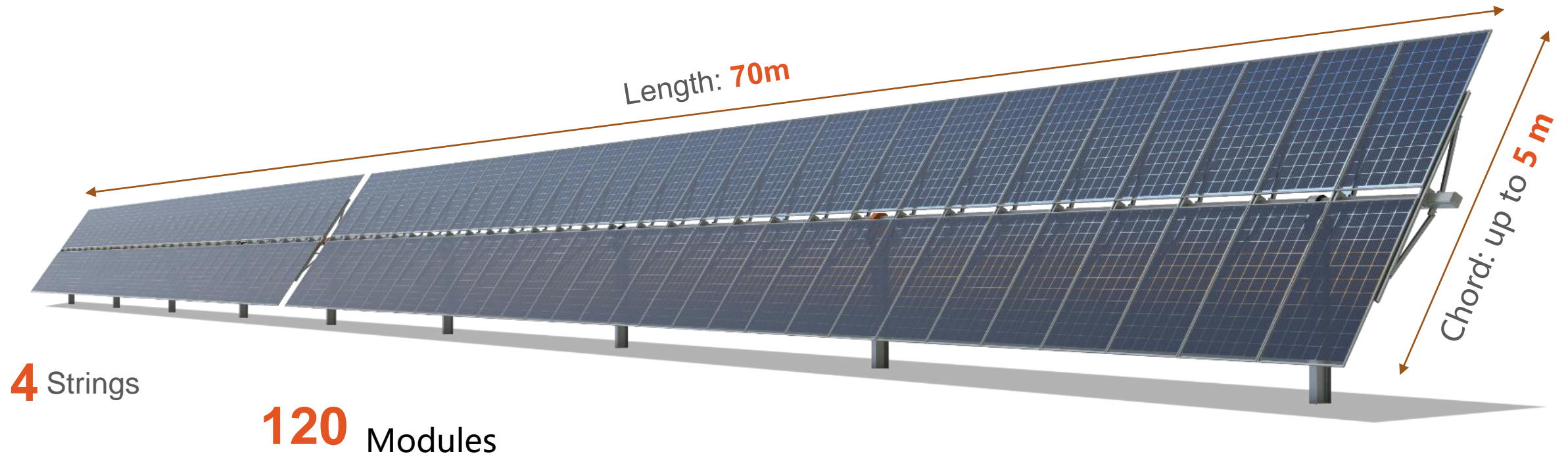


**Square
Torque Tube**



- Stability at **High Wind** Speeds
- **Lower Costs**
- **More Reflected** Energy
- **Less Shading**
- Lower Temperature

SKYSMART 2 = COMBINING BEST FEATURES

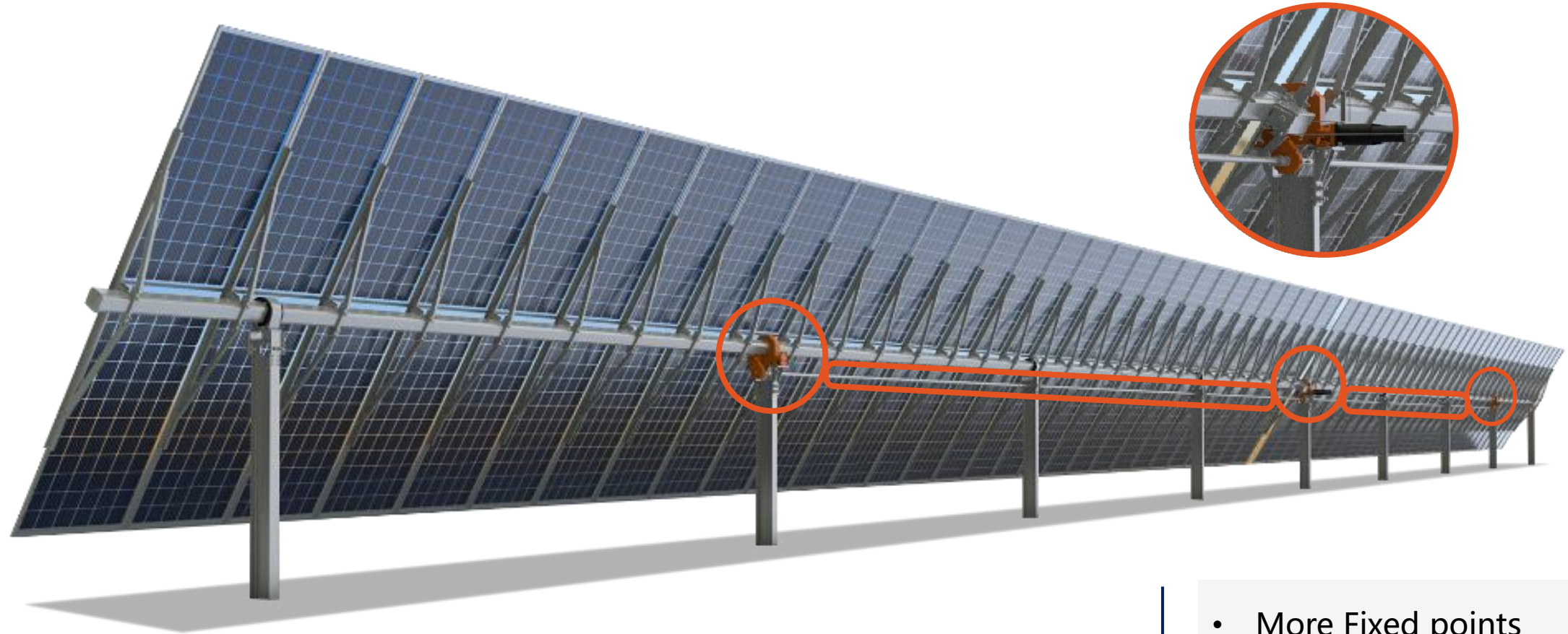


50-65 KWp*

*420 - 550W Modules

- **Best Fit fo Bifacial Modules**
- Higher for better reflection
- Lower shadow ratio

SKYSMART 2 = COMBINING BEST FEATURES



- More Fixed points
- **200% more stability in at higher wind speeds + Larger PV Module Sizes**
- AI Controller

2 WIND TUNNEL TESTS



Design 100% rigid

Collecting Data Input

Aeroelasticity

2D Simulation

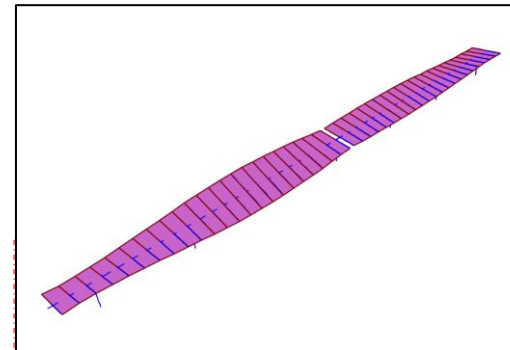
3D Test

Empiric Elasticity
Data

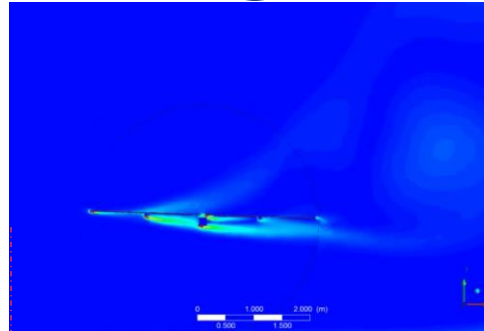
5



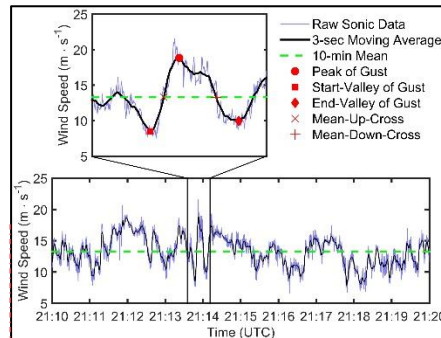
4



3



2



1



Test Completed
30 trackers

Test Completed
20 trackers

Test Completed
10 trackers

Test Completed
5 trackers


Arctech Solar

Static

Dynamic

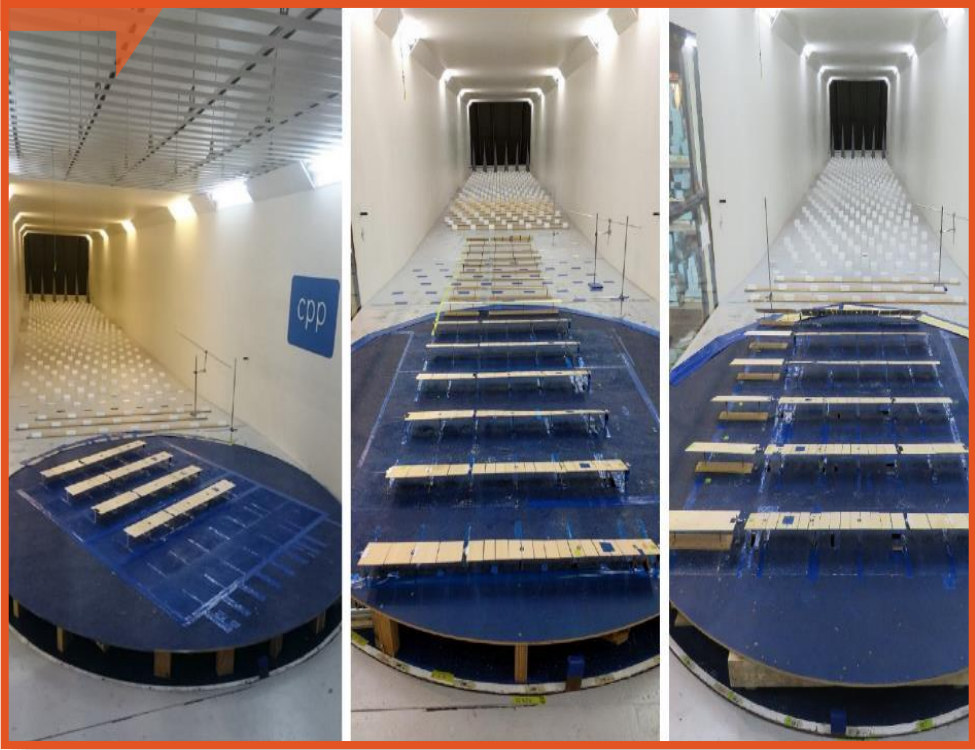
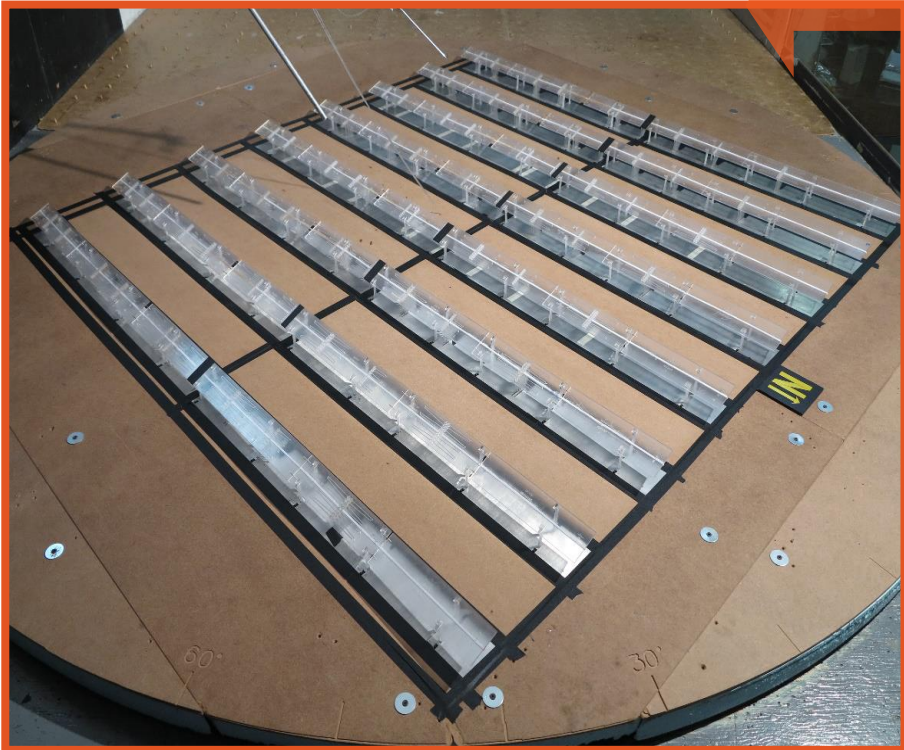
Instability

