Arctech Solar

人工智能太阳能跟踪系统模型方法
AI modeling methods for PV tracker technology

王士涛 Bruce Wang
04/12/2018

1、AI Tracking Solution Introduce

2、Demonstration System

3、Data Analysis

4、Company Introduce

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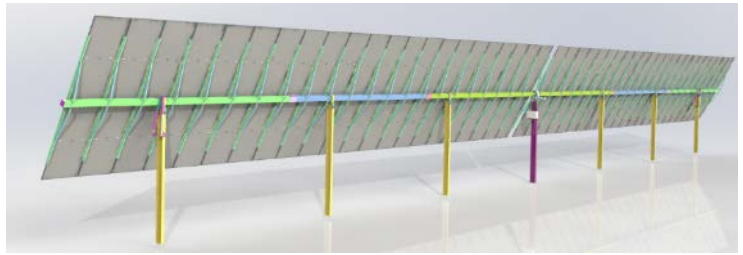
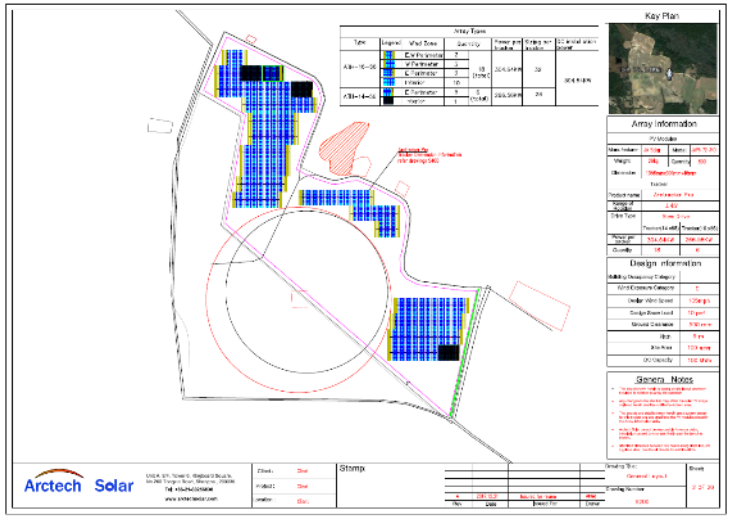
PRODUCT DESIGN

- Wind tunnel study
- Structural calculations
- Main structural design
- Component design
- Component calculations
- Electrical design
- Laboratory testing
- Certifications



PROJECT DESIGN

- Local building code analysis
- Main structural calculations
- Cost analysis
- Layout design
- PVsyst simulation
- Customer service



Yield! ← AI support

AI Solution for Bifacial module

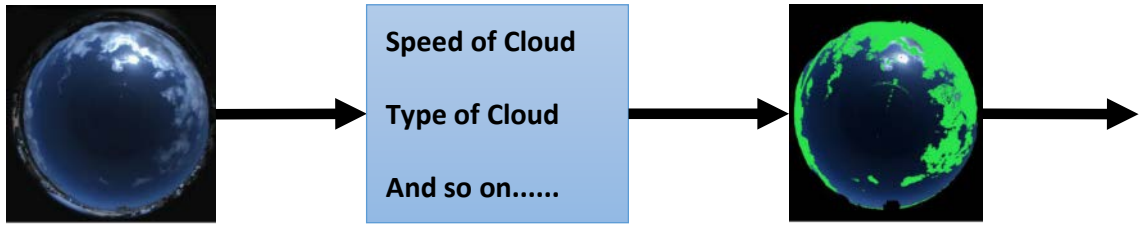
AI Solution

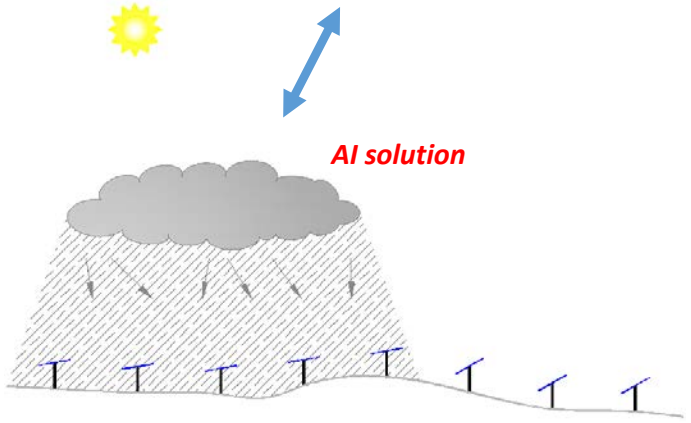
Based on big data server including weather and topography and so on. Give out the control method for Bifacial tracking system:

- **Sunny day—Current control method ;**
- **Cloudy day—sun-eye mode ;**
- **Heavy cloudy day—back+front mode ; 0.5%~2% yield increase**

Cloudy day – Sun-eye mode:

