

N TYPE

SAME SUNSHINE MORE VALUE



Mission:

Less Consumption, More Power Generation

Core Value:

Customer First, Creation First, Cooperation First, Commitment First.

Vision:

Green Energy Cultivator

Way of Development:

Strive, Innovation, Focus



GROUP INTRODUCTION



**160
GW**

Accumulated
160 GW solar
backsheet shipped

**5.0
GW**

Accumulated
5.0 GW n-type bifacial
cell & module shipped

**100,000
Household
Power
Station**

Provide 100,000 +
householders with the
green energy service

**1400
MW**

Owns total 1400MW
power stations and
reduces carbon
emissions by 1,152,000
tons per year

Jolywood (Suzhou) Sunwatt Co., Ltd. was established in March, 2008 and successfully became a public company in September, 2014. The stock code is SZ300393 and located in Shajiabang Town, Changshu City, a beautiful water town in the south of the Yangtze River. By the end of 2020, the total asset is around 12.0 billion yuan, it is the Vice chairman unit of Jiangsu Photovoltaic Industry Association. Awarded as the Jiangsu Provincial Thin Film Engineering Technology Research Center and Jiangsu Provincial High-efficiency Photovoltaic Engineering Technology Research Center, Jiangsu Enterprise Technology Center, Jiangsu Smart Factory, Jiangsu Photovoltaic Engineering Center, National Green Factory, National CNAS Certification Laboratory, TÜV North Germany Witnessing laboratory and key high-tech enterprise of the National Torch Program. The company passed the national knowledge Intellectual property standard implementation certification, 188 authorized patents, including 86 invention patents and 8 PCT patents.

In line with the corporate mission of "less consumption, more power generation", Jolywood has practiced the corporate development approach of "Strive, Innovation and focus" and deeply cultivated the photovoltaic industry. The subsidiaries are "Jolywood (Suzhou) Sunwatt Co., Ltd.", "Jolywood (Taizhou) Solar Technology Co., Ltd.", "Jolywood Minsheng Energy Co., Ltd." and "Jolywood (Shanghai) New Energy Co., Ltd." The four companies, respectively engaged in photovoltaic major businesses include advanced backsheet materials, N-type bifacial monocrystalline high-efficiency cells and modules, residential new energy integration services, and integrated smart energy projects. Among them, the company Jolywood (Suzhou) Sunwatt Co., Ltd. is the world's leading backsheet manufacturer and the world's first class backsheet brand. The company has an annual production capacity of 250 million square meters and can supply backsheet of 50GW of modules. By 2021, the backsheet material has supported 160GW power plants. Jolywood (Taizhou) Solar Technology Co., Ltd. has an N-type TOPCon cell and module production capacity of 6.6GW, is a leader in the N-type bifacial solar cell technology.

SUBSIDIARY INTRODUCTION

Jolywood (Suzhou) Sunwatt Co., Ltd.

Focusing on advanced photovoltaic materials, Jolywood is one of the largest manufacturers for solar backsheet. With annual manufacturing capacity of 250 millions sqm, which equal to 60GW solar modules, Jolywood keeps long term strategic partnership with DuPont, Daikin and other top worldclass companies. Till end of 2021, Jolywood has supplied solar backsheet to more than 160GW solar modules, its key product FFC bifacial coating backsheet sold more than 450 millions sqm. Zero quality complain during 14 years outdoor test, Jolywood now becomes one of the most reliable solar backsheet brands.

**The world's leading
manufacturer
of solar backsheet**



Jolywood (Taizhou) Solar Technology Co., Ltd.

Jolywood (Taizhou) Solar Technology Co., Ltd., the leader in the industrialization of N-type bifacial photovoltaic cells, is the first domestic and largest professional enterprise engaged in the research and development, manufacturing and sales of high-efficiency N-type TOPCon bifacial photovoltaic cells in the world.

As a leader in the industrialization of N-type bifacial solar cell technology, is the world's largest and the first Chinese enterprise to focus on TOPCon bifacial solar cells. The n- TOPCon Bifacial Cell Production Capacity is 3.6GW, n-TOPCon Bifacial Module Production Capacity 3GW, n-IBC Cell Production Capacity 150MW.

**The leader in N-type
bifacial solar cell
technology**



Jolywood Minsheng Energy Co., Ltd.