Aeroelastic

AeroPlus

Rigid Models

Aeroelasticity



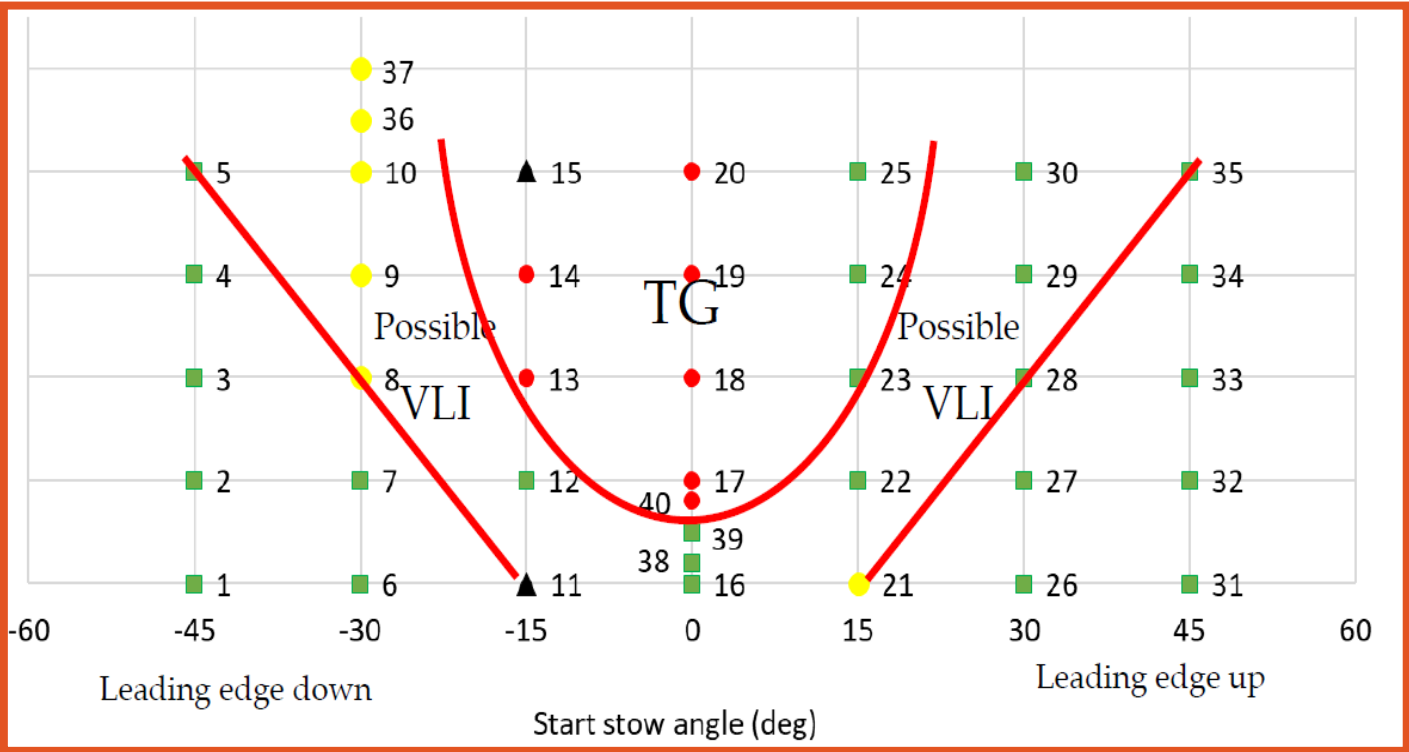
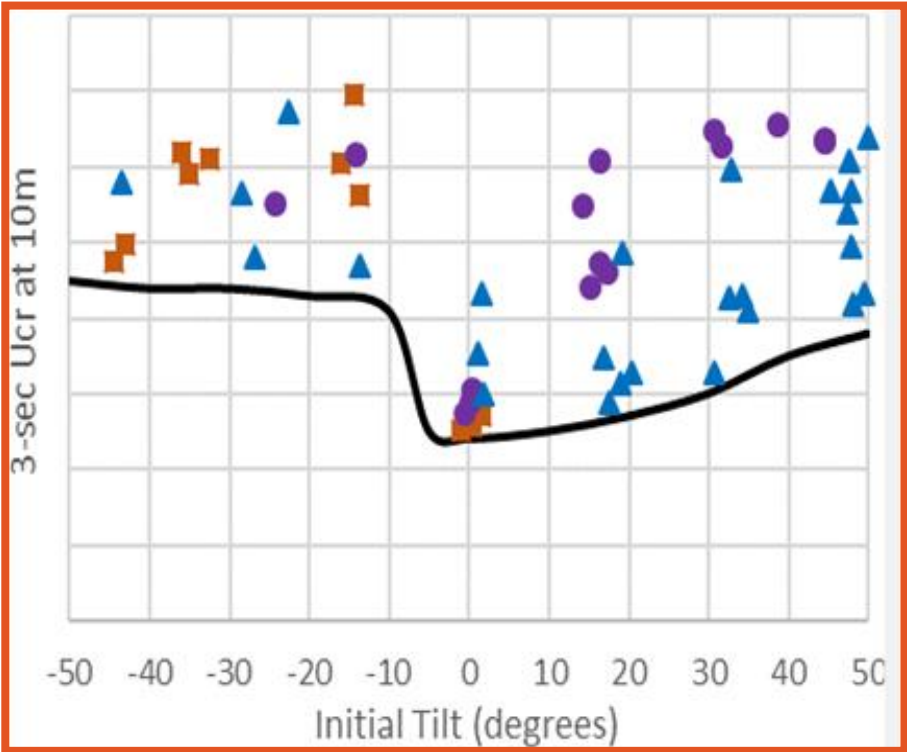
- Different worlds
- Sequential analysis and not 100% realistic