1、picture of sky **2、analyze** **3、Cloud Mapping**





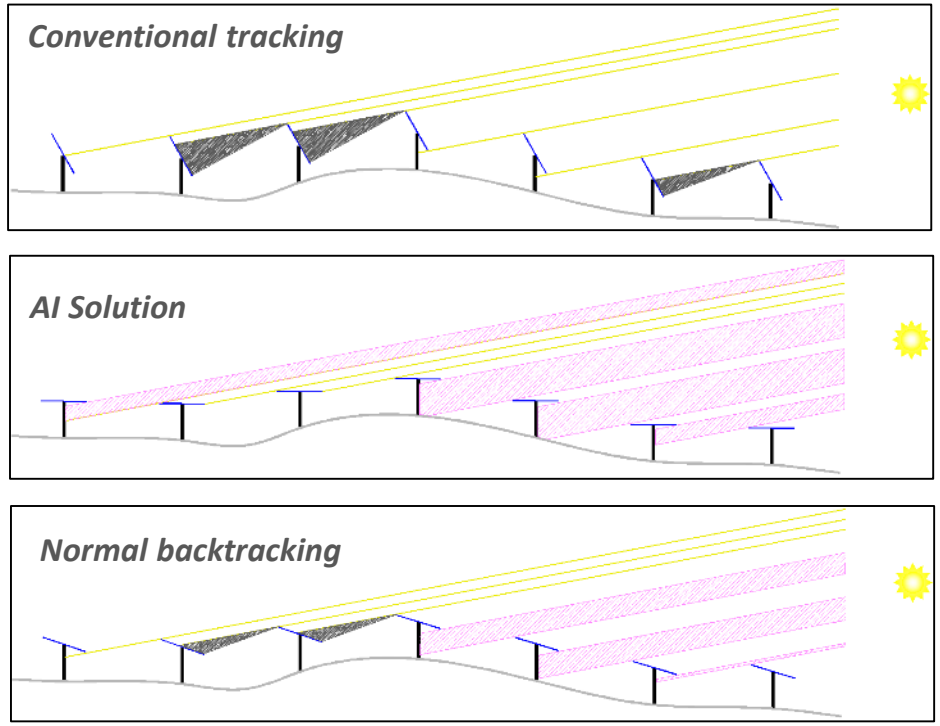
AI Solution

AI Solution

Based on topography and layout ：

- **Optimize the local topography backtracking solution ；**
- **System-level backtracking solution ；**

0%~4% yield increase



AI Solution

Undeveloped irradiation **Shading area**

Max 5%~6% yield increase

AI Tracking System

Astronomical algorithm

Location + GPS time

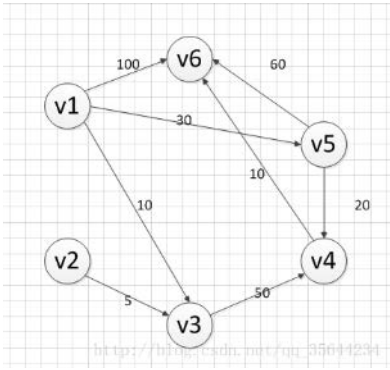
Basic Tracker algorithm (Including Basic Backtracking)

AI Tracker Algorithm

Contour map of all trackers

Sky image
Temperature/Irradiation
Bifacial irradiation

AI Algorithm (Dijkstra Algorithm)



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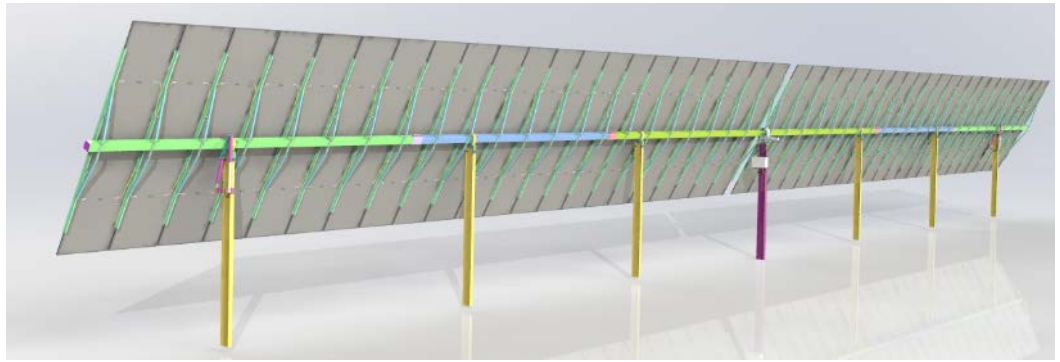
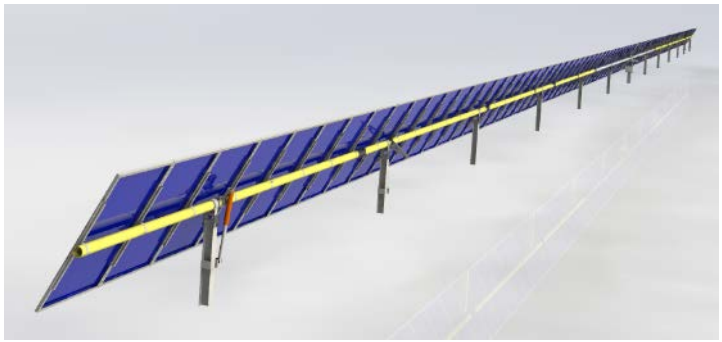
Tracking System