Devote itself to integrator of domestic residential renewable energy system, build the service platform rooted with smart internet business model. Specialise in the development, design, construction and maintenance of residential solar system etc. Based on the low risk business model, Jolywood has become the major player in residential solar market. Providing its service to millions customers with multiple business model and strong relationship with supply chain partners.

**The No.1 largest Chinese
domestic green energy
B2C service provider**



GROUP INTRODUCTION

— 2008

Jolywood (Suzhou) Sunwatt Co., Ltd. was established

— 2009

Rewarded as the high-tech enterprise and listed in the science and technology support plan of Jiangsu Province

— 2010

Rewarded as the key high-tech enterprise of the National Torch Plan

— 2011

Changed its name to Jolywood (Suzhou) Sunwatt Co., Ltd. and was identified as an innovative enterprise in Jiangsu Province

— 2012

Cooperated with ECN from the Netherlands on research and development of new backsheet and solar cell technology
Product FFC-JW30 certificated by TÜV Rheinland of Germany

— 2013

Product FFC-JW30 got JET certification of Japan
Jolywood solar thin film material laboratory passed the TÜV Nord certification
Jolywood solar thin film material laboratory passed the CNAS on-site review

— 2014

Public listed on Shenzhen Stock Exchange, stock code: SZ300393
FFC-JW30 passed CQC certification, the only one 4A grade in China

— 2015

Acquired the Italian company Filmcutter
Established Jolywood Minsheng Energy Co., Ltd., dedicated to integrated services in the field of distribution and integrated service platform of home Internet.
Established Jolywood (Shanghai) New Energy Co., Ltd., which is mainly engaged in the development, construction, operation and maintenance of industrial and commercial and ground power stations, and expands integrated smart energy business

— 2016

Established Jolywood (Taizhou) Solar Technology Co., Ltd.
Invested and built the world's largest N-type TOPCon bifacial solar cell production line with 2.1GW capacity

— 2017

The annual output of solar back sheet exceeds 110 million square meters
Two products of N-type TOPCon bifacial solar panel have got the world's first certification from TÜV Rheinland of Germany
Efficiency of N-type IBC solar cell exceeds 23%

— 2018

Invented the first transparent backsheet product of the industry
Supported SPIC to build the world's largest N-type high-efficiency bifacial Fishery-photovoltaic complementary power station

— 2019

Developed and mass-produced N-TOPCon solar cells with the efficiency of front side up to 23.5%
Participated and built the world's largest Mono 125MW N-type bifacial power station in Oman, Middle East
Released transparent solar backsheet 2.0 products
The total quantity delivered of solar backsheet exceeds 100GW

— 2020

Launched the N-type bifacial all black solar panels targeting the high-end market
Massively produced N-type TOPCon 2.0 products and the efficiency exceeds 24%
Original organic-inorganic nano-hybrid alloy technology was applied to transparent backsheet

— 2021

16 GW cell factory is under construction in Shanxi
Shipped over 5 GW n-type cells and modules globally
Cell with large size wafer achieve 25.4% efficiency in the lab, broke the record at the time

JOLYWOOD (TAIZHOU) SOLAR TECHNOLOGY CO., LTD.

SUBSIDIARY OF JOLYWOOD GROUP



Jolywood (Taizhou) Solar Technology Co., Ltd. was established in 2016 as a subsidiary of Jolywood group, is located in Jiangyan Economic Development Zone, Taizhou City, Jiangsu Province. The company's registered capital is 2.33 billion Yuan and the total assets are 4.855 billion Yuan, and the company's credit Grade is A. As a leader in the industrialization of N-type bifacial solar cell technology, is the world's largest and the first Chinese enterprise to focus on TOPCon bifacial solar cells. The n-TOPCon Bifacial Cell Production Capacity is 3.6GW, n-TOPCon Bifacial Module Production Capacity 3GW, n-IBC Cell Production Capacity 150MW. It is the national high-tech enterprise, the backbone enterprise in the industry and the only enterprise in the industry that has won the double honors of "National Green Factory" and "National Green Supply Chain Management Demonstration Enterprise". Jolywood was listed at the Tier One brand by Bloomberg New Energy Finance and covered by MunichRe reinsurance.