Static

Dynamic

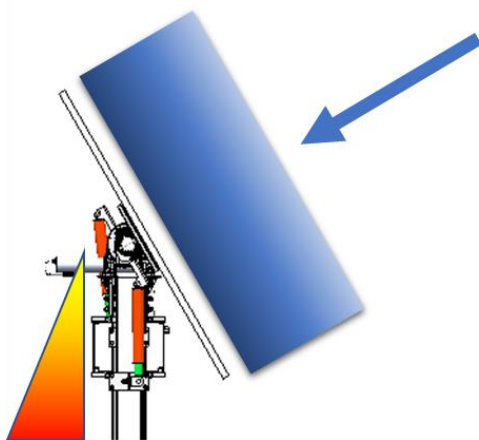
Instability

Aeroelastic



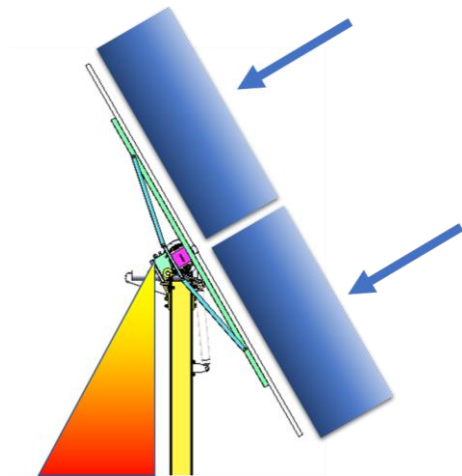
STOW POSITION

SKYLINE 1 in Portrait



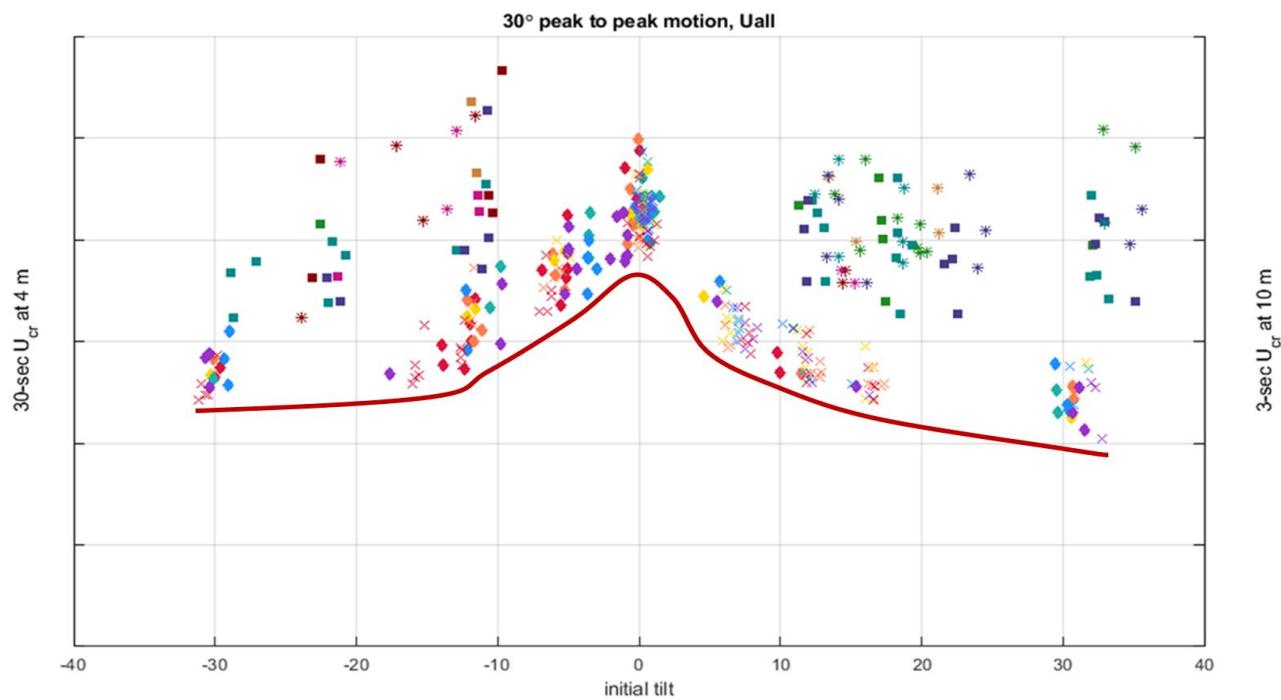
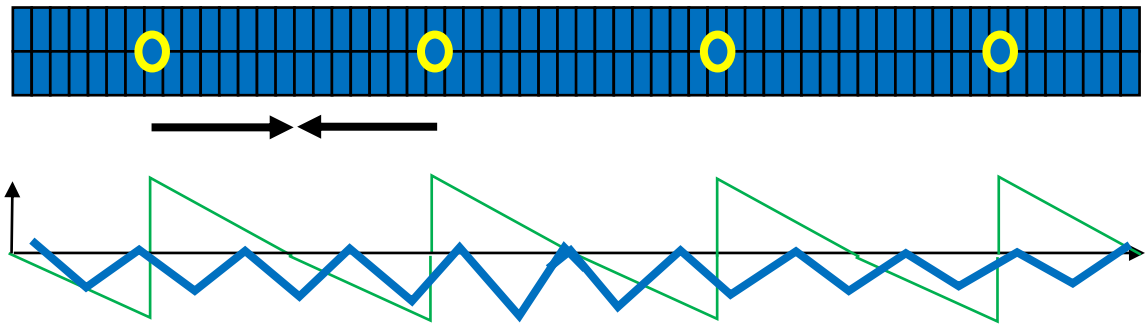
- When the anemometer detects wind speeds greater than 17 m/s, the tracker goes to **30°** for stow position.

SKYSMART 2 in Portrait



- When the anemometer detects wind speeds greater than 17 m/s, the tracker goes to **30°/15°** for stow position.

STABILITY + STOW POSITION



SKYSMART 2

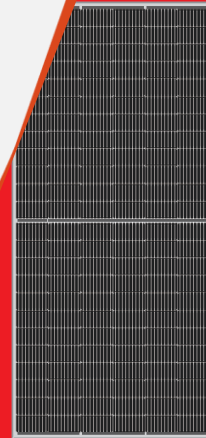
- Very **high stiffness**, means **0° stow** position

3

NEW MODULE HOMOLOGATION



LONGi Solar

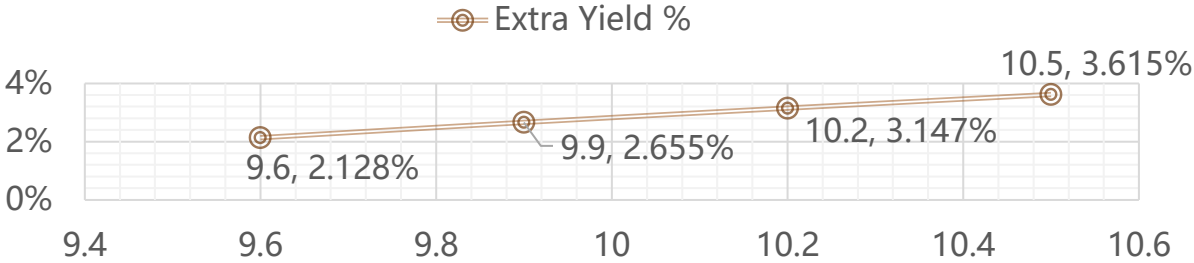


LR5-72HBD
520~540M

Hi-MO 5

*High Efficiency
Low LID Bifacial PERC with
Half-cut Technology*

	Other Solution (435W-DG + 3 string 2P tracker)	Arctech solution (530W + 4 string SkySmart 2)	Difference	
Total DC power (MW)	110	110		
Number of Modules	252,874	207,547	-45,326	-17.92%
Module per String	30	30		
String Power (kWp)	13.05	15.9	2.85	21.84%
Number of String	8,429	6,918	-1,511	-17.92%
Power per Tracker (kWp)	39.15	63.6	24.45	62.45%
Number of Tracker	2,810	1,730	-1,080	-38.44%
Total Pile	19,668	15,566	-4,102	-20.86%



I HIGH-POWER MODULES ELECTRICAL IMPACT



Based on 28 modules per string capacity comparison:

General PERC Module	
Power	405W
Number of Cells	144
Open Circuit Voltage	49V
Temperature coefficient of Voc	-0.29%/°C

High Power Module	
Power	530W
Number of Cells	144
Open Circuit Voltage	49.5V
Temperature coefficient of Voc	-0.29%/°C

SKYLINE
1 in Portrait

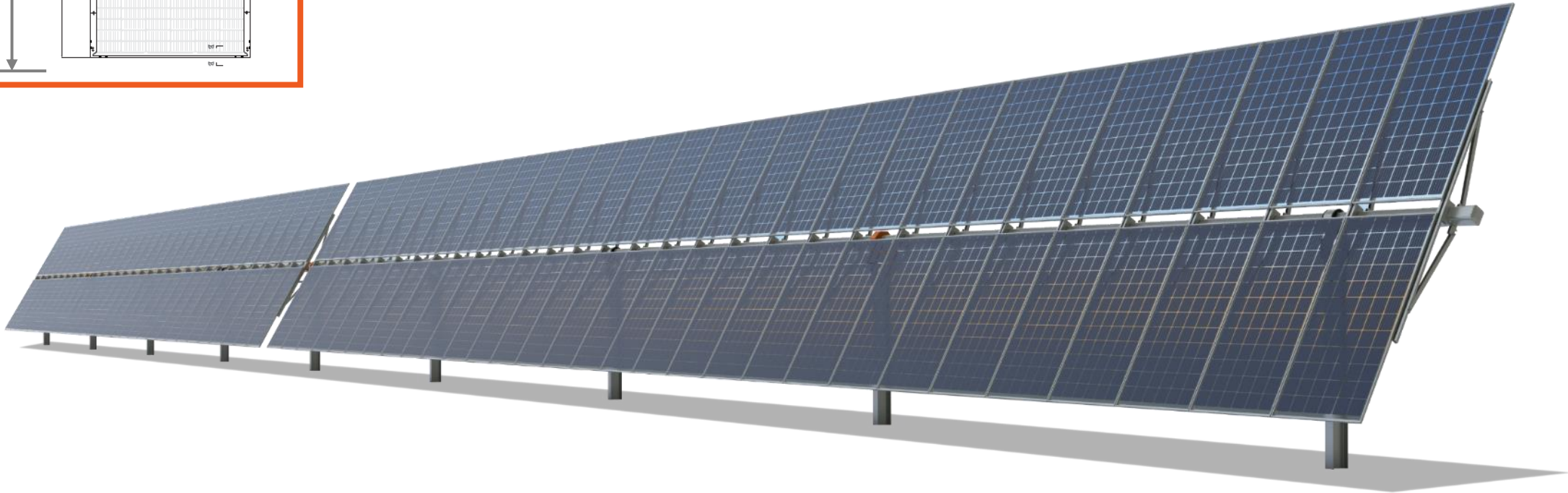
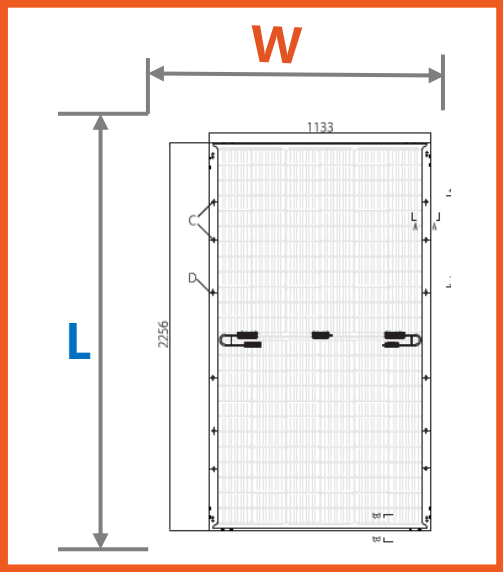
SKYSMART
2 in Portrait