- Independent System
  - 2Px45-SkySmart
  - 1Px90-SkyLine
- Linked System
  - 1Px60x16-Arctracker Pro

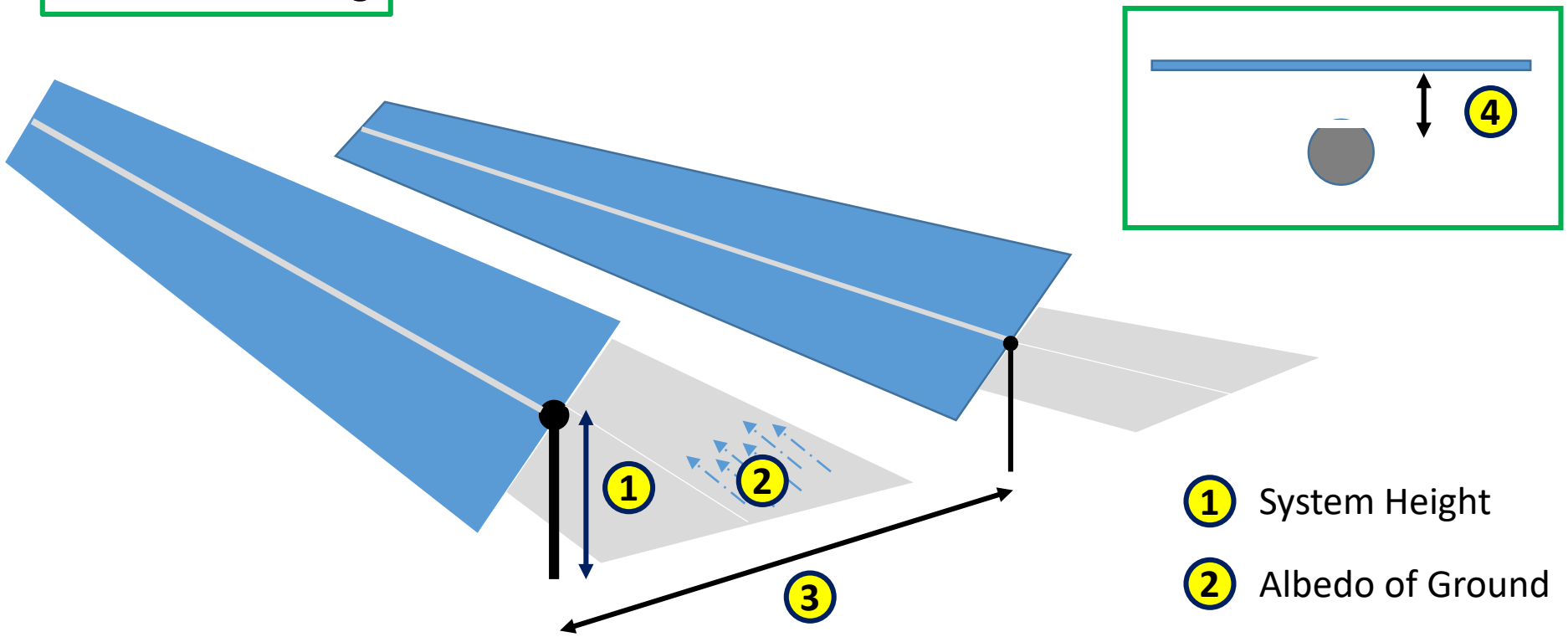




SkySmart

Arctracker Pro | SkyLine

Bifacial Modeling

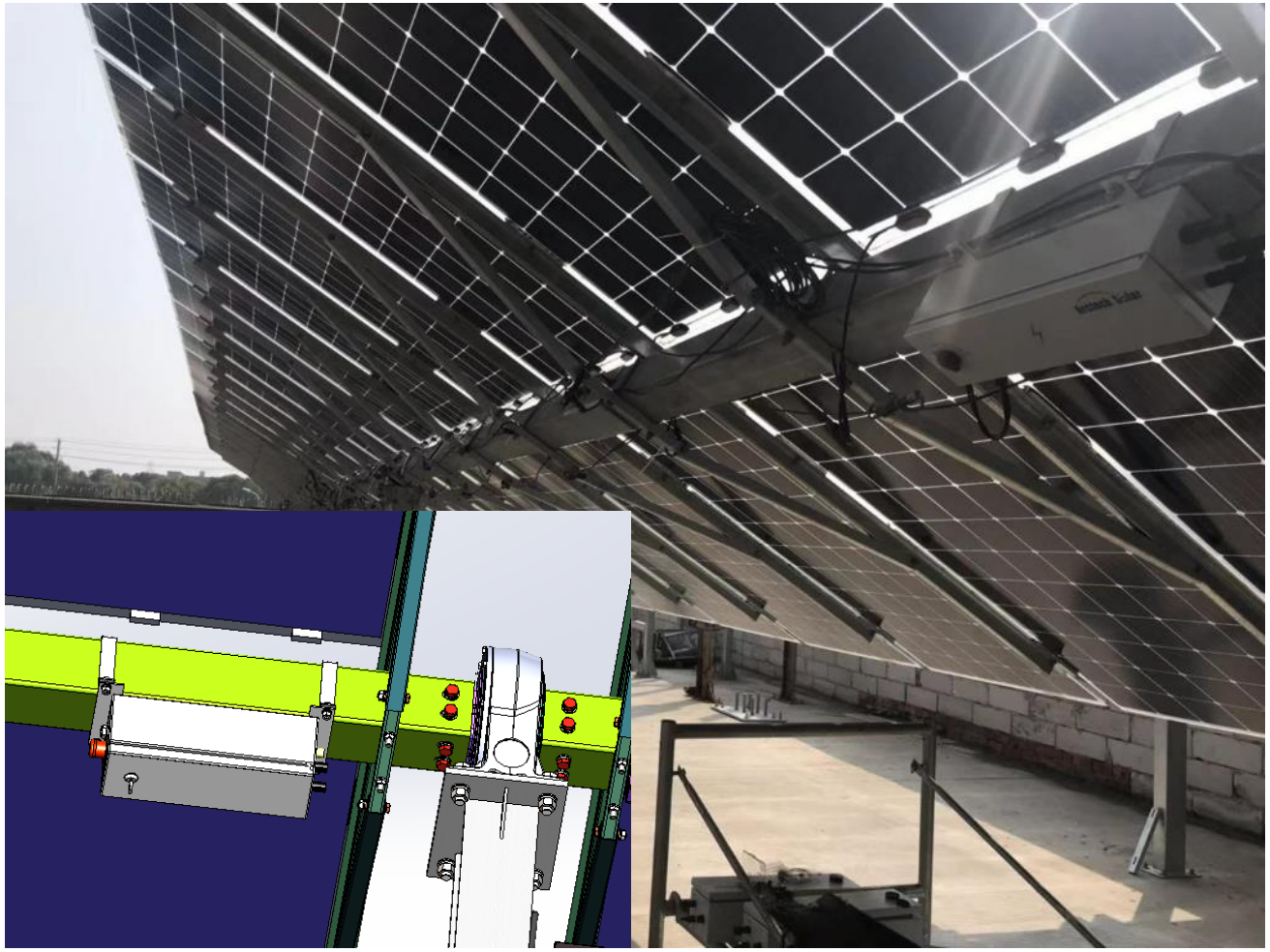


1. System Height
2. Albedo of Ground
3. System Pitch
4. Distance from Module

1P Tracker	2P Tracker
PVsyst: 4.2%	PVsyst: 7.5%
