Smart algorithms stimulate the potential of power generation by tracking system to ensure a high return on investment of the project

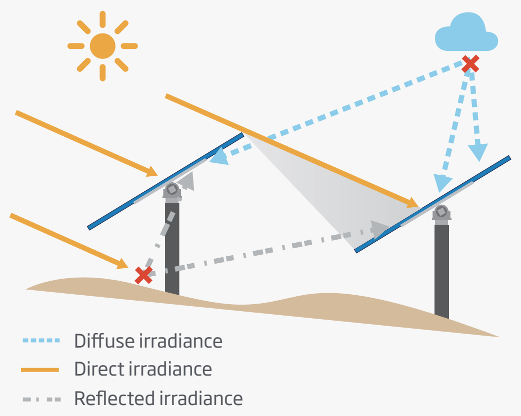
01 While the decline in costs of BOS slows down, the increase of energy yield becomes an effective way to reduce the levelized cost of energy (LCOE)

Decline slowdown, phased rebound — Steady decline

Levelized cost of energy (LCOE) = Total cost / Total energy yield = (Initial investment + Operating expenses) / Total energy yield during the life cycle

Great potential for trackers to increase energy yield

02 Conventional tracking algorithms (astronomical algorithm + backtracking algorithm) cannot fully optimise a tracker's energy generation potential



Globally, there is a shortage of flat terrain resources, and uneven terrain will gradually become the main application scenario. Conventional tracking algorithms cannot reduce energy losses due to row-to-row shading.

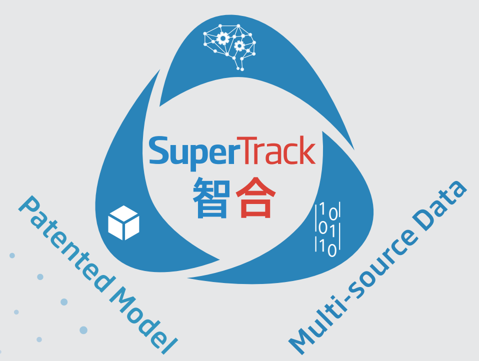
⚠ up to 40% loss of instantaneous power

Conventional tracking algorithms mainly consider direct irradiation, cannot fully utilize diffuse irradiation on a cloudy day or in other conditions with highly diffused irradiance.

⚠ up to 15% loss of transient irradiation

Conventional tracking algorithms only consider the power generation by front of the modules, cannot fully optimise a module's energy generation potential, while bifacial modules have been commercialized globally.

SuperTrack Smart Tracking Algorithm



TrinaTracker has developed the smart tracking technology - SuperTrack, which includes smart algorithms (STA&SBA), multi-source data and patented models.

SuperTrack can calculate the optimal power generation angle of the bifacial module in real time for different weather conditions, and identify the characteristics of the complex terrain in an intelligent way, independently optimize the angle of backtracking in each row, avoid row-to-row shading, and fully optimise the power generation potential of tracker. Compared with conventional tracking algorithm, boosting energy generation by as much as 8%.

Core Values of SuperTrack

High energy yield

- Compared with conventional tracking algorithm
- SuperTrack can increase energy generation by as much as 8%

High adaptability

- Meeting the diversified needs of customers
- Adapting to complex terrains and various weather conditions