SKYSMART 2
2 in Portrait – 4 strings

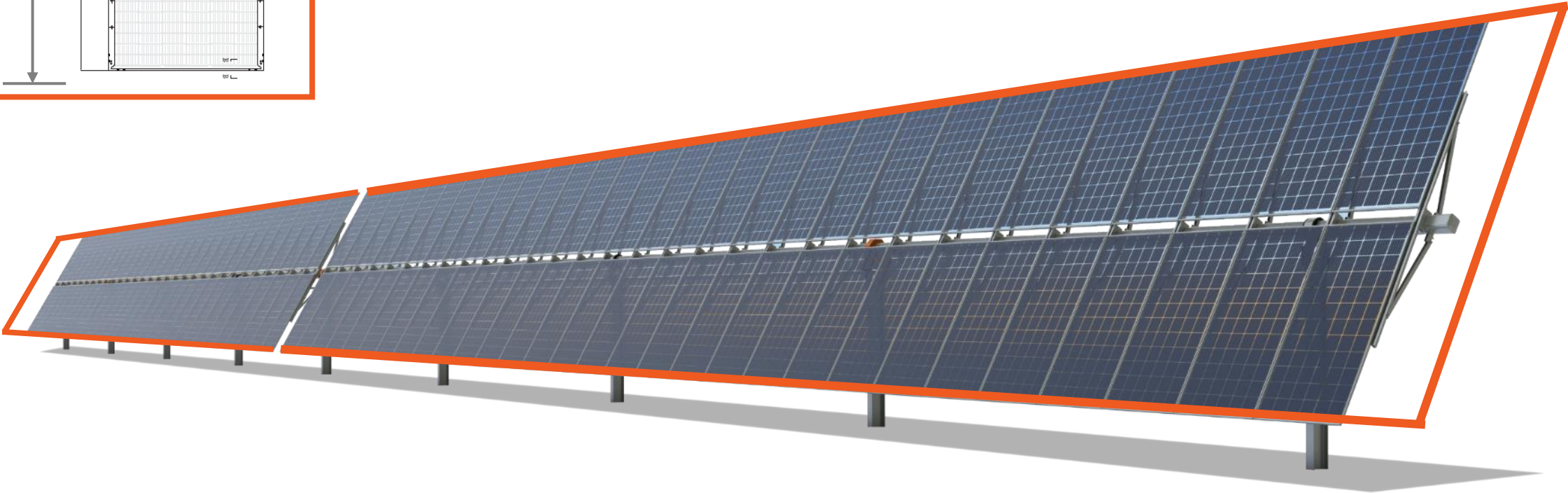
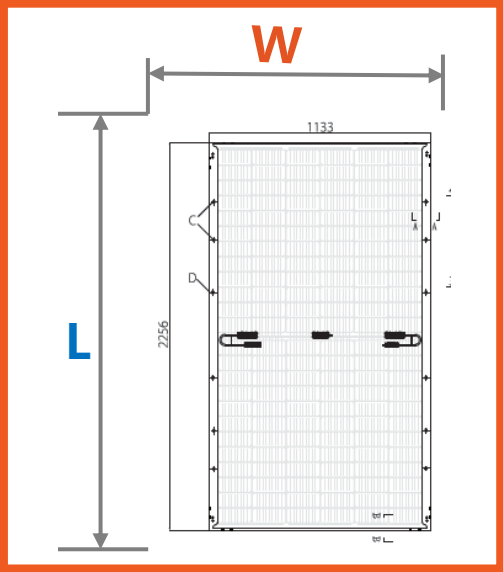
Minimum ambient temperature	Modules per string	SkyLine & SkySmart		
		Number of strings	Number of modules	Tracker Capacity
-20°C	≤27	≤3	81	32.8kW
-10°C	≤27	≤3	81	32.8kW
0°C	≤28	≤3	84	34.0kW
10°C	≤29	≤3	87	35.2kW
20°C	≤30	≤3	90	36.5kW

Minimum ambient temperature	Modules per string	SkySmart2		
		Number of strings	Number of modules	Tracker Capacity
-20°C	≤27	≤4	108	57.24kW
-10°C	≤27	≤4	108	57.24kW
0°C	≤28	≤4	112	59.36kW
10°C	≤29	≤4	116	61.48kW
20°C	≤30	≤4	120	63.6kW

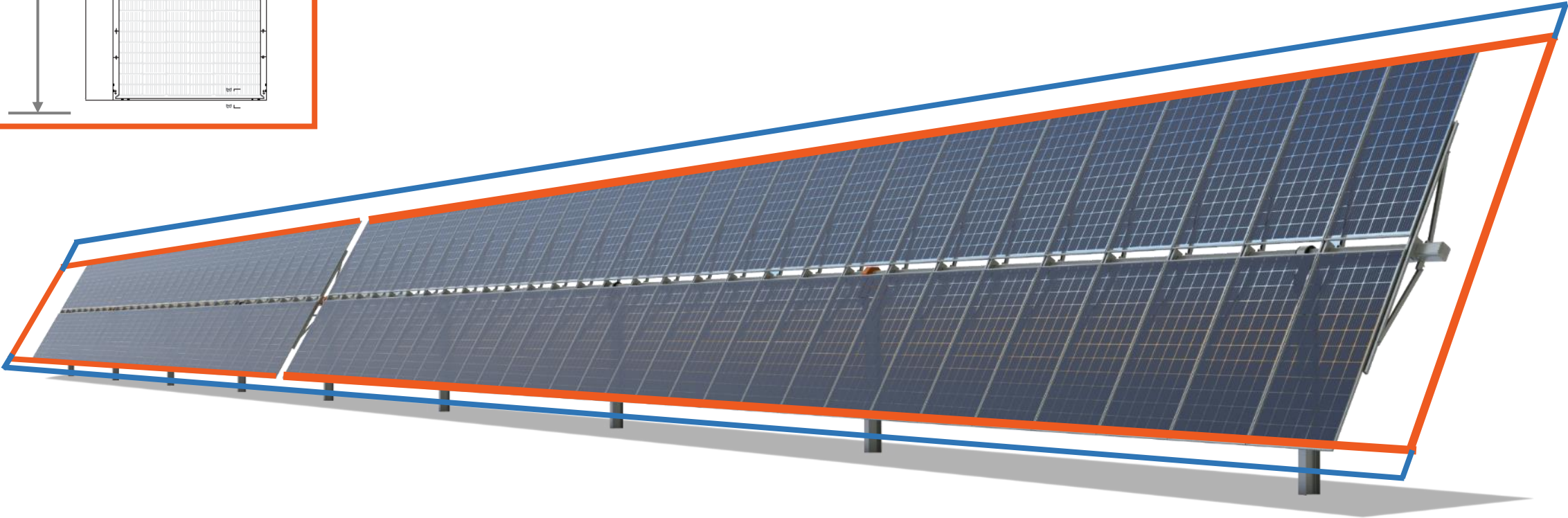
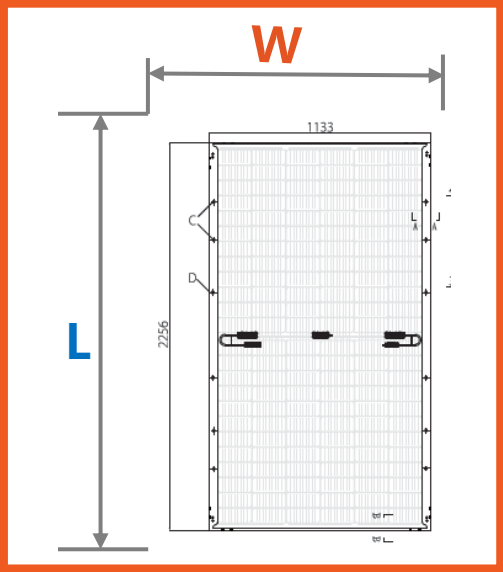
I HIGH-POWER MODULES MECHANICAL IMPACT



I HIGH-POWER MODULES MECHANICAL IMPACT



I HIGH-POWER MODULES MECHANICAL IMPACT



SKYSMART2

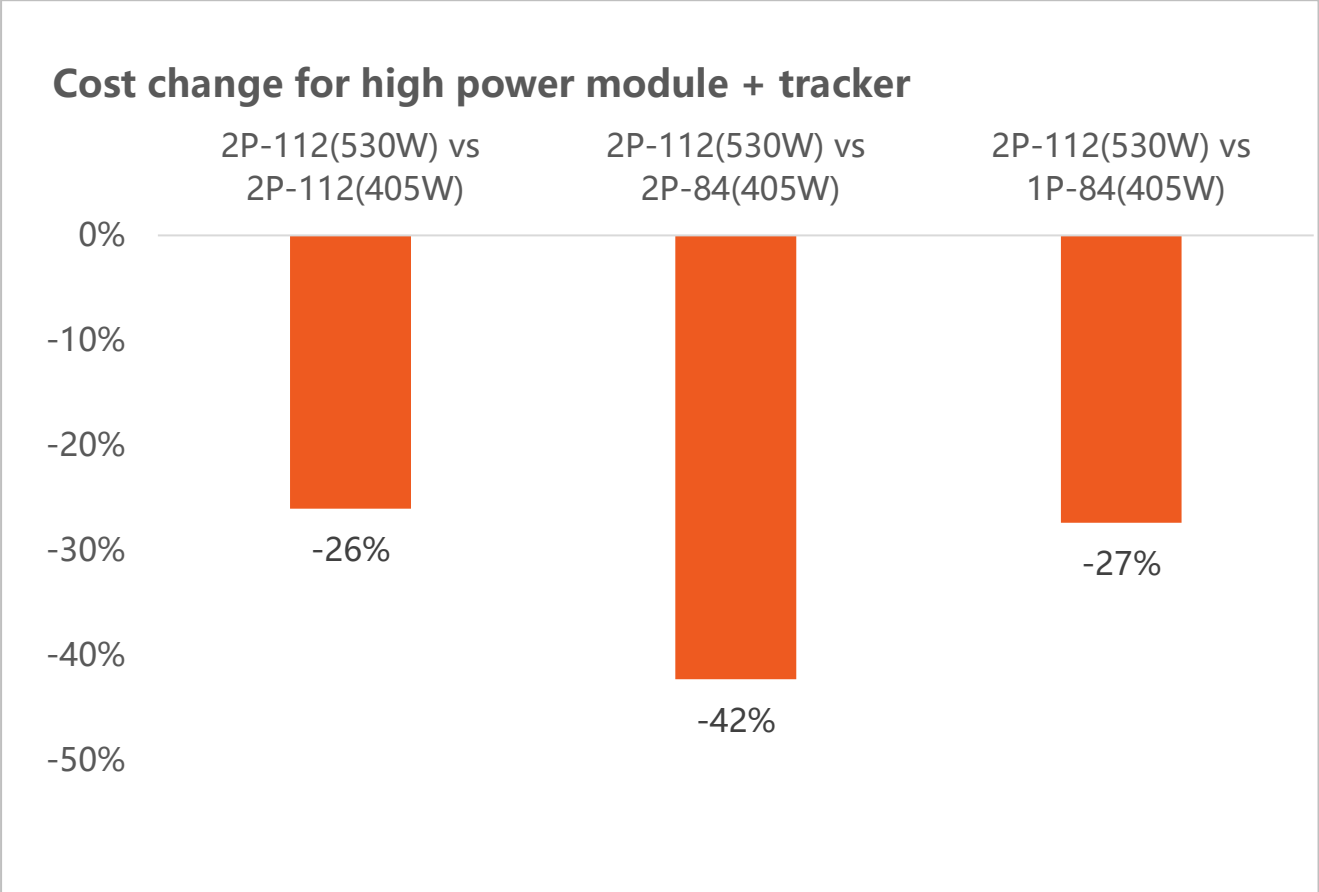
2 in Portrait



- Compatible from 4m to 5m *chord* total tracker width.
- (Modules from 1.95 a 2.45m length)