Isc: 7%	Isc: 12%

STRING POWERED TRACKER

- PV String feed the DC motor
- 0.04 kWh per day one tracker
- String power saving cable loss and installation cost
- Lithium-ion Battery backup
- IC chip level design
- Lora wireless monitoring system



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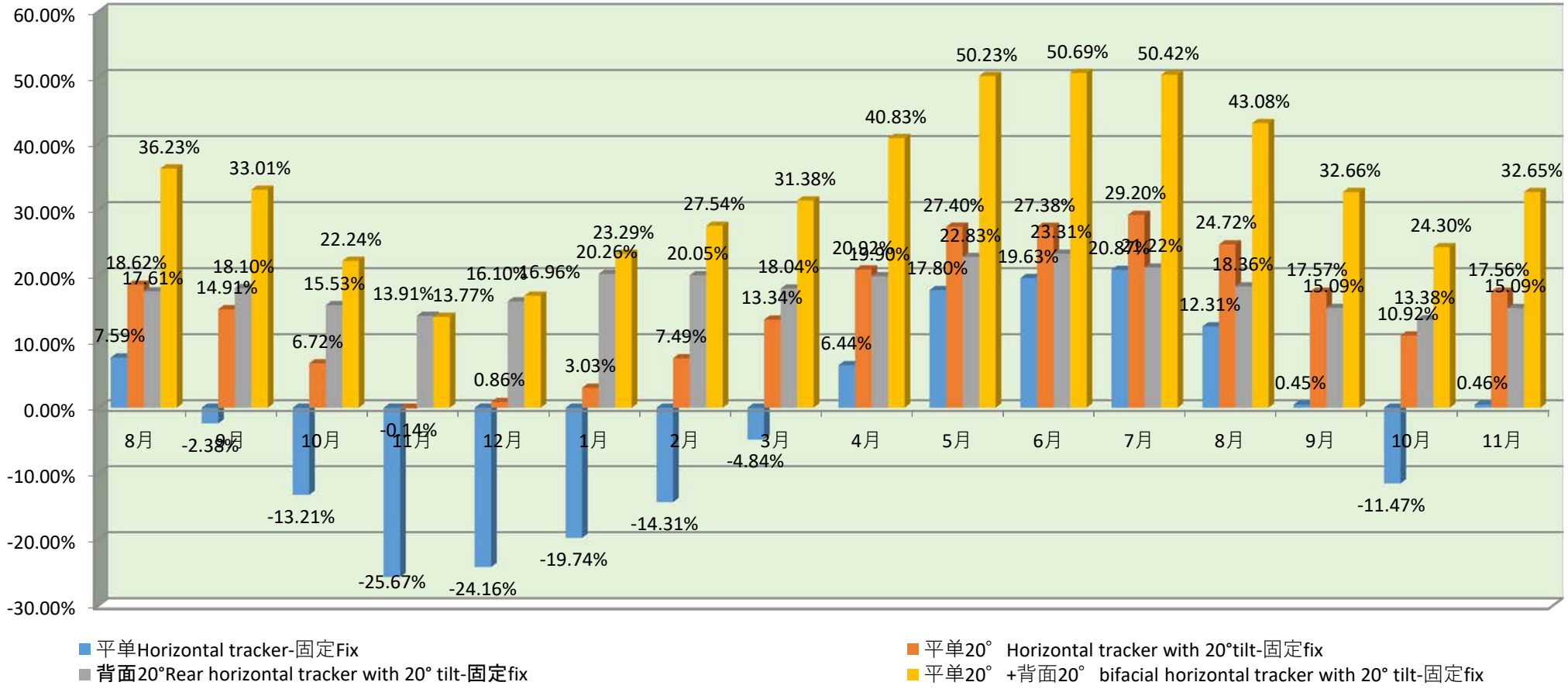
哈工大太阳能研究所　威海双面跟踪增幅对比