The company has established Jiangsu Province efficient photovoltaic engineering technology research center, provincial enterprise technology center, provincial intelligent factory and CNAS certified Photovoltaic Testing Center. Passed the national intellectual property certification, the company has applied for 188 patents and authorized 86 patents, including 25 invention patents. The company has completely independent intellectual property rights in terms of the technology of solar cells. The company's J-TOPCon2.0 solar cell efficiency reached 24.5%, passed Appraisal of scientific and technological achievements in Jiangsu Province. The company's Niwa series TOPCon products are characterized by its high power, high reliability, high bifacial rate, low degradation, low temperature coefficient and a series of advantages which are deeply praised by customers. Jolywood has delivered more than 5 GW N-Type solar modules in more than 50 countries.

3.6
GW

n-TOPCon
Bifacial Cell
Production Capacity

3.0
GW

n-TOPCon
Bifacial Module
Production Capacity

150
MW

n-IBC
Cell
Production Capacity



ENTERPRISE ADVANTAGE

Technology Accumulation and Precipitation

Jolywood has committed itself to the R&D of N-type cells and modules for years, possess good technology accumulation and technology precipitation.

R & D Investment

Supported by national, provincial and municipal-level scientific and technological projects; annual new investment in R&D investment exceeds 100 million yuan.

Core Equipment

The core equipment is independently researched and developed through independent cooperation, with external sales restrictions; currently 100% of the equipment localization rate can be achieved. The equipment investment GW TOPCon cell production line has dropped sharply, close to Perc

Core Material

Silver paste, non-silvered metal paste, etching additives and other core raw material

300+ Engineers

6 employees
hold doctor degrees
41 employees
hold master degrees
R & D team

188 Patents Applications Submitted

86 patents granted



GLOBAL COOPERATION PARTNERS

Long-term technical and commercial cooperation with world's first-class enterprises, such as Dupont, Daikin, Sharp and etc.

Including long-term technical cooperation with IMEC, the world's top research institution and famous domestic universities.



Signing ceremony of cooperation between Jolywood and IMEC in the field of n-type bifacial photovoltaic technology



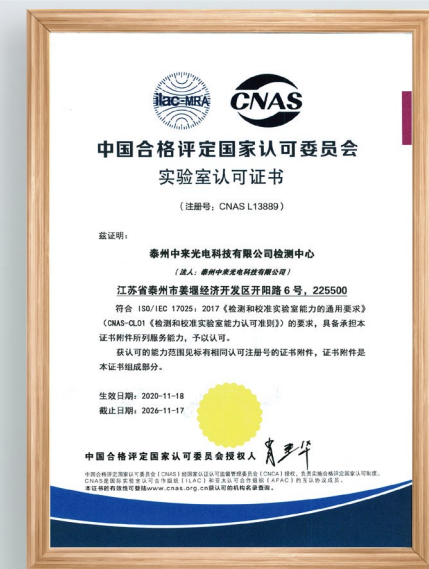
The professor team of Nanjing University signed a contract with Jolywood for the next generation high efficiency cell research and development



The first n-type flexible PV module certified by TÜV NORD

EXCELLENT QUALITY CONTROL SYSTEM

As a global leader in N-type bifacial high-efficiency innovative technology, Jolywood has an excellent quality control system, product and quality certification system. We have won the TÜV Rheinland "Quality in China" award for the outdoor power output of bifacial photovoltaic modules. The company has been awarded the TÜV Rheinland "Quality in China" award for the outdoor power generation of bifacial photovoltaic modules, and was awarded the first N-type flexible PV module certified by TÜV North Germany. The company was awarded the Best Photovoltaic Material Award by PV Magazine, the world's leading PV industry magazine, for two consecutive years. The PV testing centre was accredited as a CNAS accredited laboratory for its testing capabilities and management.



QUALITY ASSURANCE

Jolywood's TOPCon modules have been certified by TÜV Rheinland, TÜV NORD Germany, CQC, JET, CSA and other domestic and foreign authoritative organizations.