According to the actual number of strings, the cost changes of high-power modules + tracker:

	General PERC module	High Power module
Power	405W	530W
Number of Cells	144	144
Open Circuit Voltage	49V	49.5V
Temperature coefficient of Voc	-0.29%/°C	-0.29%/°C
Power	84 or 112 (0°C)	84 or 112 (0°C)



SKYSMART 2

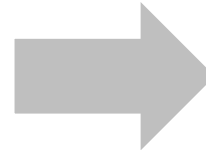
2 in Portrait

HAS 1 MORE STRING (4 total)

HIGH POWER MODULE

FEWER MODULES

INCREASED PITCH

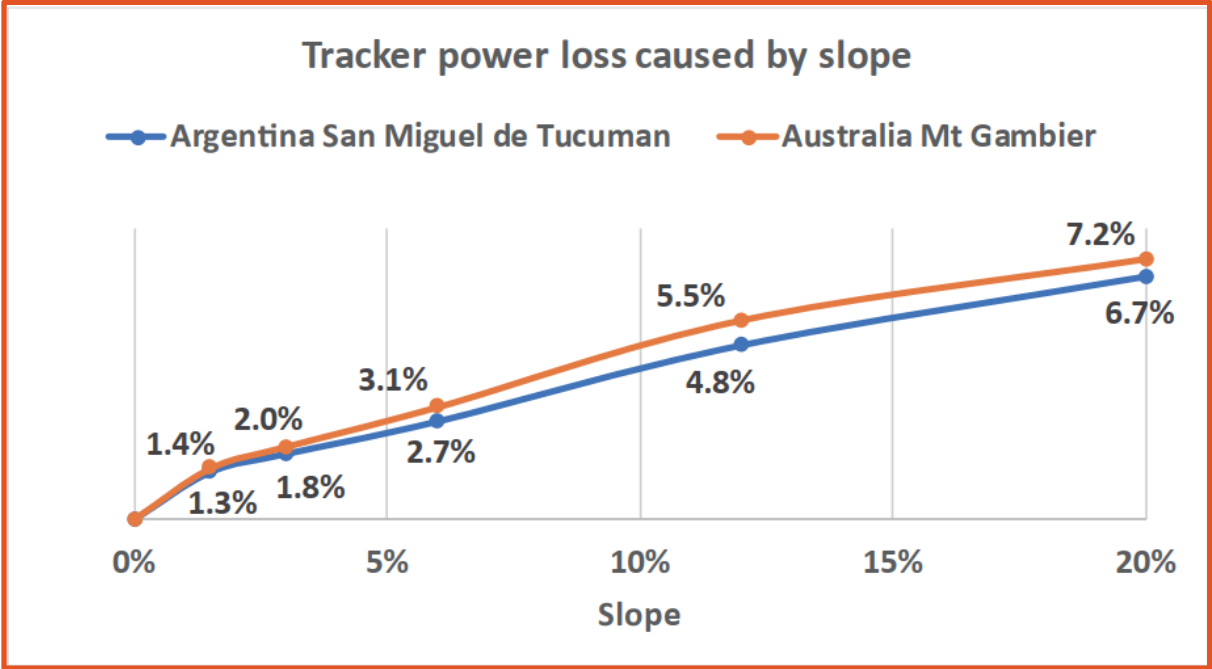
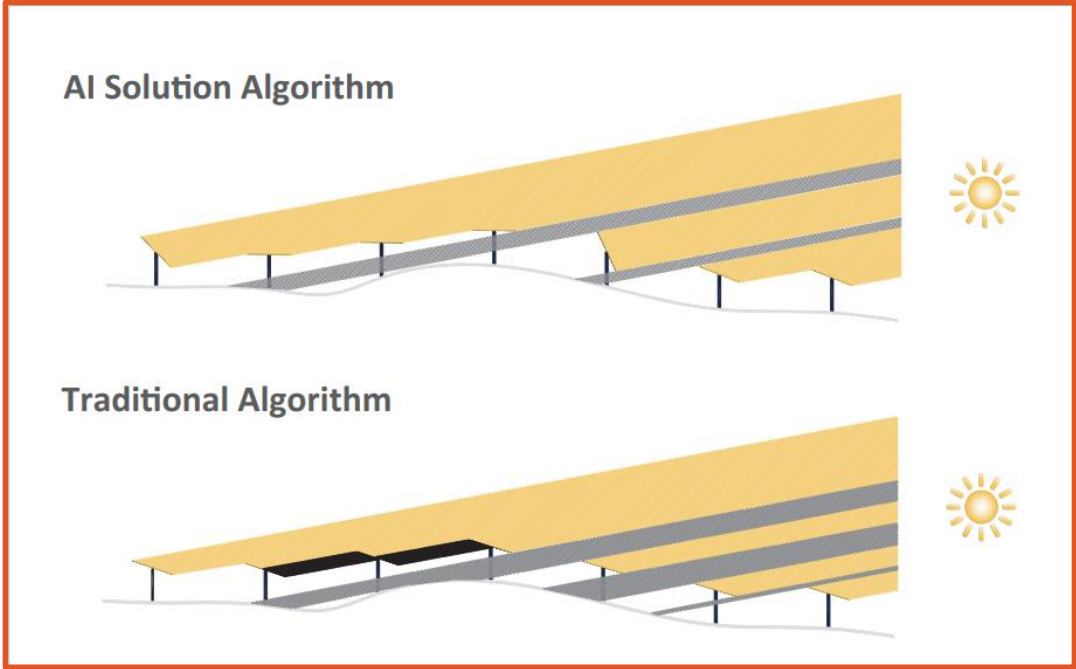


- Module Installation Efficiency On The Tracker By 30%
- Tracker Capacity Increase 62.5%
- More Space
- Higher Yield

4 AI CONTROLLER

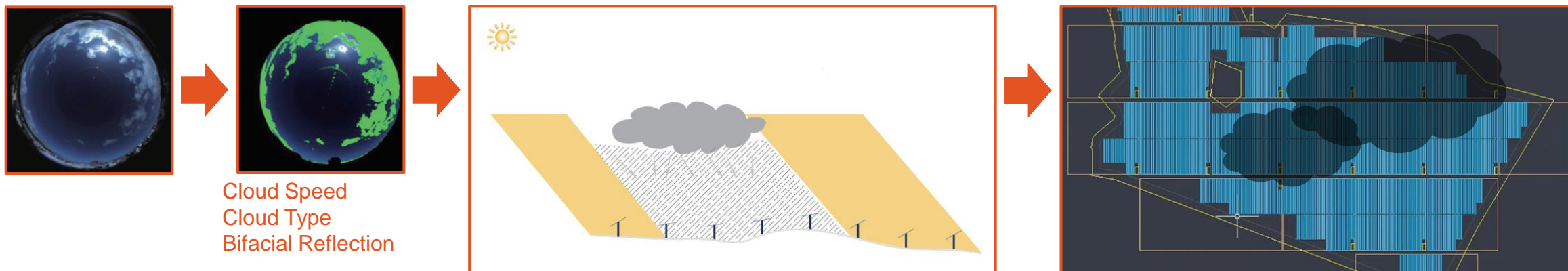


- 32

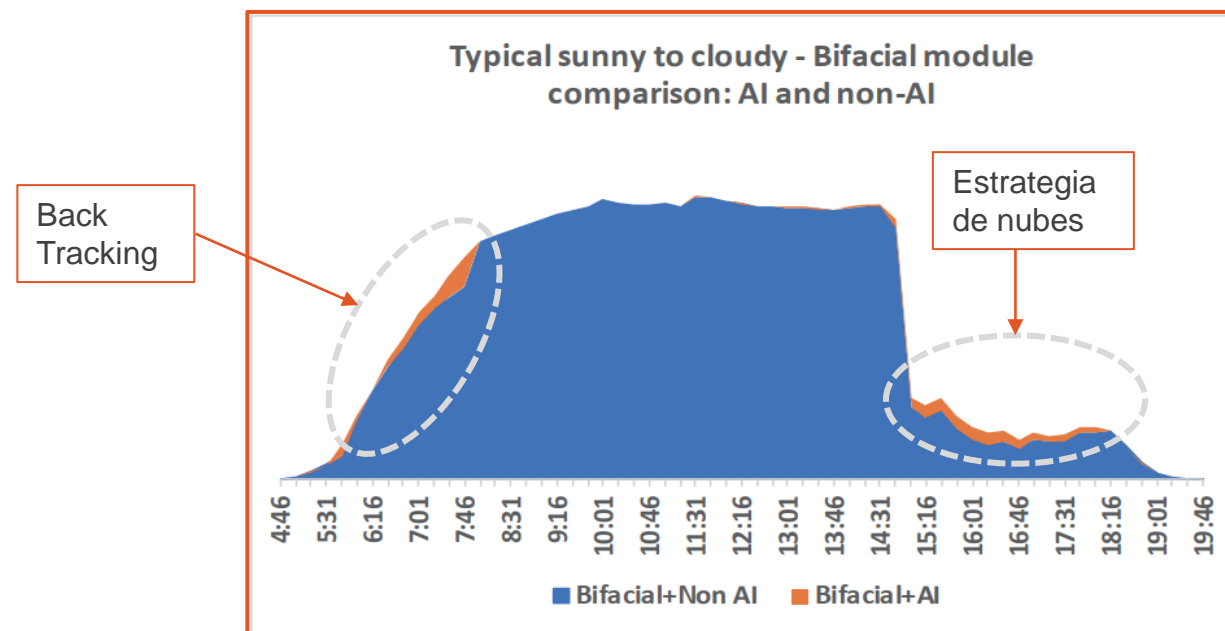


- Analysis of project design and topography
- **Optimization of radiation received and generated (2-4%)**