Bifacial +Tracking Irradiation Comparason at Weihai , HIT Solar Research Institute

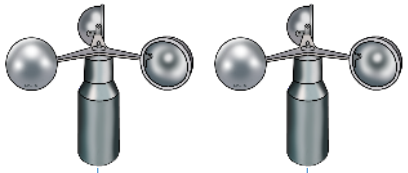


Bifacial +Tracking Irradiation Analysis at Weihai , HIT Solar Research Institute

Bifacial module + Horizontal Tracker:
Better Annual performance ,especially during winter

Bifacial module + conventional track algorithm(including backtracking)
Annual Irradiance benefit: 37.51%

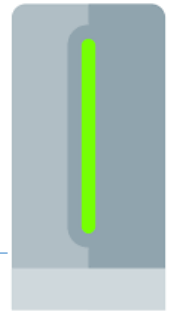
Bifacial module + AI Tracking System(including optimized backtracking)
Further increase the power generation up to 4-6%



8.6MW per Communication Box

4 Block per Communication Box

Wind Speed Sensor



Communication Box

Firewall Gateway

Local SCADA

Cloud Server

LoRa™

Up to 96 Controllers

1 Controller
1 Battery
1 Motor
1 built-in inclinometer chip

1 Controller
1 Battery
1 Motor
1 built-in inclinometer chip

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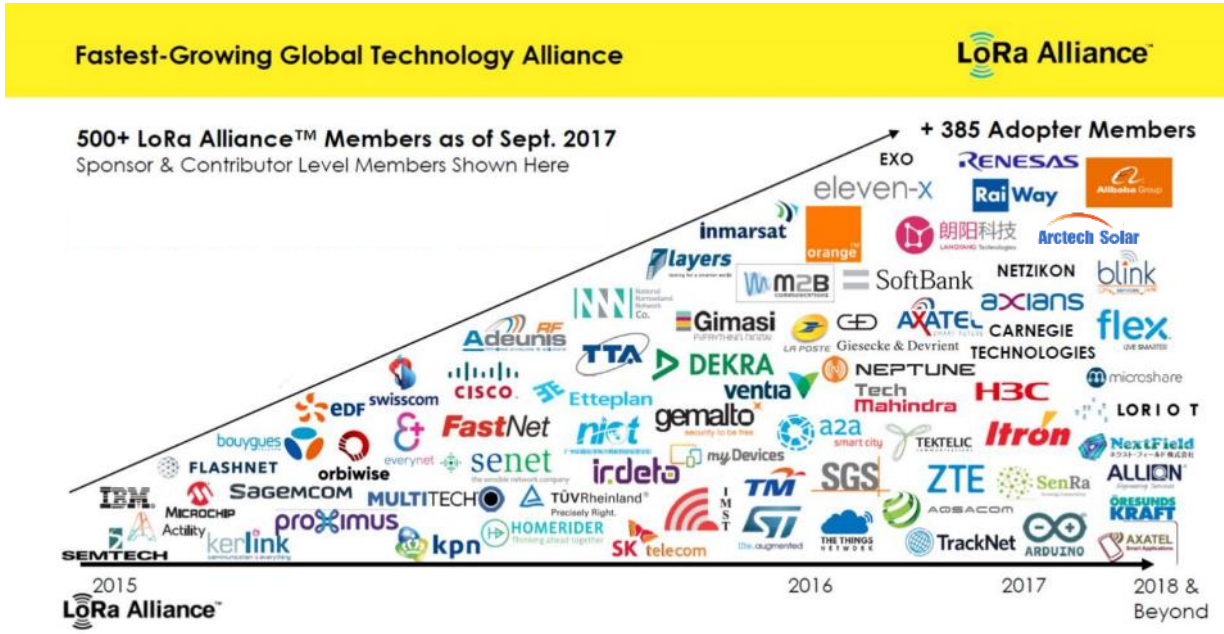
Low Consumption