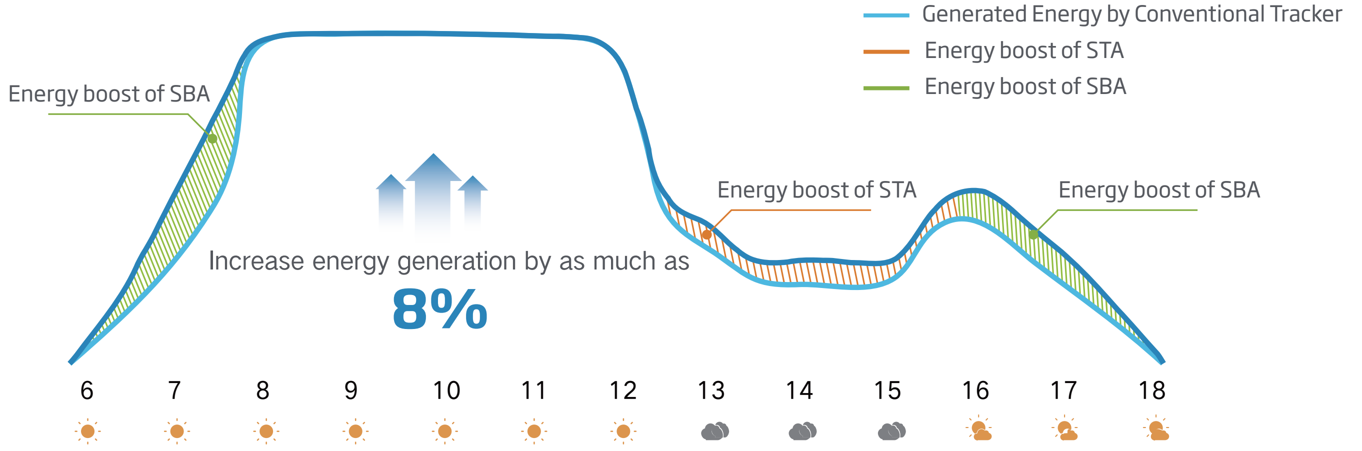
High intelligence

- Self-recognition, Self-training, Self-optimization
- Proprietary technology for the power generation model

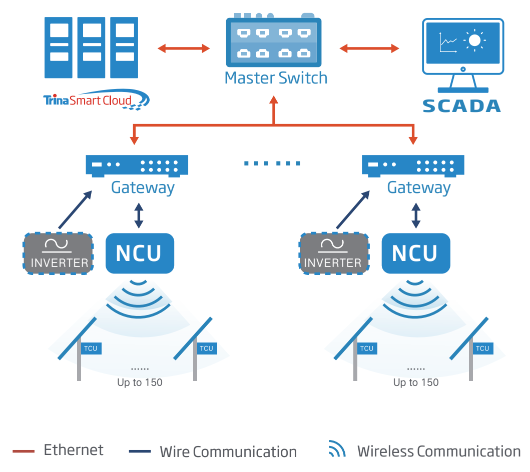
High stability

- Long-term test data analysis
- Reducing the rotation of the tracker

SuperTrack Smart Algorithms



TrinaTacker Smart Control System



100MW PV Station Configuration Table

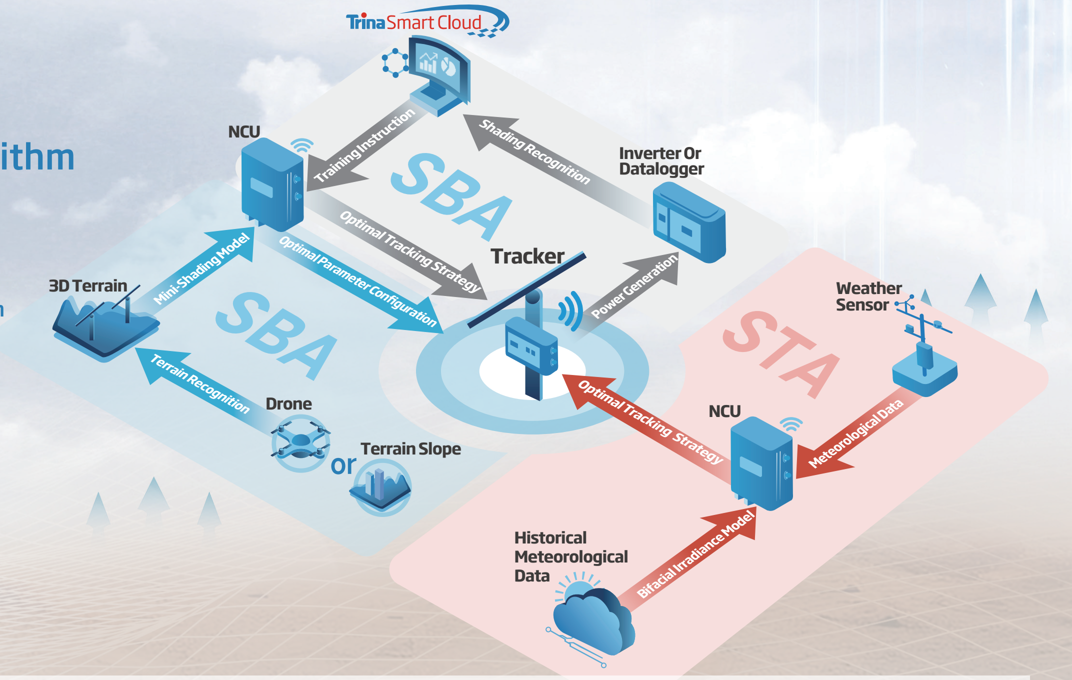
	Tracker	TCU	NCU	Software Platform	Sensor
Smart Solution	1500 sets	1500	10~20	1 set	1 set
Conventional Tracking System	1500 sets	1500	10~20	/	/