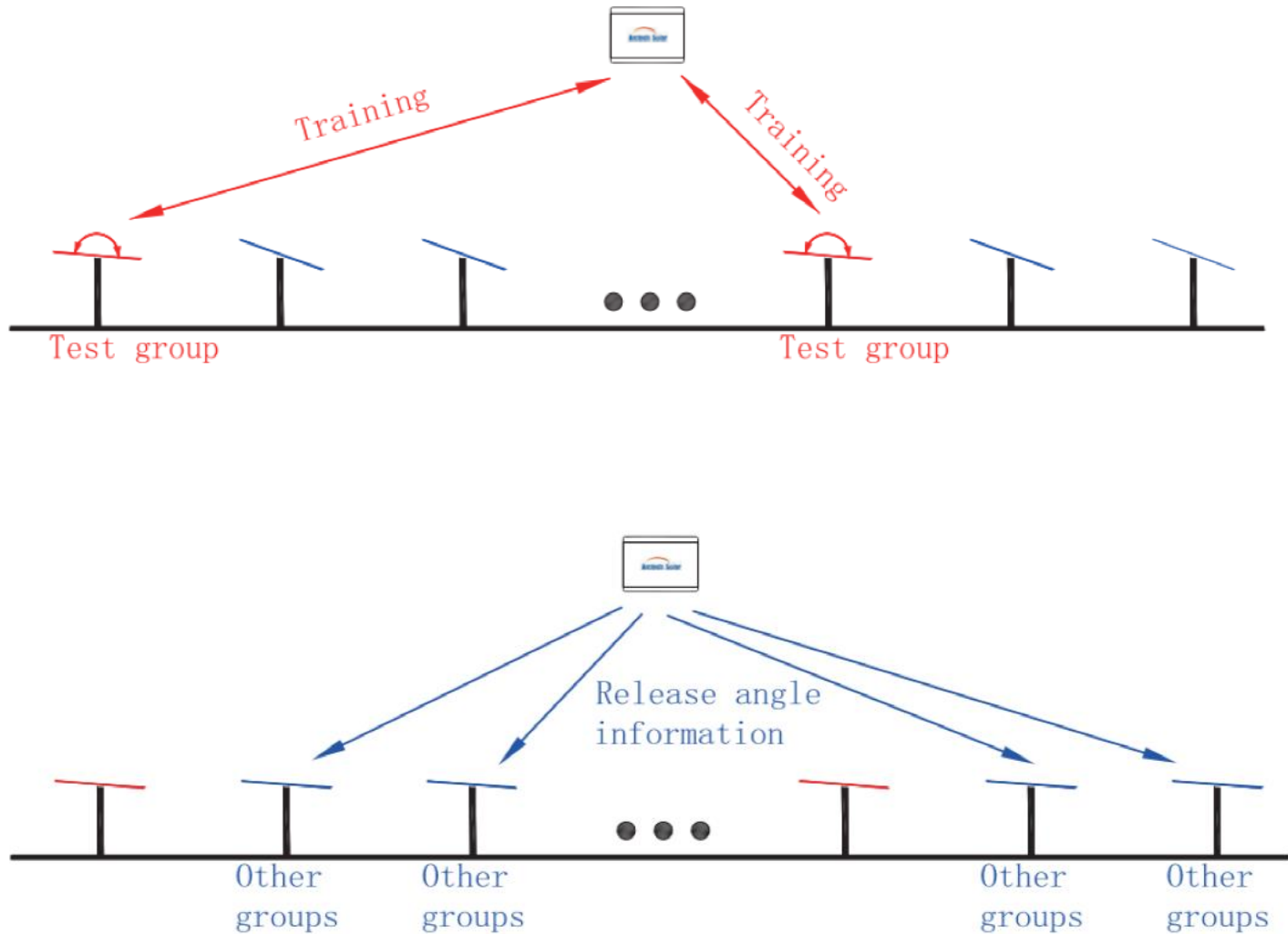
I PARTIAL SHADING ROUTINE



- Meteorological database
- Cloud shading analysis in real time
- **Tilt adjustment to maximize generation**



I TILT OPTIMIZATION



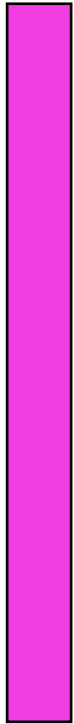
- Obtaining maximum power
- New parameters for all trackers
- **MAX Electricity generated (no collection)**
- **2.5- 6% TOTAL of higher generation.**

5 LAYOUT OPTIMIZATION 1P/2P

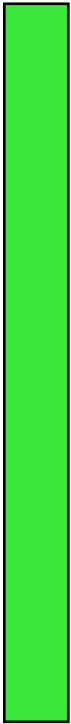


SKYSMART
2 in Portrait

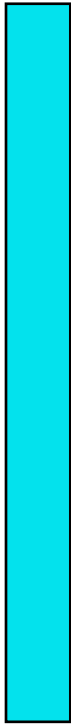
SKYLINE
1 in Portrait



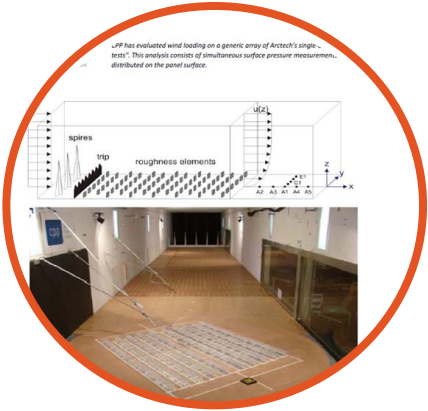
Exterior



Interior

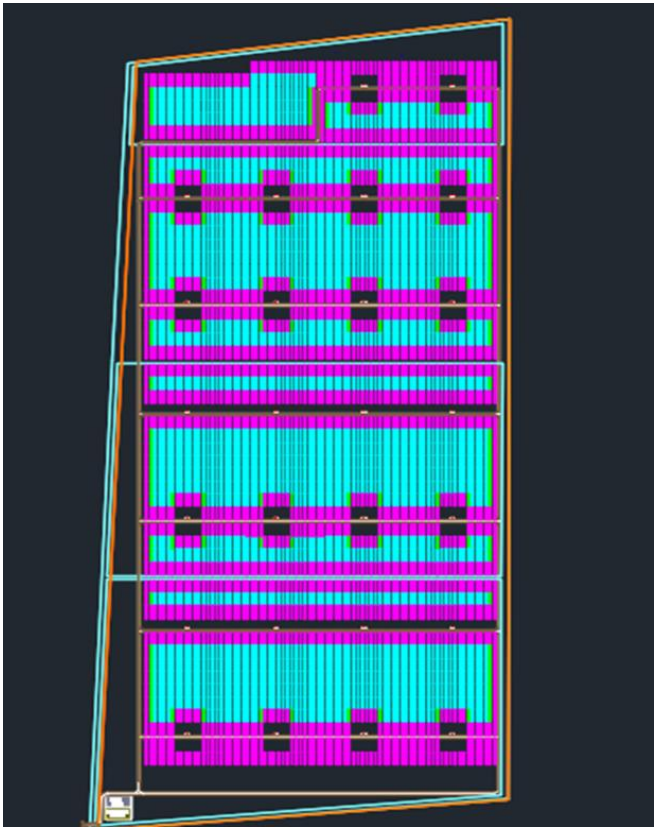


Far Interior



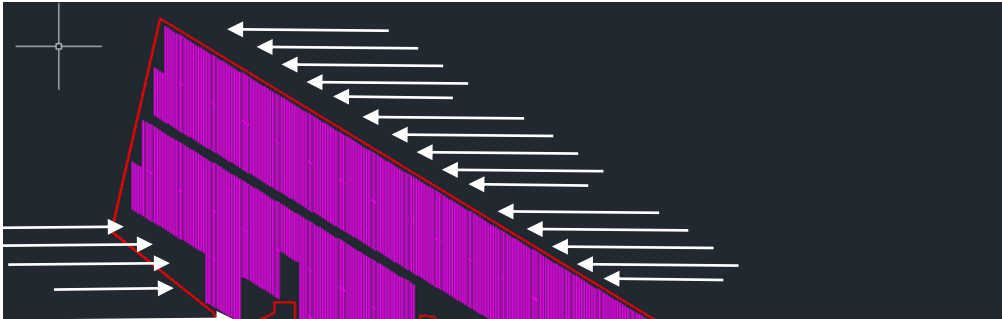
- Layout should minimize exterior trackers.

SKYSMART
2 in Portrait



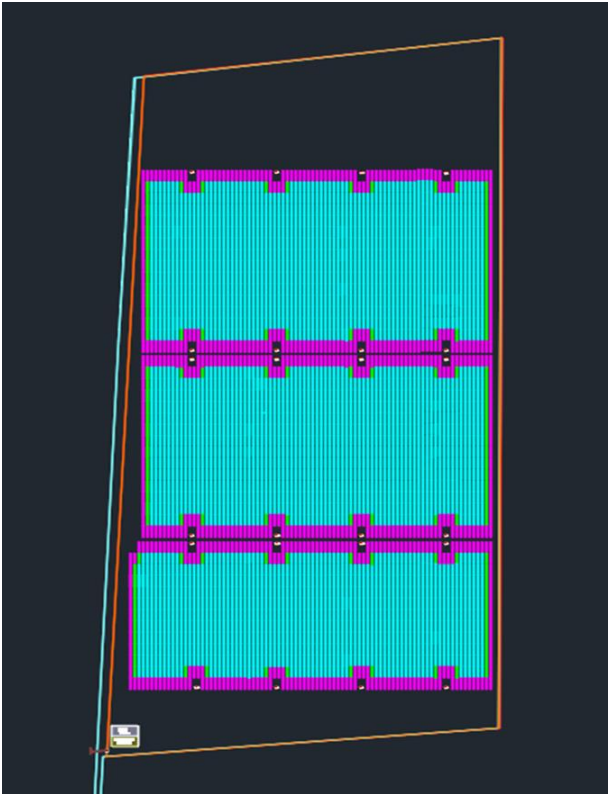
Tracker location/type	Number of Trackers	Percentage
Exterior (3 strings, pink)	1707	45,2%
Interior (3 strings, green)	122	3,2%
Far Interior (3 strings, blue)	1945	51,5%
Total	3774	100,00%