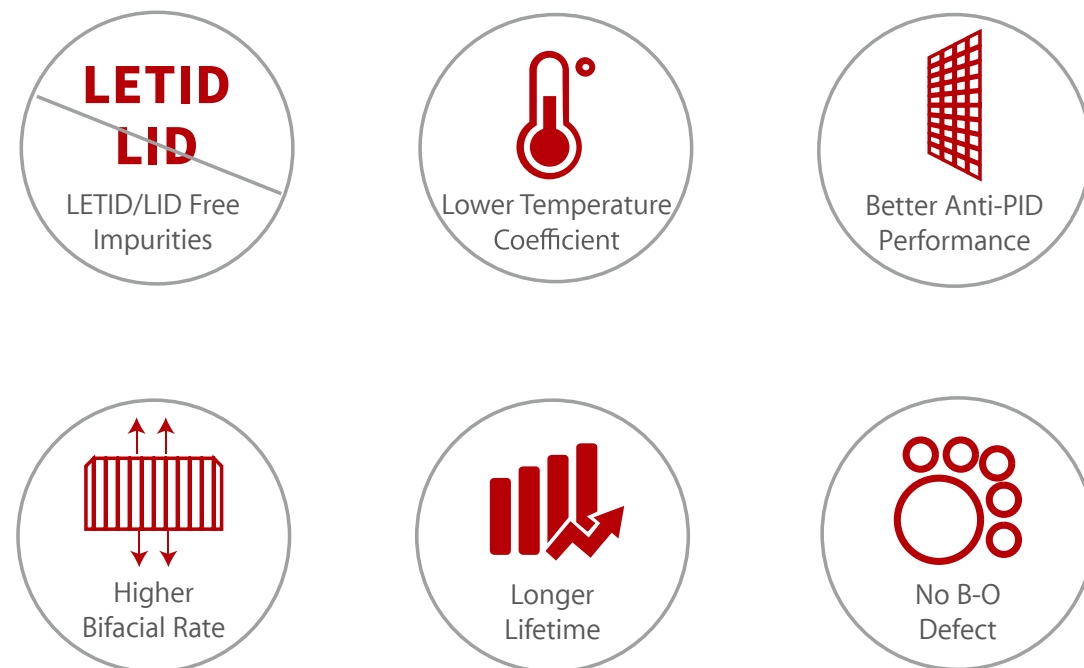


All Quality Matters Award

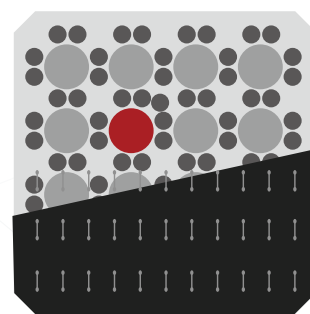


TOPCon TECHNOLOGY

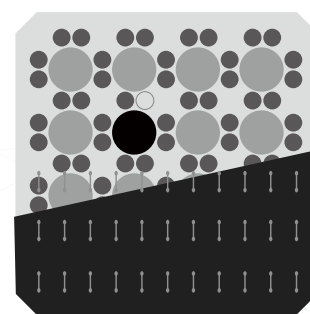
Advantages of N Type Solar Cells



● Silicon ● Electron ● Phosphorus ● Boron



N type solar cells



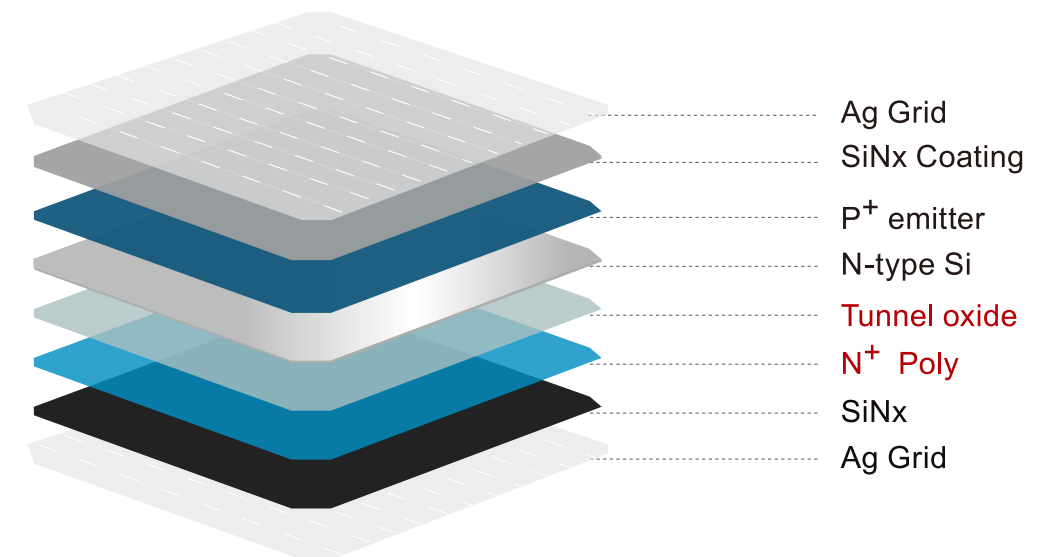
P type solar cells

Comparing with P-type solar cells, TOPCon cells have longer lifetime, lower degradation and higher potential of efficiency enhance.

