this webinar is powered by GoodWe

pv magazine webinars

Utility-scale PV and string inverter market trends

7 March 2023

2:00 pm – 3:30 pm | GMT, London
3:00 pm – 4:30 pm | CET, Berlin, Madrid, Paris
4:00 pm – 5:30 pm | EET, Athens

Marjia Maisch
Editor
pv magazine

Mark Hutchins
Editor
pv magazine

Alvaro Zanón
Technical Director EMEA – Utility & Large Scale
GoodWe

David Sánchez
Sales Director EMEA – Utility & Large Scale
GoodWe

Ryan Alexander
Research lead
Aurora Energy Research

Peijun Shen
Senior Manager Product Marketing
LONGi

this webinar is powered by GoodWe

pv magazine webinars

Utility-scale PV and string inverter market trends

7 March 2023

2:00 pm – 3:30 pm | GMT, London
3:00 pm – 4:30 pm | CET, Berlin, Madrid, Paris
4:00 pm – 5:30 pm | EET, Athens

Marjia Maisch
Editor
pv magazine

Mark Hutchins
Editor
pv magazine

Felix Jetter
Team Leader
Power Plant Engineering
BayWa

Alberto Campayo
Head of Operations
Prosolia Energy

Nitish Sinha
Project Engineer and
Inverter specialist
Ecorus

Welcome!

Do you have any questions? ❓

Send them in via the Q&A tab. 👉 We aim to answer as many as we can today!

You can also let us know of any tech problems there.

We are recording this webinar today. 📹

We'll let you know by email where to find it and the slide deck, so you can re-watch it at your convenience. 👀 💡

this webinar is powered by

GoodWe

pv magazine webinars

Utility-scale PV and string inverter market trends

Welcome

7 March 2023

2:00 pm – 3:30 pm | GMT, London
3:00 pm – 4:30 pm | CET, Berlin, Madrid, Paris
4:00 pm – 5:30 pm | EET, Athens

Marjia Maisch
Editor
pv magazine

Mark Hutchins
Editor
pv magazine

Alvaro Zanón
Technical Director EMEA – Utility & Large Scale
GoodWe

this webinar is powered by GoodWe

pv magazine webinars

Market analysis and future trend of Europe PV industry

7 March 2023

2:00 pm – 3:30 pm | GMT, London
3:00 pm – 4:30 pm | CET, Berlin, Madrid, Paris
4:00 pm – 5:30 pm | EET, Athens

Marjia Maisch
Editor
pv magazine

Mark Hutchins
Editor
pv magazine

Ryan Alexander
Research lead
Aurora Energy Research

AURORA ENERGY RESEARCH

Macro trends in European Solar PV investment

March 2023

Agenda

AURORA

I. European policy environment for solar PV

1. RePowerEU targets and implications for build out rates
2. EU Solar Energy Strategy

II. Revenue models for solar PV

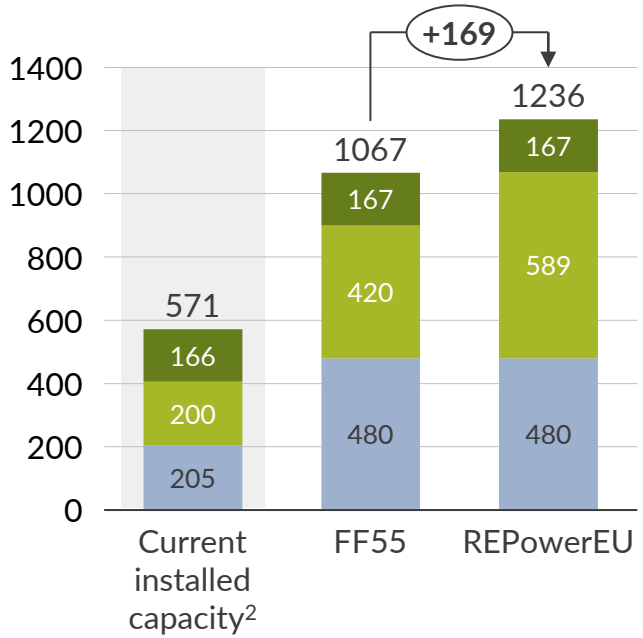
1. Government support schemes
2. PPA supply/demand balance by market
3. Solar PV capture prices by market

