

ASTRONERGY A CHINT COMPANY

Introduction of Astronergy/Chint Solar

Marketing Department 10/2020

Clean Energy System Integration Operator

Empower the world





01 About CHINT

CHINT Group Overview

Founded in 1984, CHINT Group is a leading global provider of smart energy solutions.

Annual sales 2019

Revenue 2019

\$1.7 billion

Forbes Asia listed company

TOP 50

Number of employees

30000 +

CHINT Overview – Major Industries



Electrical whole industry chain system solution integration provider



CHINT Overview – Global R&D layout



• Three global R&D centers

Customer-centered Service supreme

The average annual normal R&D investment accounts for **4-12%** of the sales.

A total of nearly **4,000** patents were approved.

Product certification: more than **1600 certifications** including China CCC, US UL, European CE, VDE, TUV, KEMA, SEMKO, Canada CSA, Russia EAC, India BIS, and South Africa RCC, with products in line with the standards such as China's GB, US UL, European EN and IEC.



CHINT Overview- Domestic Industrial Layout



Manufacturing sites are mainly located in Wenzhou, Hangzhou, Shanghai, Jiaxing and Xianyang, with overseas plants in Thailand, Egypt, Singapore, Vietnam and Malaysia.



CHINT Overview- Domestic Industrial Layout



Shanghai Noark base



Shanghai T&D base



Haining solar power base



Hangzhou solar energy base



CHINT Overview-International Industrial Layout



Thailand battery production base



Egypt power transmission, distribution and production base









Vietnam kit electrical equipment production base



CHINT Overview- Global Sales Network



We have established sales representative offices and logistic bases in over 140 countries and regions around the world







02 Introduction of Astronergy/Chint Solar



Astronergy - Clean Energy Solution Provider





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Astronergy - Whole Industry Chain of PV Industry



Relying on the entire electrical industry chain of the Group and rich experience in solar power station, Astronergy grows into an energy solution provider with advantages in both system and technology integration.

The whole PV industry chain of Astronergy is an important part of the whole industrial chain of CHINT Electrics.



Smart Factory



- Updated Smart Factory
- Industry 4.0
- Utilizing internet of things and big data to establish high efficient, environment harmonious factories, creating the highest manufacturing in China.



 Listed as intelligent PV pilot demonstration enterprises by MIIT (Ministry of Industry and Information Technology), the only GW Club company in Zhejiang province, Top 3 in China.

Smart Factory



Transparent Factory



Automatic batching







Process automatic detection

Al quality inspection



Flexible Manufacturing~Compatible with 8 Types of Products



ASTRONERGY

• Chint information physics system (CPS), with the connection to the Internet, enables the physical equipment to have five functions: calculation, communication, precise control, remote coordination and autonomy.

Smart Manufacture: AI 100% EL Detection



The first Enterprise to Realize AI Automatic EL Detection for Cells

Automatic EL Detection in Crystalline Silicon Cells



Original



AI Automatic Recognition



• With a small number of EL machines and less manpower, EL full inspection of the cell is realized, and the accuracy is 97% at the detection speed of 0.5 second/piece.

Smart Manufacture: AI 100% EL Detection



The first Enterprise to Realize AI Automatic EL Detection for Modules

Automatic detection of El defects before and after lamination, automatic and accurate identification of failure type



- Through the introduction, upgrading of testing equipment, and the establishment of big data analysis knowledge base, to improve product hit rate, also the results shall be put into the knowledge base to form self-learning
- Using automatic detection of El, the rate of missing detection is 70% lower than that of manual operation.



ASTRONERGY Module Product Architecture

ASTRO Product Architecture

ASTRONERGY



Intelligent Manufacturing - ASTRO Series module



Ranked as the first Tier supplier of photovoltaic modules in the world by Bloomberg

Won the title of "Top component performance" of DNV GL for three times;











ASTRONERGY Module Durability is Verified

Recognized as 2020 Top Performer in PVEL/DNV GL



- PVEL | DNV GL series of activities regarding the "PV Module Reliability Scorecard" have provided the industry with an important basis for measuring the long-term reliability and performance of PV modules.
- PQP includes the following 5 test sequences: Thermal Cycling x 600; Damp Heat x 2000 hours; Dynamic Mechanical Load + Thermal Cycling x 50 cycles + Humidity Freeze x 30 cycles; PID x 192 hours and PAN Performance test, each evaluation result includes a "Top Performer" status.
- With the excellent reliability and attenuation performance of AstroTwins bifacial series and AstroSemi single-sided series, ASTRONERGY won the honor of Top Performer for the fourth time, and AstroTwins bifacial series are the ONLY WINNER in the 5 full-featured Grand Slams among all competitors . A CHINT COMPANY

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ASTRONERGY Module Durability is Verified



In the first batch of top runner projects in Datong, Shanxi Province, the attenuation rate of Astrohalo is only 0.78%, ranking first.