SKYLINE
1 in Portrait



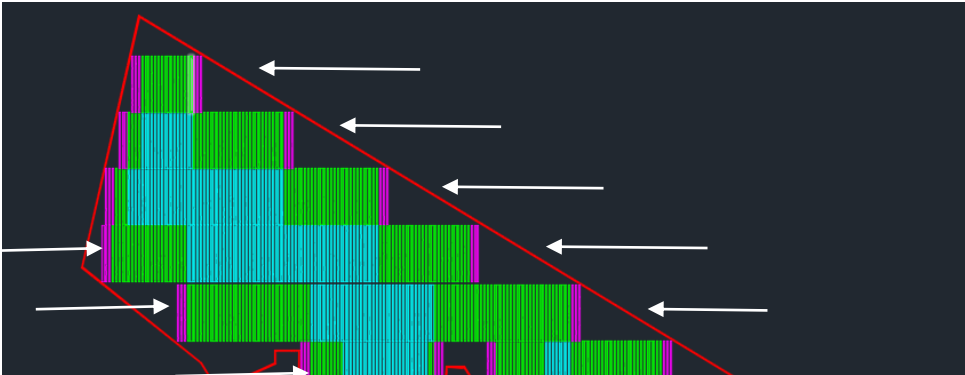
Tracker location/type	Number of Trackers	Percentage
Exterior (3 strings, pink)	669	100,0%
Interior (3 strings, green)	0	0,0%
Total	669	100,00%

SKYSMART
2 in Portrait



Tracker location/type	Number of Trackers	Percentage
Exterior (3 strings, pink)	634	16,8%
Interior (3 strings, green)	141	3,7%
Far Interior (3 strings, blue)	2999	79,5%
Total	3774	100,00%

SKYLINE
1 in Portrait



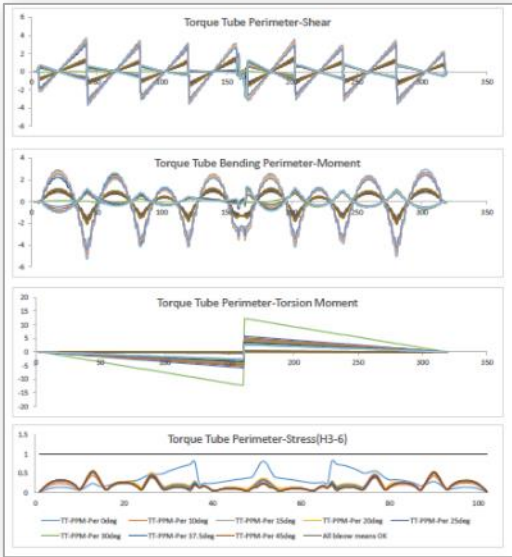
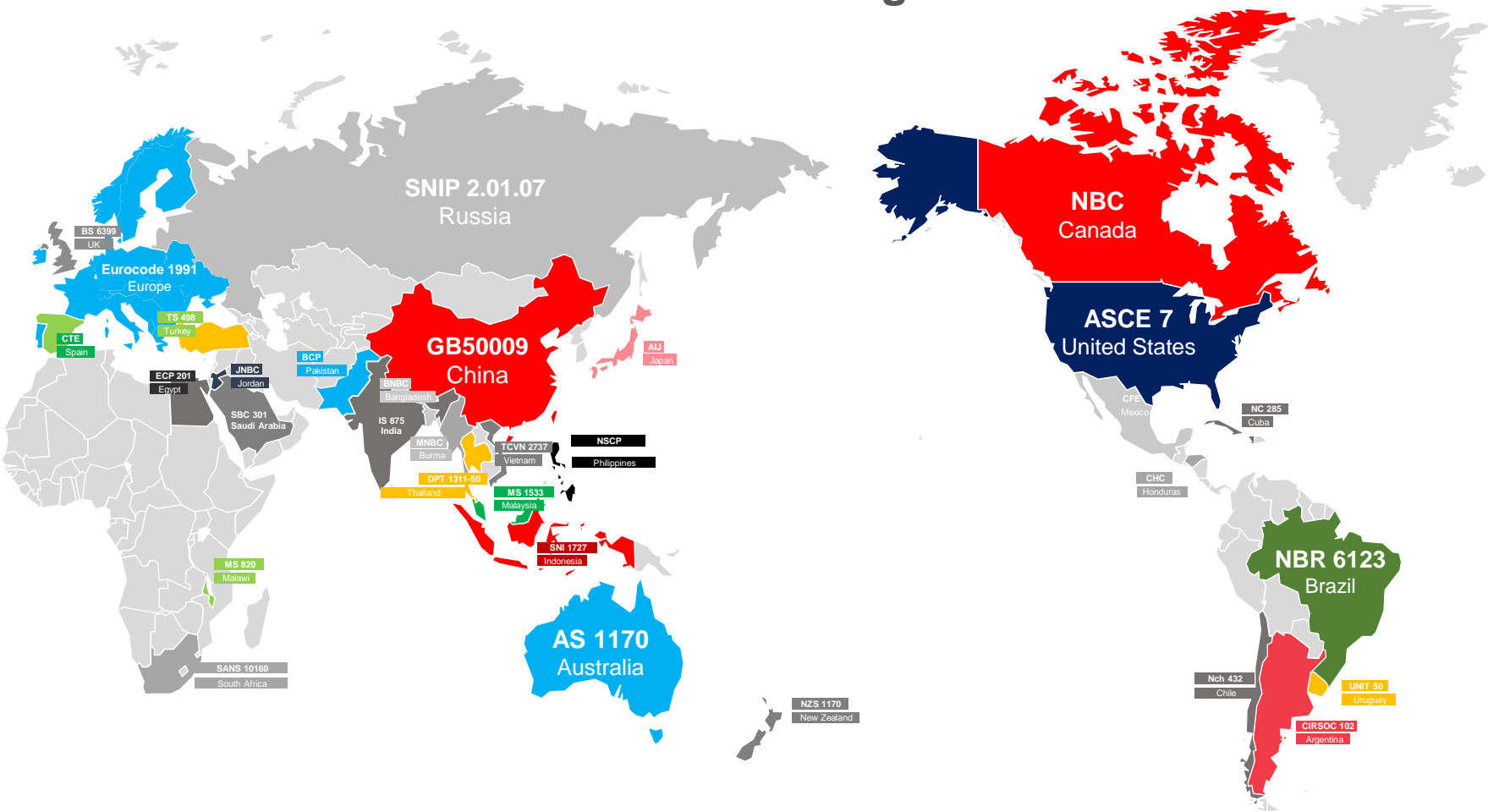
Tracker location/type	Number of Trackers	Percentage
Exterior (3 strings, pink)	72	10.7%
Interior (3 strings, green)	402	59.6%
Far Interior (3 strings, blue)	200	29.7%
Total	674	100.00%

6

STRUCTURAL CALCULATIONS (SIZING UPPER STRUCTURE & FOUNDATION)



30+ Countries Building Code



I DESIGN LOADS

• Local Code

- Wind
- Snow
- Seismic

• Weight (Module and Structure)