The Commission has proposed to increase the EU renewables target to 1236 GW of capacity by 2030, requiring 3x faster deployment

AURORA

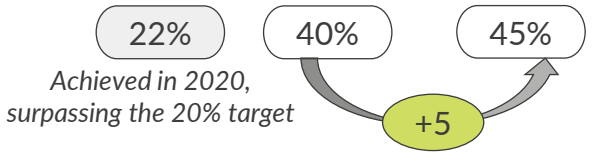
Target installed RES capacities by 2030[1]

GW



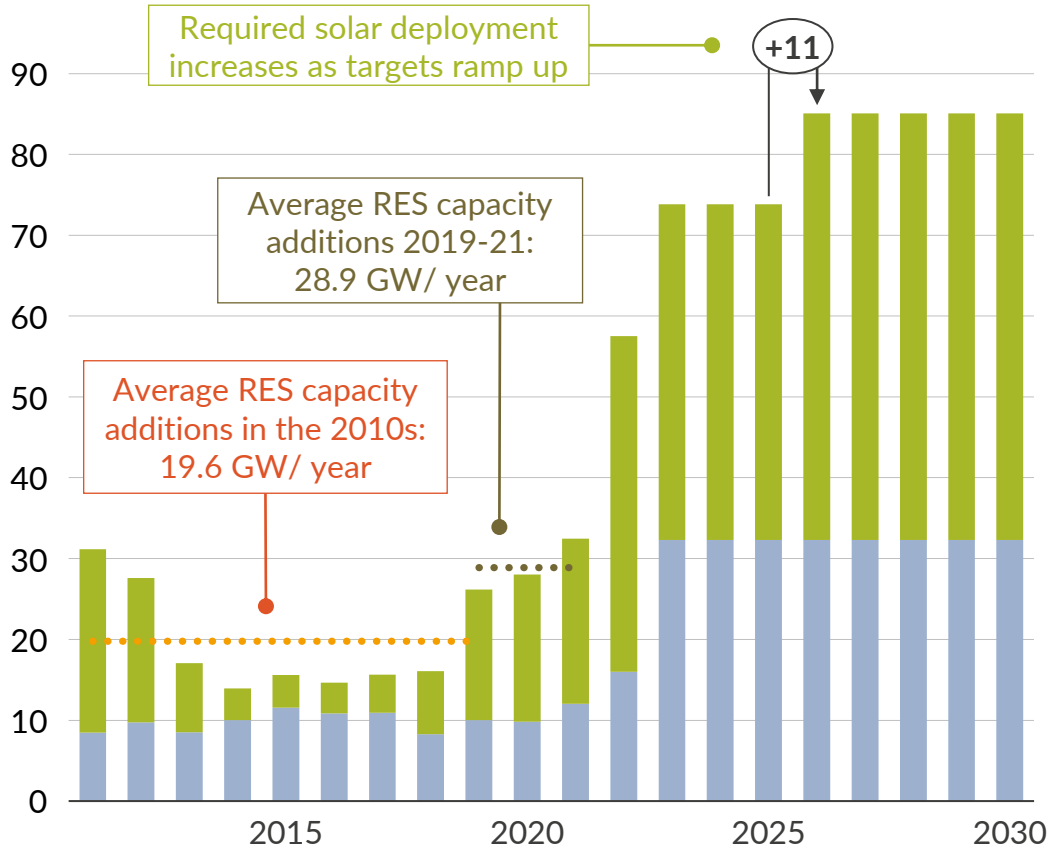
Target RES share of final energy consumption

%



Wind and solar capacity commissioned per year[1]

GW



Other RES[3] Solar Wind

Avg build rate (2011-2019) Avg build rate (2019-2021)