Advanced Technology A+ certification from CGC



Certification of "Super top runner" of product efficiency by CGC

ltem	Sub item	Score	Level	
C. II (25%)	Sample weighted average efficiency21.16%Performance stability index0.85			
Cell performance (25%)			At	
Module performance	Sample weighted average efficiency	18.34%		
(25%)	Performance stability index	0.75	A .	
	Technical capability index	0.95		
Tachnology stability	Facility, technology control index	0.92	A+	
(50%)	Product reliability index	0.97		
	Quality management index	0.95		
Comprehensive evaluat	ion level of technology maturity	ŀ	\ +	



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Three Year Outdoor Attenuation Test by CTC



Certification of "Top runner" module annual attenuation rate by CTC

- The first year attenuation is only 1.08%
- The average attenuation in the second year is only 0.30%
- The average attenuation in the third year is only 0.12%



ASTRONERGY Module Powered by Low LeTID Cell



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Institute	Sample Type	Test Condition	Test Time	Power Loss
стс	CHSM6612P/HV-350 (Multy PERC)	Sample1: Reverse current I=Isc-Impp, 75°C; Sample2: Reverse current I=Isc-Impp, 60±5°C; Sample3: Reverse current I=Impp, 75°C; Sample4: Reverse current I=Impp, 60±5°C;	168h	Sample1: 0.24% Sample2: -0.05% Sample3: 0.28% Sample4: 0.00%
TÜVRheinland	CHSM72M-HC-380 (Mono 9BB half cell)	Reverse current: 2×I=2× (Isc-Impp), 75°C±3°C; P _{final} ≥0.95×P _{initial} × (1- r(%)/100)	300h	1.2%~1.6%
TUV NORD	CHSM72M-HC-380 (Mono 9BB half cell)	a) Reverse current I=Isc-Impp, 75°C, 162h (+8/-0h; b) Repert a) until power loss < 1% or the power increase ; Follow the equation: $P_{\text{final}} \ge 0.95^*P_{\text{initial}}^*$ (1-r)	336h	Sample1: 1.1% Sample2: 1.2%

✓ LeTID (Light elevated Temperature Induce Degradation) of PERC cell is related to the subsequent power generation performance;

- ✓ Low LeTID solution:
 - Wafer with high quality;
 - Advanced passivation process;
 - Excellent annealing technology;



First LeTID certification issued by TUV Rhine

ASTRONERGY Module Energy Yield is Verified





- TÜV Rheinland established PAN file with performance measurement under different irradiance, temperature and incident angle using randomly selected module samples from production shipment;
- Simulated energy yield in five different cities globally; average 1.57% more generation than average number of competitors.

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Manufacturing Capability & Technology Bankability



Firm/ brand	Annual module capacity, MW/year
Jinko*	16,000
Longi*	15,000
JA Solar*	15,000
Canadian Solar	13,000
Risen Energy	11,100
Hanwha Q-Cells*	10,700
Trina Solar*	8,000
GCL Systems*	7,200
First Solar*	6,200
Talesun	6,000
Seraphim*	5,000
Wuxi Suntech*	4,500
Chint/Astronergy*	4,200
ZNShine*	3,500
Jinneng/ Jinergy	2,700
BYD	2,400
SunPower/ Maxeon*	2,400
LG Electronics*	2,000
Sumec/ Phono Solar	2,000

List of tier1 module makers Source: BloombergNEF



■ Bankable ■ Not bankable ■ Never heard of

Technology bankability survey results

Source: BloombergNEF

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Due Diligence from Black & Veatch



FINAL

PHOTOVOLTAIC MODULE INDEPENDENT ASSESSMENT

BLACK & VEATCH PROJECT NO. 400176

• As the assessment for bankability, Black & Veatch, a well-known institution, made a detailed due diligence on the scale, manufacturing, products and market performance of Astronergy.