Advantages of N Type Solar Cells

Passivated contact structure of J-TOPCon 2.0:

- Good interface passivation effect & field passivation effect
- Most of the carrier selective funneling effect, rapid carriers transport between absorption and doped layer.



Advantages of J-TOPCon 2.0

- Higher efficiency
- Lower Temperature coefficient
- High bifaciality
- Lower degradation

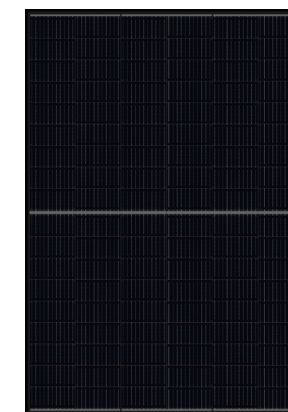
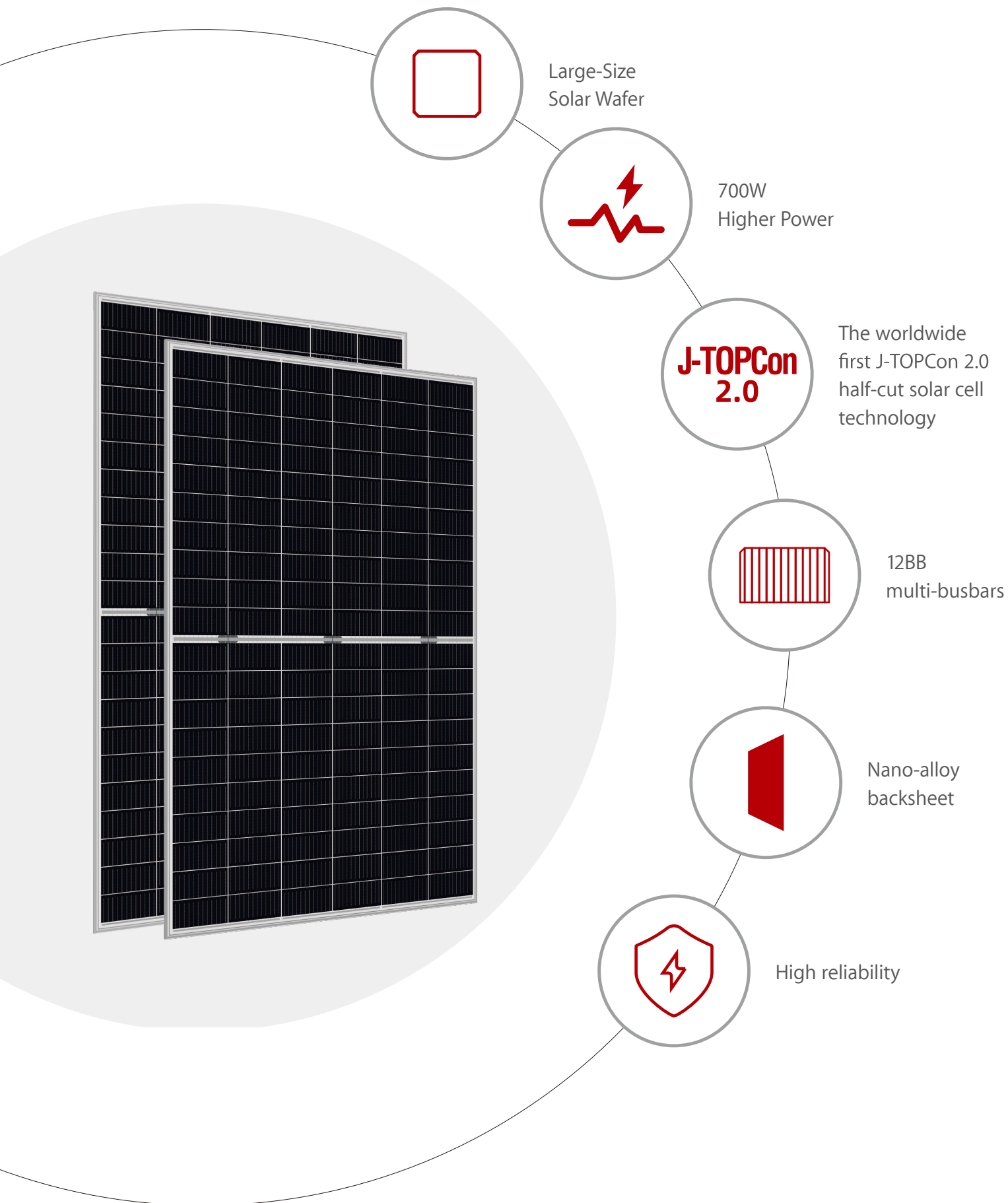
Efficiency **24.5%**