Long Distance Communication

LoRa™



- LoRa technology has been used for **many industry**.
- It has lower power consumption and **Longer Range** (8km).
- **Sky Tracker** is the **1st tracker** to use LoRa

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Annual Peak Capacity

10GW

Fully Automated

6GW Fixed Structures

6GW Tracker

120,000 ㎡ in production

9 Years

China Top 20 PV Structure Suppliers

Ranked

NO.1

China

No. 1

Global

No. 4

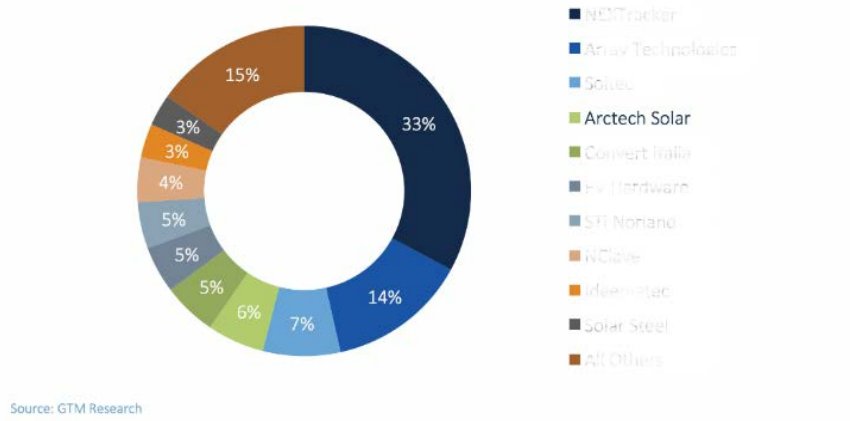
Asia Pacific

No. 1

India

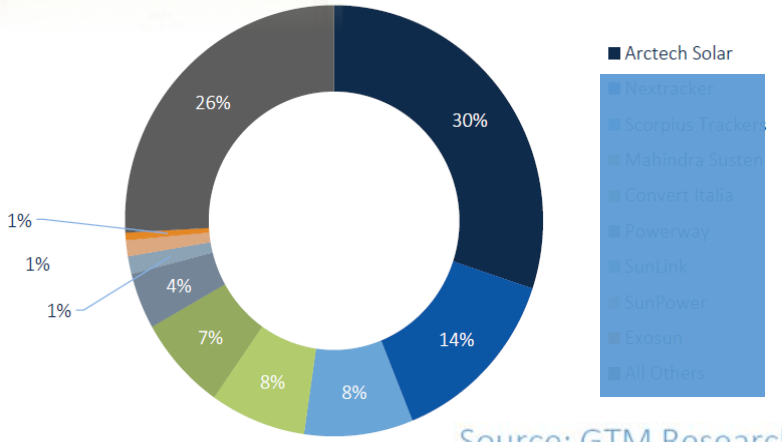
No. 1

Global Solar PV Tracker Market Shares by MW Shipped, 2017



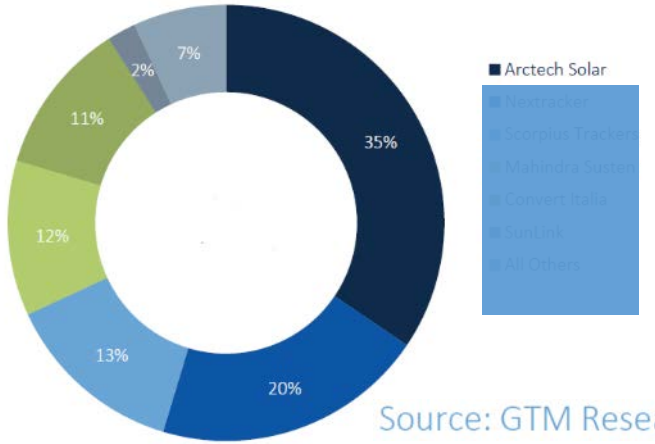
Source: GTM Research

2016 Asia-Pacific PV Tracker Market Shares by Shipments



Source: GTM Research

2016 India PV Tracker Market Shares by Shipments (MWdc)



Source: GTM Research

2016 Asia-Pacific PV Tracker Market Shares by Shipments (MWdc)

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TÜV SÜD Greater China
Add value. Inspire trust.