- Shape
Coefficients
- DAFs

India: IS875-2015

Saudi Arabia: SBC 301

Chile: Nch 432

Brazil: NBR 6123

USA: ASCE 7-05/10/16

Australia: AS 1170

New Zealand: NZS 1170

Argentina: CRSOC 102

Malaysia: MS 1553

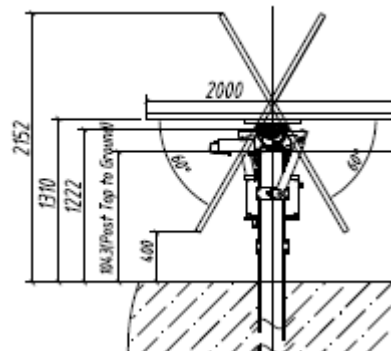
Philippine: NSCP 2010

Vietnam: TCVN 2737

Mexico: CFE Design Manual

Europe: Eurocode 1991

Japan: JIS C 8955/AIJ



LOCAL CODE

SITE LOADS

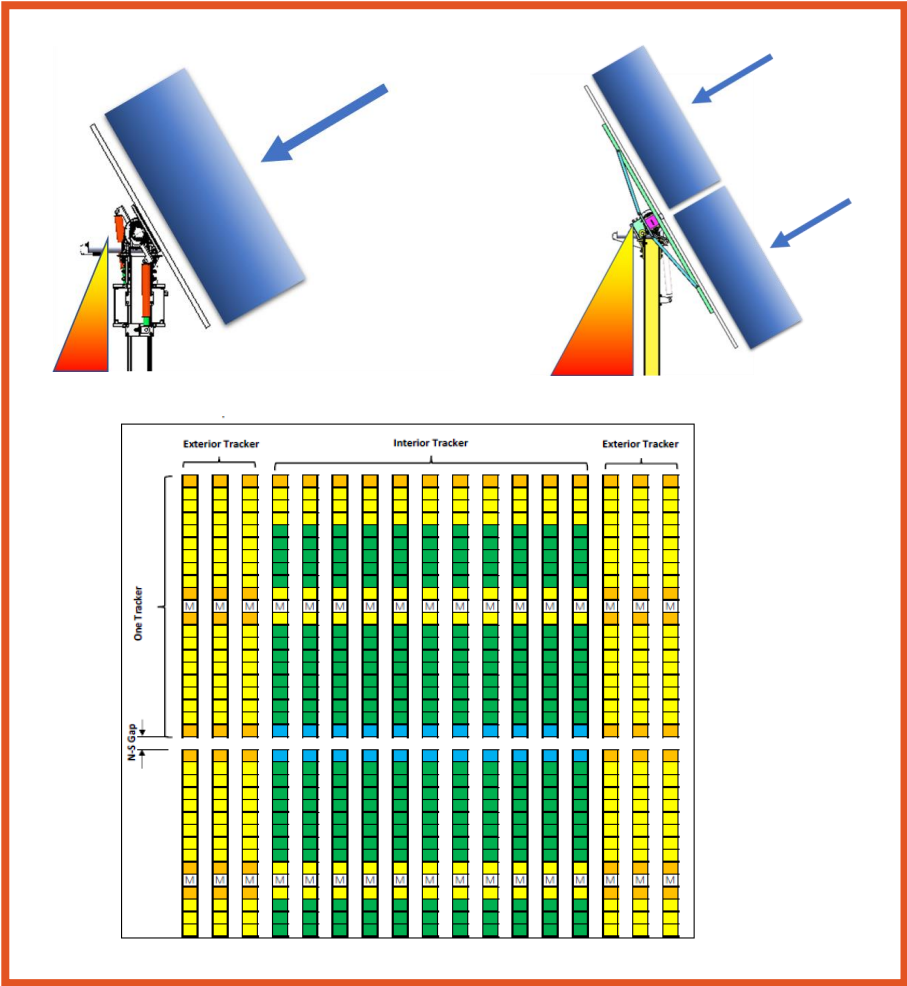
DEAD LOAD

TRACKER



UPPER STRUCTURE

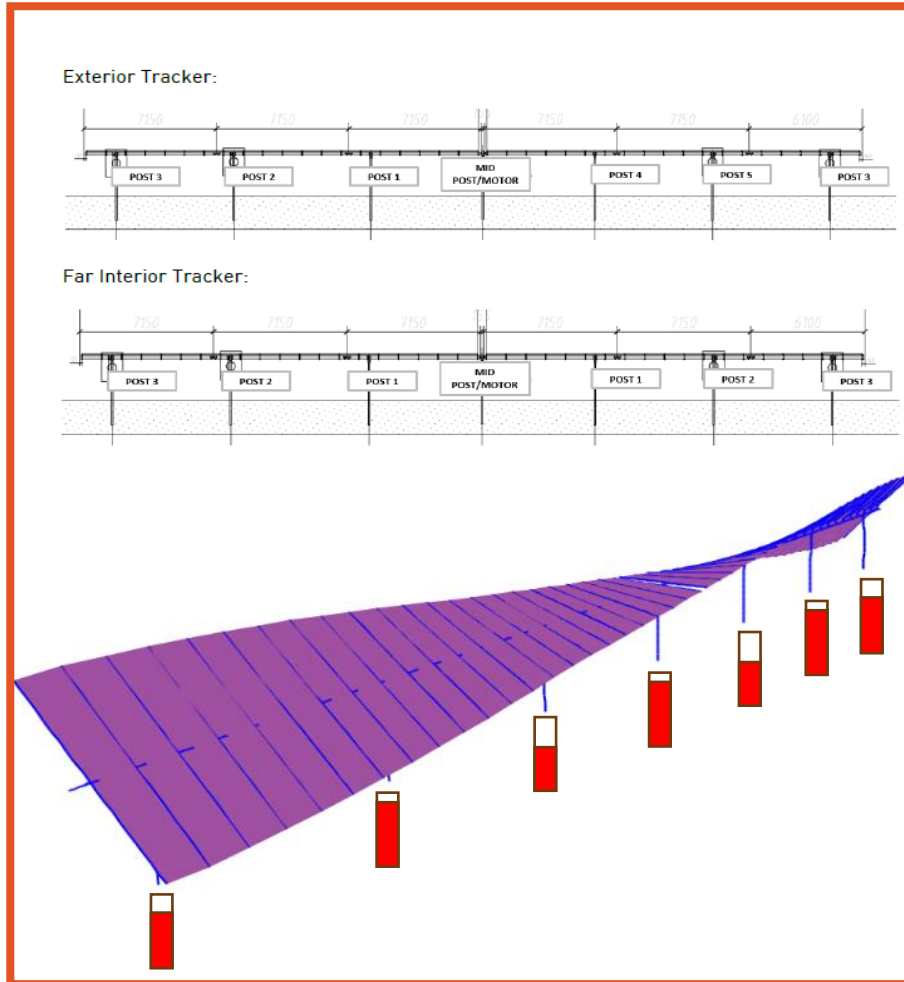
TORQUE TUBE DESIGN



- Once loads are obtained, **reactions on the torque tube** are determined according to the type of tracker. (Exterior, Interior or Far Interior) and module location (motor, inner, edge)

LOADS REACTIONS ON PILES

FOUNDATION DESIGN



- Load reactions coming from **upper structure**.
- Calculation of Forces and Moments at Grade
- SLS, ULS and FoS=2.0

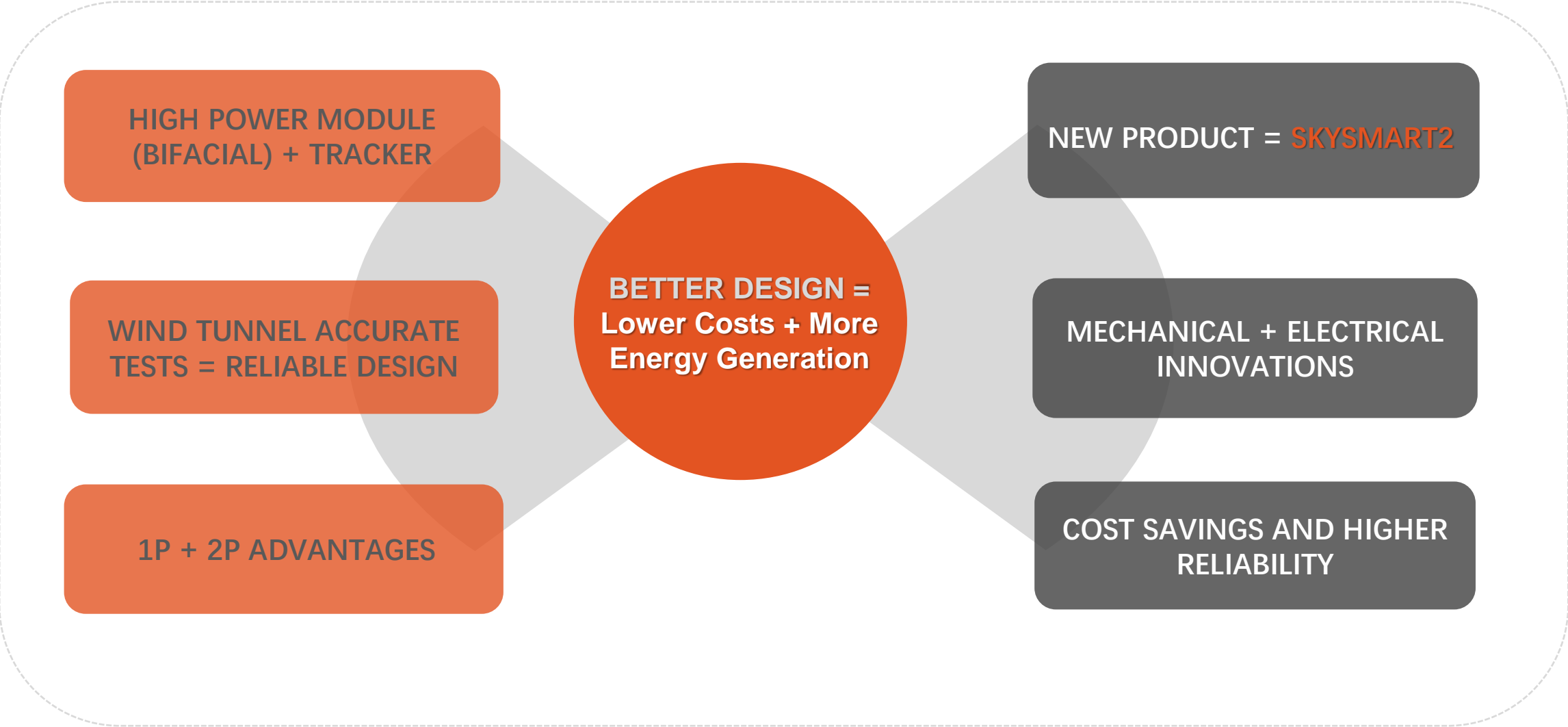
7 CONCLUSIONS

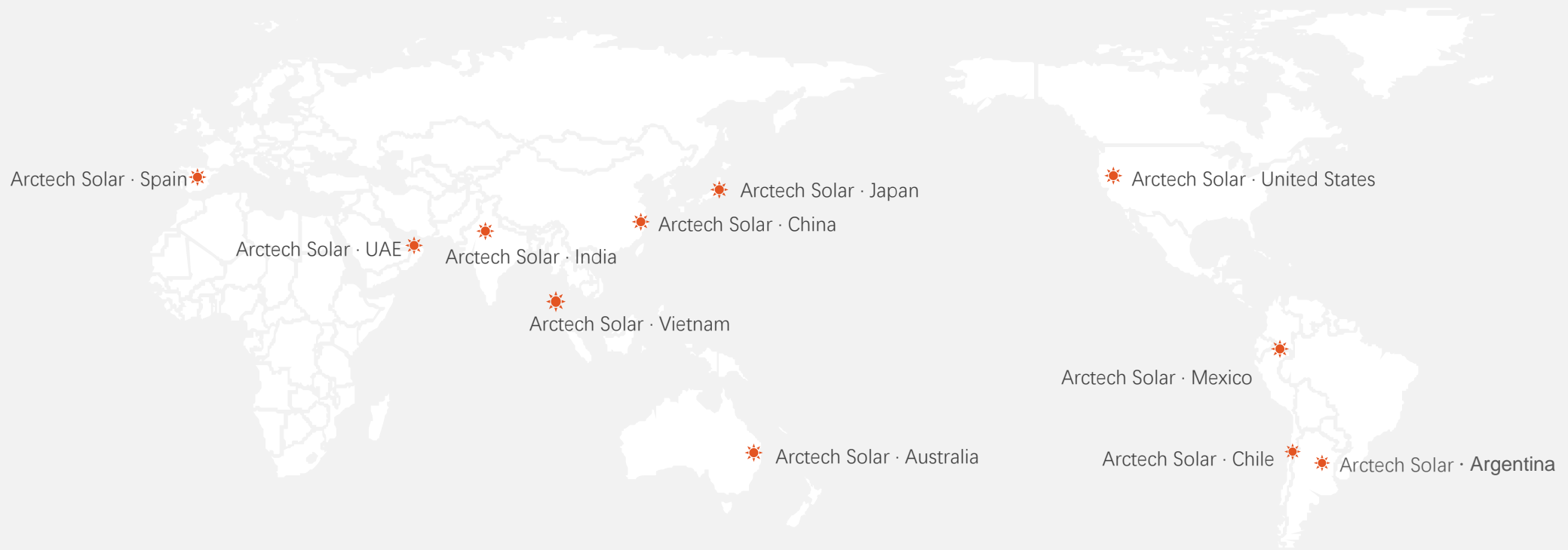


Lower Costs
More Energy Generation

Better Design







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Technical Sales Manager - LATAM

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Gracias | Thank You | 谢谢

Contact us: sales@arctechsolar.com