Temperature coefficient reaching **-0.30%/°C**

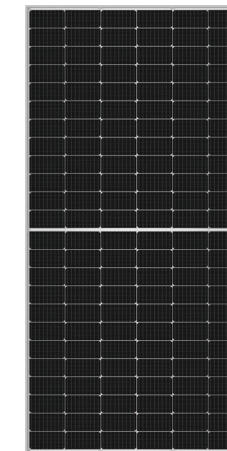
Bifacial rate reaching **85%**

Degradation in first year **1%**

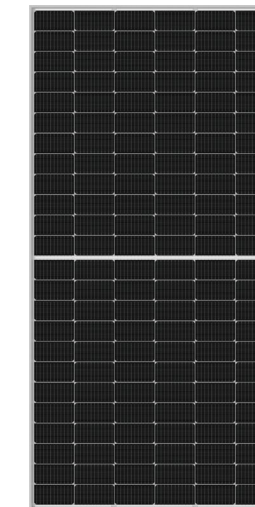
NIWA SERIES SOLAR MODULES



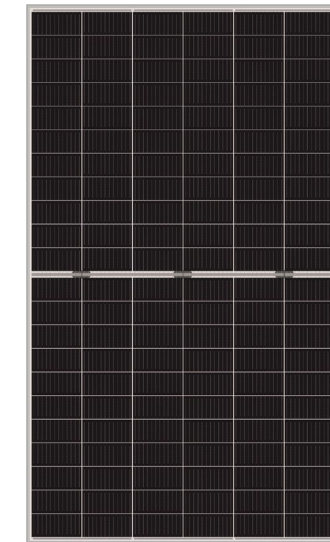
Niwa Black
HD108N-400-420wp



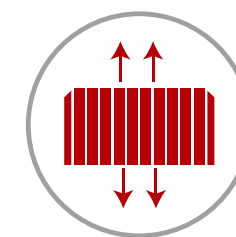
Niwa Pro
HD144N-445-470Wp



Niwa Super
HD144N-550-575Wp

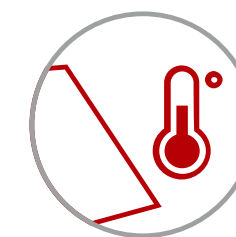


Niwa Max
HD132N-675-700Wp



Additional Power Generational Gain

At least 30-year product lifetime and bifacial design, more than 10-30% additional power gain comparing with the regular modules



Better Temperature Coefficient

Higher power generation under working conditions adopting Passivating Contact Cell technology



ZERO LETID and LID

N-type TOPCon solar cell technology has no LID and LETID naturally, can increase power generation



Better Weak Illumination Response

Higher power output even under low-light power generation conditions like smoggy or cloudy days comparing with the regular modules.



Low LCOE

Adopting high-power solar cell with 1500V technology to decrease the LCOE of the whole photovoltaic system to increase the ROI.



Wider Applicability

Wider application with bifacial design, like BIPV, Vertical installation, snowfield, highhumid area, windy and dusty area