World 1st TUV Certificated Lab of Tracker








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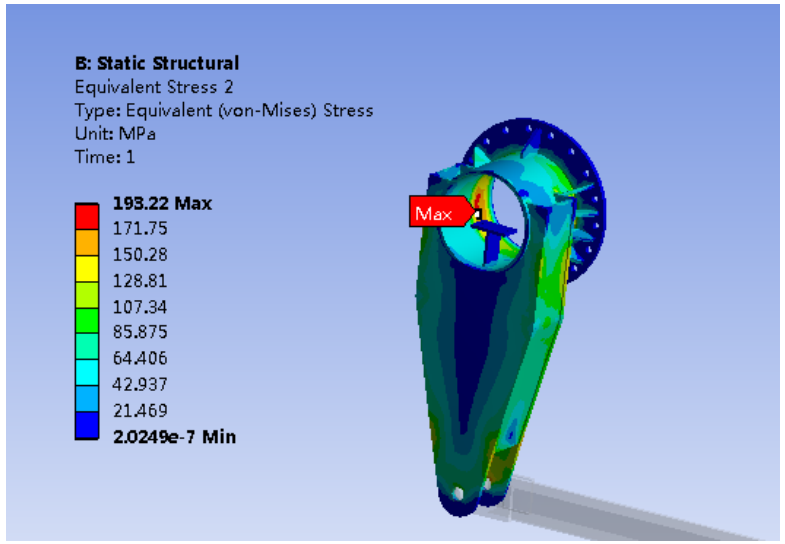
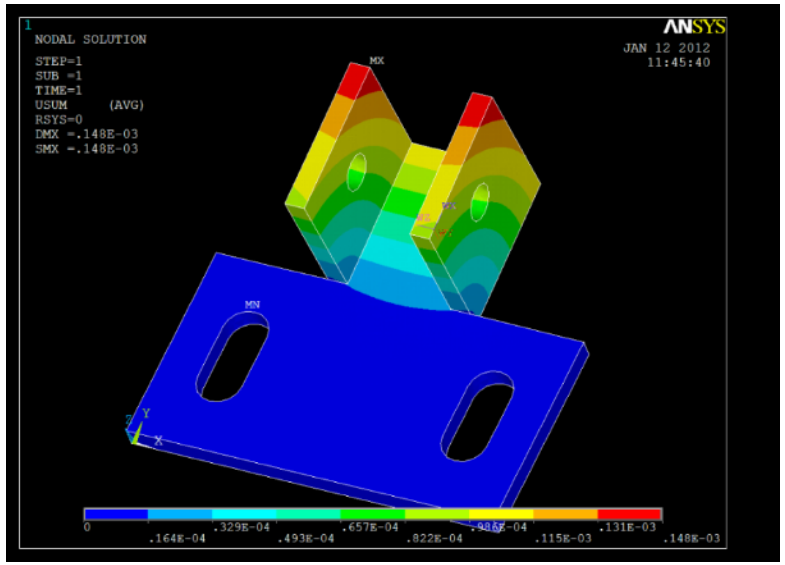
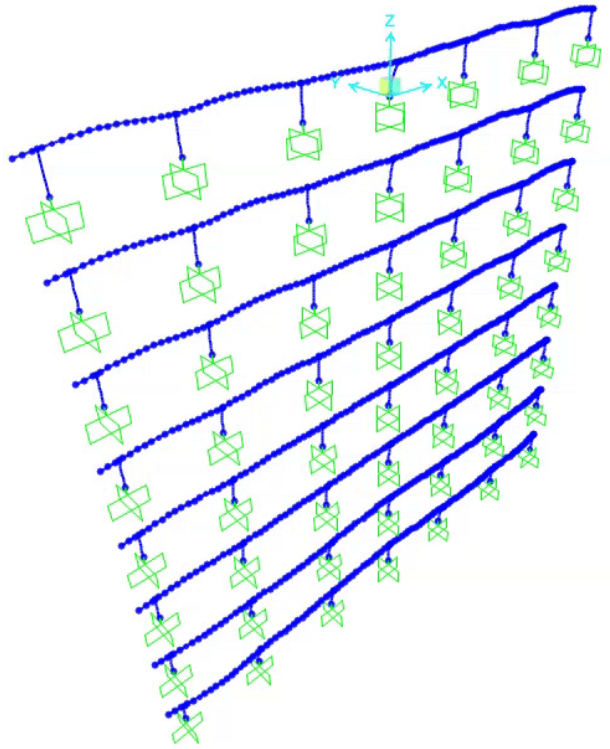
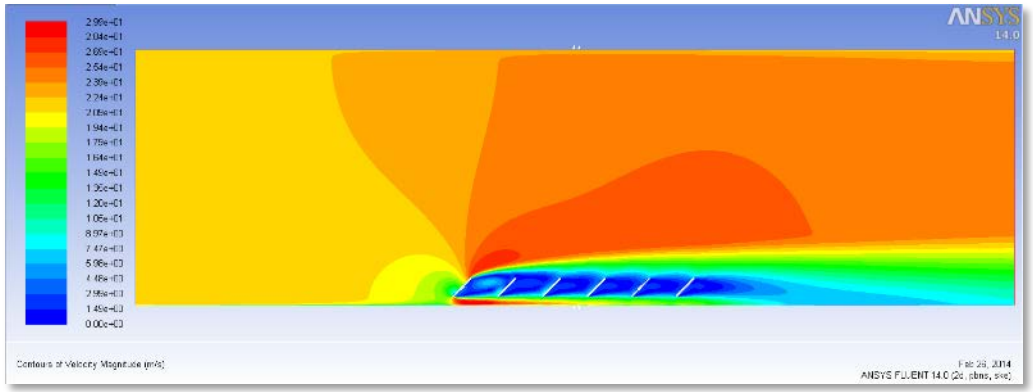