TrinaTacker smart control system includes the tracker, the tracker control unit (TCU), the network control unit (NCU), the SuperTrack smart tracking algorithm, Trina Smart Cloud platform. It is flexibly compatible with plant level SCADA, inverters and other equipment, creating an integrated solution for the PV tracking system.

SuperTrack

Smart Tracking Algorithm Logic Diagram

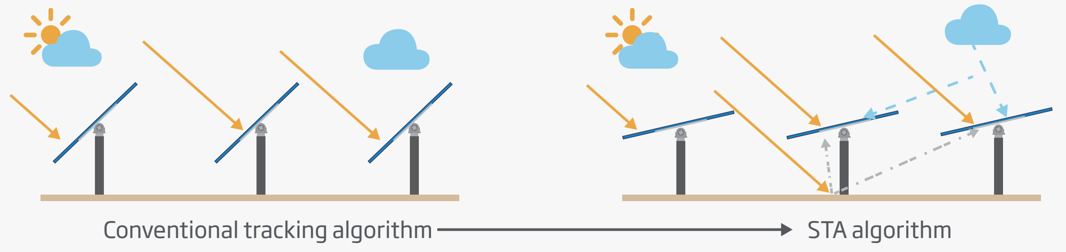
STA:Smart Tracking Algorithm
SBA:Smart Backtracking Algorithm



Core Algorithm

01 Smart Tracking Algorithm (STA) - improve generating power on a cloudy day or in other conditions with high diffuse irradiance.

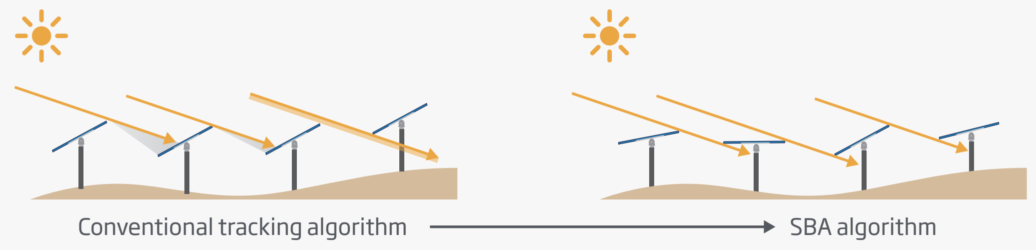
The proprietary technology for the Bifacial irradiance Model and the deep learning model are utilized to identify the power generation characteristics of the bifacial modules under the influence of multiple parameters. The data of meteorology and system operation is utilized to optimize the tracking angle real-time, so as to improve generating power on a cloudy day or in other conditions with high diffuse irradiance.



1. The bifacial irradiance model fully considers 12 key factors that have an impact on energy yield
2. Analyzing the power generation performance of the modules from multiple dimensions to ensure the optimal energy yield throughout the entire life cycle
3. Reducing the rotation of the tracker to effectively extend the service life of the motor and the tracker

02 Smart Backtracking Algorithm (SBA) - reduce generation losses due to row-to-row shading, which are more significant on complex terrains.

The data of system operation has been performed by disturbance training and (or) utilizes terrain topography data to identify shading and construct three-dimensional terrain. Based on the machine learning algorithm and the Mini - Shading Model, it outputs the optimal backtracking angle group for overall power generation through iterative decision-making and effectively enhances the power generation at the stage of backtracking.