- The 'Fit for 55' (FF55) package targeted 1067GW RES capacity by 2030 including 480 GW of wind and 420 GW of solar
- The REPowerEU plan adds a further 169 GW, raising the target to 1236 GW by 2030 with a focus on solar PV, aiming for 320 GW by 2025 and almost 600 GW by 2030
- 42 GW of solar would need to be deployed annually until 2025, rising to 53 GW from 2026 onwards while 32 GW of wind would need to be deployed annually to 2030
- These represent a cumulative average of 80 GW required annually, 4x faster than average build rate over the last 10 years
- To support deployment of these capacities, the Commission also presents the *EU solar strategy* and *European Solar Rooftop Initiative* and plans to speed up permitting and innovation

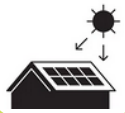
1) Shown for EU-27 only. 2) As at the end of 2021. 3) Other RES includes hydro and biomass.

Sources: Aurora Energy Research, European Commission, Eurostat, WindEurope

The EU Solar Energy Strategy outlines a comprehensive vision to rapidly deploy solar energy

AURORA

The EU Solar Energy Strategy outlines a comprehensive vision to swiftly reap the benefits of solar energy, and presents four initiatives to overcome key challenges faced.



European Solar Rooftops Initiative

- Aims at unlocking the vast, underutilised solar generation potential of rooftops which could provide almost 25% of the EU's electricity consumption
- Permitting for all rooftop solar installations will be limited to a maximum of 3 months
- Provisions will be made to ensure that all new buildings are "solar ready" and installation of rooftop PV made compulsory for:
  i. All new public and commercial buildings by 2026
  ii. All existing public and commercial buildings by 2027
  iii. All new residential buildings by 2029

Faster and simpler permitting procedures

- The Commission presents a Recommendation on permitting to hasten and simplify the procedures
- Ensure RES assets qualify for the best procedures available and are deemed of public interest & safety
- Establish clearly defined, fast and as short as possible deadlines for all the permitting steps
- Establish binding maximum deadlines for all relevant stages of the EIA procedure
- Create a single unified application process for the entire permitting and granting process
- Allow applicants to update the technology specifications through the process to facilitate the uptake of innovative technologies

Availability of abundant skilled workforce

- Aims at ensuring the availability of an abundant skilled workforce to face up the challenge of producing and deploying solar energy all across the EU
- Member States are encouraged to analyse the skills gap in the solar energy sector and develop training programmes fit for purpose, taking into account the potential to increase women's participation
- At EU level, as part of REPowerEU plan, the Commission will bring together the relevant stakeholders in the renewable energy sector, to set up an EU large-scale skills partnership for onshore renewable energy, including solar energy, under the Pact for Skills.

European Solar PV Industry Alliance

- Aims to secure diversity of supplies through more diverse imports and scaled up solar PV manufacturing in the EU of innovative and sustainable solar PVs to mitigate potential supply risks
- The alliance will include a research and innovation pillar with strong links to Horizon Europe and at EU level:
  - InvestEU can provide de-risked financing to private investments
  - Innovation Fund can channel funding towards innovative zero and low-carbon equipment
  - Recovery and resilience and Cohesion policy funds to support relevant projects