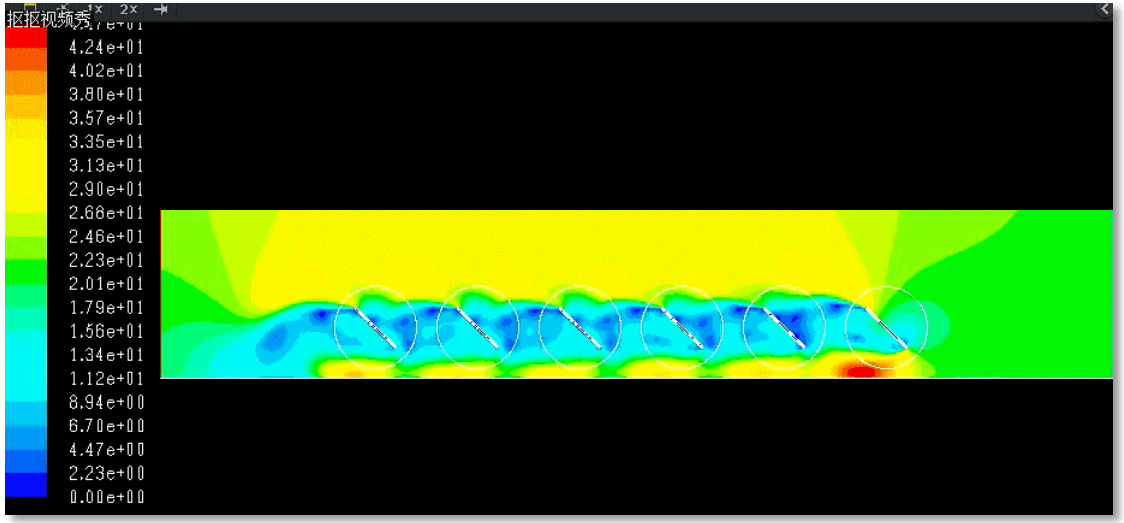


Structure FEM Design:

- Key Component Strength
- Bolt Connection Strength
- Weldment Connection Shear Strength
- Movement Connection Fatigue Strength



$$\begin{cases} \dfrac{\partial u_x}{\partial t}+u_x\dfrac{\partial u_x}{\partial x}+u_y\dfrac{\partial u_x}{\partial y}+u_z\dfrac{\partial u_x}{\partial z}=f_x-\dfrac{1}{\rho}\dfrac{\partial p}{\partial x}+\nu\left(\dfrac{\partial^2 u_x}{\partial x^2}+\dfrac{\partial^2 u_x}{\partial y^2}+\dfrac{\partial^2 u_x}{\partial z^2}\right) \\ \dfrac{\partial u_y}{\partial t}+u_x\dfrac{\partial u_y}{\partial x}+u_y\dfrac{\partial u_y}{\partial y}+u_z\dfrac{\partial u_y}{\partial z}=f_y-\dfrac{1}{\rho}\dfrac{\partial p}{\partial y}+\nu\left(\dfrac{\partial^2 u_y}{\partial x^2}+\dfrac{\partial^2 u_y}{\partial y^2}+\dfrac{\partial^2 u_y}{\partial z^2}\right) \\ \dfrac{\partial u_z}{\partial t}+u_x\dfrac{\partial u_z}{\partial x}+u_y\dfrac{\partial u_z}{\partial y}+u_z\dfrac{\partial u_z}{\partial z}=f_z-\dfrac{1}{\rho}\dfrac{\partial p}{\partial z}+\nu\left(\dfrac{\partial^2 u_z}{\partial x^2}+\dfrac{\partial^2 u_z}{\partial y^2}+\dfrac{\partial^2 u_z}{\partial z^2}\right) \end{cases}$$



Static CFD Simulation:

- Navier-Stokes Equations
- Continuity Equation
- Mass Conservation
- Momentum Conservation
- Fluent Solver
- UDF Function

TRACKING SYSTEM

Place: India
Time: 2017
Scale: 172MWp

Place: India
Time: 2017
Scale: 78MWp

Place: India
Time: 2016
Scale: 60MWp

Place: Shou County, Anhui, China
Time: 2016
Scale: 80MWp

Place: Qinghai, China
Time: 2016
Scale: 70MWp

Place: Hailaer, Inner Mongolia, China
Time: 2015
Scale: 30MWp

TRACKING SYSTEM

Place: India
Time: 2015
Scale: 420MWp

Place: India
Time: 2017
Scale: 390MWp

Place: India
Time: 2015
Scale: 50MWp

Location: Fukuoka, Japan
Time: 2014
Capacity: 30MWp

Place: Nara, Japan
Time: 2014
Scale: 5MWp

Place: Ibaraki, Japan
Time: 2014
Scale: 3MWp

THANKS!

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