1. Multiple technologies to intelligently identify the real terrain
2. Automated training and learning without human involvement
3. Secondary precise optimization of the backtracking angle based on the power generation characteristics of the modules affected by shading

Project Case and Third-Party Appraisal

CGC appraisal
Boosting energy gain by 3.06% annually

Project location	Tongchuan, Shaanxi Province	Test period	May 2020 - October 2021
Latitude and longitude	35.16°N,109.17°E	Topography	Average slope about 3%
Operating temperature	-21℃ ~ 39.7℃	Module	TSM-NEG6MC, 20(II)335W bifacial modules
Irradiation	$1300kWh/m^2$–$1400kWh/m^2$	Tracker	Vanguard 2P
Proportion of diffuse irradiation	53%	GCR	0.41
Project conditions	Grassland	Height	3.5m

Energy gain on the typical sunny day 4.64%
Energy gain on the typical overcast day 9.41%

Project location	Changzhou, Jiangsu Province	Test period	September 2020 - October 2021
Proportion of diffuse irradiation	64%	Topography	Average slope 3.3%

*Note: The array for comparison is a single-row tracker in the low-lying terrain (shading in the morning and afternoon)

Average energy gain under weather conditions featuring high diffuse irradiation 3.84%
Energy gain on the typical overcast day 8.03%

Project location	Nangong, Hebei Province	Test period	June 2021 - September 2021
Proportion of diffuse irradiation	60%	Number of days featuring high diffuse irradiation/number of effective days	25/77

*Note: The project location is basically flat with almost no shading loss

Energy gain on the typical sunny day 3.21%
Energy gain on the typical overcast day 11.83%

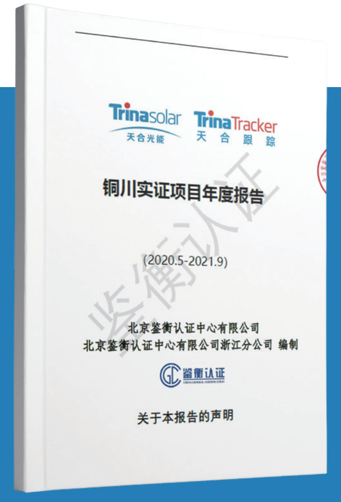
Project location	Shizuishan, Ningxia	Test period	February 2023 - December 2023

Gain Potential Assessment

The main factors affecting the energy gain are latitude, terrain (proportion of arrays affected by shading and slope), proportion of diffuse irradiation, and system design (such as array spacing). The simulation results of the gain potential of trackers in different regions are shown in the table below.