8 MW

Arnhem Project
in the Netherlands

37 MW

The Netherlands
solar energy park

11.75 MW

Zonnepark Rilland N-Type bifacial
PV plant in the Netherlands



11.5 MW

Bremen port Project
in Germany

4.15 MW

Donaueschingen Project
in Germany



125MW
Oman Project, 2019

320 MW

United Arab
Emirates ACWA Project

125 MW

Oman Project

458 MW

Oman Ibri II Project



5.6 MW

Starosynnyavs'ky, 2019

5.6 MW

Ukraine Stara Synyava
N-Type bifacial plant

4.2 MW

Ukraine Fruzynvka
N-Type bifacial plant



30 MW

Shanxi, China, 2017,
Quanyang Top Runner Project

30 MW

Quanyang Top Runner Project

29 MW

Panda Solar Project

153 MW

Qinghai UHV
PV Plant Project



94.42 MW

Jilin Top Runner Project

30 MW

Quanyang Top Runner Project

29 MW

Panda Solar Project

30 MW

Quanyang Top Runner Project

90 MW

Guizhou N-Type bifacial
PV plant

60 MW

Guangxi N-Type bifacial
PV plant



64.64 MW

Hebei, Haixing, 2019,
Top Runner Hebei Project

64.64 MW

N-Type bifacial PV plant in Hebei

74.52 MW

N-Type bifacial PV plant in Hebei

44 MW

Poverty-relief Project in Hebei

104 MW

Sihong Top Runner Project I

110 MW

Sihong Top Runner Project II



JOLYWOOD GLOBAL PROJECT FOOTPRINT

Till the end of 2021, Jolywood N-type product
have installed 5 GW globally



PANDA POWER STATION IN DATONG

29.2 MW

Panda Power station in Datong
Datong, Shanxi, China, 2017

This project is a green energy demonstration project jointly promoted by The United Nations (UN) Development Programme (UNDP) in 2016, with an installed capacity of 50MW, covers an area of 1,234,000 square meters. On June 29, 2017, the power station was on-grid. The average annual effective power utilization hours can reach 1600 hours and the annual power generation can reach 80000000kW·h, the conversion efficiency reached 83%. Jolywood supplied 94248pcs of N-type Topcon bifacial modules, total 29.2MW.



IBRI II POWER STATION IN OMAN

458 MW

ACWA Ibri II Project in Oman
Ad-Dhahirah, Oman, 2021

ACWA Oman Ibri II Power station is invested and constructed by ACWA Power. The project is located in the Ad-Dhahirah region of Oman and the total installed capacity is 575MW, wholly using N-type TOPCon bifacial modules. Jolywood supplied 458MW Bifacial module for the project. The project is the largest ground-mounted power plant in Oman. At the peak of power generation, the power station can power 33,000 homes and reduce Oman's carbon dioxide emissions by 340,000 tons per year.





QINGHAI UHV PV PLANT PROJECT

153 MW

Qinghai UHV PV Plant Project
Qinghai, China, 2020

Qinghai UHV project starts in Hainan prefecture of Qinghai Province and ends in Zhumadian City of Henan Province, with a total investment of about 22.6 billion yuan. It was grid connected in September 2020. After the completion of the project, it is estimated that the annual power generation will reach 40 billion kwh, equivalent to replacing the use of 18 million tons of raw coal, helping to reduce emissions of 14000 tons of smoke and dust, 90000 tons of sulfur dioxide, 94,000 tons of nitrogen oxides and 29.6 million tons of carbon dioxide.



VERTICAL INSTALLATION OF AGRICULTURE- COMPLEMENTARY PROJECT IN GERMANY

4.1 MW

Vertical installation of AgriculturecomplementaryProject in Germany

Donaueschingen-Aasen,
Baden-Württemberg, 2020

The project was developed and installed by Next2Sun in Germany and was on grid connect in 2020. Its unique vertical installation method is a patented technology and the project has received good reputation from the market. The project is Agriculturecomplementary Project and it takes advantage of the bifacial modules that can generate electricity on both sides, all modules are installed at a vertical angle. The space between the mounting system can be used for agricultural planting without affecting the growth of crops and greatly improving the utilization of the land.



ROOFTOP PROJECT



1 MW, Vietnam



273 kw, France



163.5 kw, France



120 kw, Poland



258.6 kw, France



240.7 kw, France



50 kw, Poland



10 kw, Poland



227.3 kw, France



216 kw, France



7 kw, Germany



6 kw, Poland

Global Partners

Trusted by Industrial Strong PV Players



Jolywood Solar Bankability

Recognized by Most of Banks Globally





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JOLYWOOD (TAIZHOU) SOLAR TECHNOLOGY CO.,LTD.

ADD: No.6 Kaiyang Rd., Jiangyan Economic Development
Zone, Taizhou, Jiangsu Province, China,

TEL: +86-523-80612799

FAX: +86-523-80770837

www.jolywood.cn

WeChat
Official Accounts