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Chint Solar (Hong Kong) Co., Ltd. | PHOTOVOLTHIC MODULE INDEPENDENT ASSESSMENT

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Recognition from Financial Institution

 Photon consulting also ranked Astronergy as NO.1 player in the PV triathlon report. Astronergy financial health, downstream diversity and risk management got recognition widely from these financial institutions and banks.





• Bloomberg lists Astronergy as Tier 1 solar module provider for consecutive years.

		100	%	
		100	%	
		96%		4%
		96%		4%
		91%		9%
		91%		<mark>5%</mark> 5%
		91%		9%
		90%		<mark>5%</mark> 5%
		90%		10%
		89%		11%
		85%		10% 5%
		79%		16% <mark>5%</mark>
Chint/ Astronergy		76%		4% 10%
		76%	10	% 14%
-		73%	18	8% 9%
	Bankable	■ Not bankable	Never heard of	

Source: BloombergNEF

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The 3rd Party Module Performance Insurance



LLOYD'S



Insurance Coverage Declaration

We herewith confirm that Ariel Syndicate 1910 of Lloyd's reinsures the Policy (Solar Photovoltaic Module Replacement Cover – Manufacturer Corporate Insurance Policy), originally issued by PICC to the following Policyholder:

Chint New Energy Development (Zhejiang) Co., Ltd and its subsidiaries. [Astronergy] 1335 Binan Road, Binjiang District, Hangzhou City, Zhejiang Province, P.R.China

Manufacturer Corporate Insurance Policy provides backing to Astronergy's Limited Product and Performance Warranty to protect both Astronergy's and its Photovoltaic module buyers that are registered under this Policy during the Policy Period of January 1st 2019 to December 31st 2019. The agreed upon insurance terms and conditions for the Manufacturer Corporate Insurance Policy includes:

- Insurance coverage for 25 years
- Insurance coverage is effective immediately with NO waiting period
- The insurance policy is not cancellable
- Insurance back-stops Astronergy's Limited Warranty, including Product defect and Performance output
- In the event of Insolvency of Chint New Energy Development (Zhejiang) Co., Ltd, those customers of Astronergy's that are registered under the Policy will become Beneficiaries according to the terms and conditions of the Policy
- Insurance makes available Project Cover with customized insurance structure at Projects with Astronergy's Photovoltaic modules covered under this Policy and qualified for coverage by the Insurer
- A.M Best 'A' (Excellent), S&P "A+" (Strong), Fitch AA- (Very Strong) rated insurer at time of issuing the declaration

The 3rd party reinsurance company, LLOYDS provides module performance insurance.

- 25 year irrevocable module power insurance
- Protect the interests of end buyers of modules

Financial Partners









Overseas Bloomberg **Tier 1 Supplier NEW ENERGY FINANCE** Benvenuto in **Santander** UniCredit **CIMB** BANK International **Finance** Corporation World Bank Group EAST WEST BANK KB 국민은행 SCB ไทยพาณิชย์ North American Development Bank

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Project Reference

Localization Team



Astronergy has set up four investment platforms and two local EPC platforms overseas, with international investment operation team and local execution team.



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EPC qualification



Third grade general contracting of electric power engineering construction



license for undertaking installations of electrical power facilities





Enterprise credit rating



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Competitive Advantage



先发优势 Since 2006

全球化优势 Globalization

运维优势 Operation & Maintenance Service

成本优势 Cost Performance

规模优势 4.5GW+ Construction Experience

> 集成优势 Equipment and Technology Integration

金融优势 Financial Advantage

International Partner



Cooperation with mainstream photovoltaic companies of manufacturing, development and installation world widely.



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Global Power Plant Construction > 4.5GW





Location: Kubuqi Desert, China Developer: Chint Capacity: 310 MW Completion: 6/2016



Location: Turkey Developer: Chint Turkey Capacity: 70 MW Completion: 7/2017



Location: Netherlands Developer: Chint Dutch subsidiary Capacity: 103 MW Completion: 12/2019



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References-Europe



By the end of 2019, Chint solar has developed solar power stations in the Netherlands with a total capacity of 274MW. According to the Top50 data of Dutch solar power plants published in early 2019, three projects are in the top 10 of the list, among which the Midden Groningen project(103MW) is the largest solar power plant in the Netherlands at present.





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References-Europe





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References-America





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References-Africa



In Africa, China participated in the construction of Benban solar Park in Egypt, one of the largest solar energy project in the world. In August 2019, three sub projects with a total capacity of 165.5MW were officially connected to the grid.



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References-Asia





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References-Australia





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References-China







Thank You for Kind Attention.

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