Country	City	Latitude	GCR	Proportion of diffuse irradiation	Shading loss	Gain due to STA	Gain due to SBA	Total gain
Gabon	Libreville	0.39°N	0.69	57.8%	3.35%	1.05%	2.71%	3.76%
Singapore	Singapore	1.37°N	0.70	56.0%	7.35%	2.23%	5.88%	8.11%
Columbia	Medellin	6.25°N	0.69	38.2%	5.72%	0.66%	4.26%	4.92%
Columbia	Monteria	8.75°N	0.68	49.5%	4.32%	0.72%	3.44%	4.16%
India	Bangalore	12.99°N	0.64	41.7%	6.73%	1.08%	5.38%	6.46%
Thailand	Bangkok	13.70°N	0.64	55.3%	5.58%	1.70%	4.46%	6.16%
Mexico	Mexico City	19.43°N	0.60	42.5%	5.84%	0.88%	4.67%	5.55%
Saudi Arabia	Jeddah	22.30°N	0.58	39.4%	5.59%	0.59%	4.47%	5.06%
China	Guangzhou	23.14°N	0.57	66.8%	3.78%	2.26%	3.02%	5.28%
America	Columbia	34.01°N	0.46	45.6%	4.30%	0.77%	3.44%	4.21%
China	Tongchuan	35.14°N	0.45	56.8%	2.98%	1.16%	2.38%	3.54%
Spain	Arahal	37.26°N	0.40	34.1%	3.69%	0.49%	2.64%	3.13%
Japan	Hokkaido	43.23°N	0.33	54.1%	2.79%	0.91%	2.23%	3.14%
Brazil	Santa Kitteria	4.33°S	0.80	45.8%	5.88%	0.65%	4.73%	5.38%
Brazil	Aracati	4.58°S	0.69	41.3%	5.40%	0.65%	4.36%	5.01%
Brazil	Limoeiro do Norte	5.30°S	0.68	41.4%	6.92%	0.92%	5.54%	6.46%
Indonesia	Surabaja	7.26°S	0.69	48.5%	4.99%	0.81%	4.04%	4.85%
Brazil	Brejo Santo	7.49°S	0.69	40.2%	5.49%	0.70%	4.40%	5.10%
Brazil	Saint Joseph Dubelmonti	7.86°S	0.69	38.7%	5.64%	0.65%	4.50%	5.15%
Brazil	Venturosa	8.59°S	0.69	39.3%	6.00%	0.68%	4.87%	5.55%
Brazil	Garanhuns	8.93°S	0.69	40.4%	5.89%	0.72%	4.77%	5.49%
Brazil	Delmiro Gouveia	9.38°S	0.69	40.3%	5.64%	0.69%	4.63%	5.32%
Brazil	Oliveira dos brejinhos	12.33°S	0.65	34.7%	6.65%	0.65%	5.32%	5.97%
Mozambique	Cuamba	14.80°S	0.60	34.3%	4.58%	0.50%	3.42%	3.92%
Chile	Maria Helena	22.34°S	0.58	16.1%	6.44%	0.05%	5.15%	5.20%
Chile	Calama	22.46°S	0.60	25.2%	6.22%	0.34%	4.81%	5.15%
South Africa	Greater Letaba	23.49°S	0.60	34.3%	4.86%	0.48%	3.65%	4.13%
Argentina	San Salvador de Jujuy	24.20°S	0.53	27.8%	4.81%	0.43%	3.62%	4.05%
Argentina	El Carmen	24.39°S	0.53	32.3%	4.53%	0.66%	3.41%	4.07%
Argentina	Chaco	25.34°S	0.54	38.6%	4.10%	0.56%	3.17%	3.73%
Chile	Eelas	32.83°S	0.44	46.1%	7.82%	0.54%	5.70%	6.24%
Chile	Santiago	33.50°S	0.48	37.9%	4.15%	0.90%	3.01%	3.91%
Argentina	San Luis	32.44°S	0.48	35.1%	4.41%	0.66%	3.34%	4.00%
Australia	Alelaide	34.89°S	0.44	34.6%	3.82%	0.56%	2.72%	3.28%
New Zealand	Kaitaia	35.10°S	0.44	38.9%	3.81%	0.74%	2.82%	3.56%

*Note: The shading loss and the gain due to SBA are calculated based on the slope of 6% and the proportion of arrays affected by shading of 50%


铜川实证项目年度报告
(2020.5-2021.9)
关于本报告的声明

Based on self-developed simulation software, TrinaTracker selected typical cities in different latitudes and different climate conditions to simulate the shading loss and evaluate the gain potential. TUV-SUD used the industry-wide authoritative software PVsyst to carry out simulation checking on the shading loss of typical cities, which is basically consistent with the calculation result of Trina's self-developed software.

SGS verified the evaluation process and result of SuperTrack gain. STA gain is mainly associated with the annual diffuse proportion of the project site. SBA gain is associated with GCR, terrain slope and shading array proportion. SGS gave the opinion that the gain result is reasonable and reliable.

At the same time, CGC conducted an authoritative verification on the accuracy and effectiveness of the data. In its report, the CGC drew the following conclusions: The test in Tongchuan lasted for a year, and the results show that power generation in SuperTrack was improved by 3.06%. CGC indicates that the test data is valid.

Add: No.2 Tianhe Road,Trina PV Industrial Park, New District, ChangZhou City, JiangSu Province
Postcode: 213031
Hotline:400-988-0000
Email: sales_china@trinasolar.com

TrinaTracker

Smart Tracking Technology

SuperTrack

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