Sources: Aurora Energy Research, European Commission

Agenda

AURORA

I. European policy environment for solar PV

1. RePowerEU targets and implications for build out rates
2. EU Solar Energy Strategy

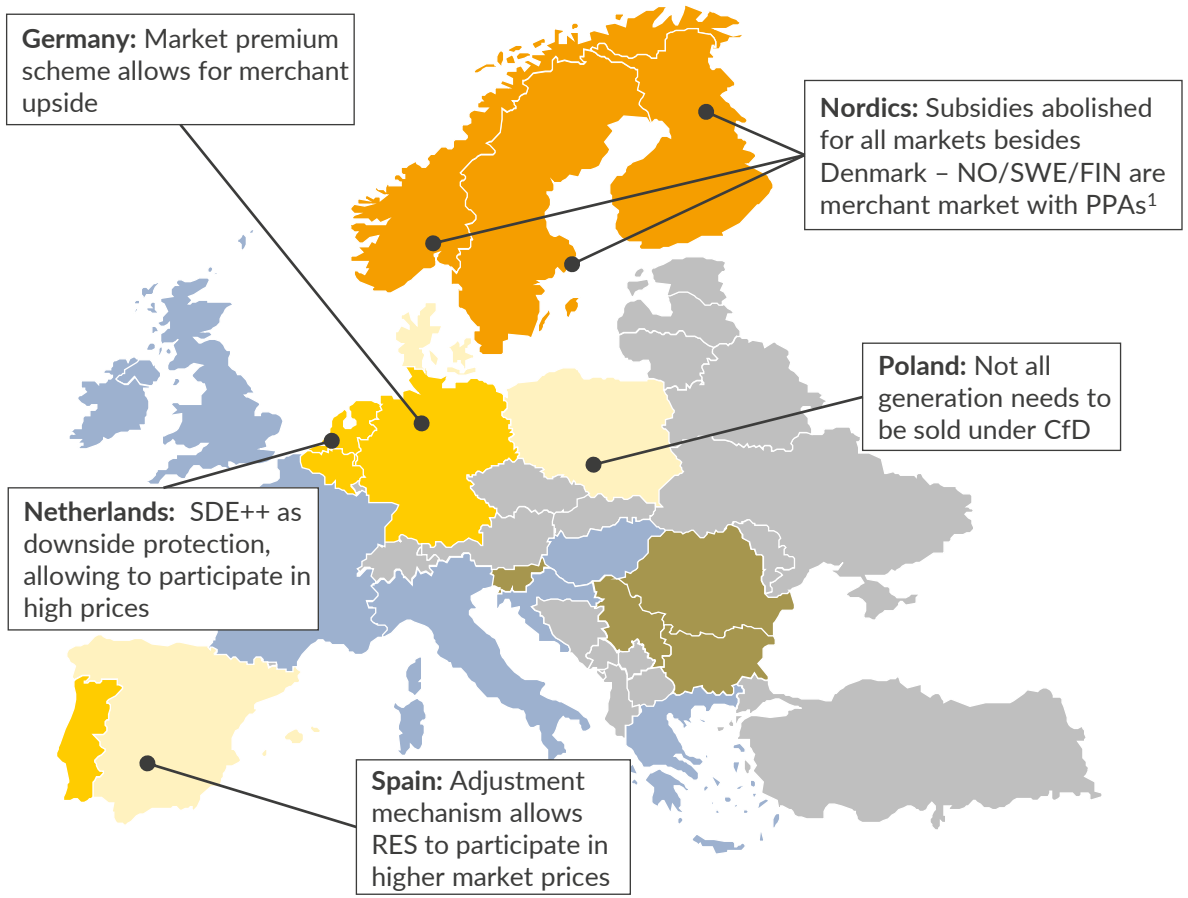
II. Revenue models for solar PV

1. Government support schemes
2. PPA supply/demand balance by market
3. Solar PV capture prices by market

Government support schemes are still the biggest driver of solar build-out across most of Europe, with varying degrees of merchant exposure

AURORA

Renewable support schemes: Some markets allow for merchant exposure



Impact of European Power Market reform discussion on merchant exposure

- If CfDs were rolled out as the default renewable subsidy scheme for new assets, this would especially affect developers in markets where the current instrument allows for merchant upsides
  - For instance, in Germany and the Netherlands support schemes serves as downside protection, but allows developers benefitting from price peaks, which was historically meant to foster market integration of renewables
  - Yet, CfDs could help developers reduce commercial risks around covering their levelised costs, bringing down financing cost
  - Stronger reliance on CfDs could challenge the uptake of PPAs, as CfDs eliminate counterparty risk and could crowd out PPA supply
- Imposing CfDs on existing assets (those not covered by PPAs, e.g. post-subsidy assets) would be an even stronger challenge to merchant business models
- Credit guarantees could make the PPA market more navigable for developers, reducing offtaker risk and allowing them to access smaller offtaker segments
- Should the majority of (renewable) developers be covered by CfDs or PPAs, an additional revenue cap will not be necessary for these technologies

1) Except for offshore. In Denmark, an innovative two-sided CfD exists. 2) France allows up to 18 months merchant window before entering into two-sided CfD contract.

Sources: Aurora Energy Research

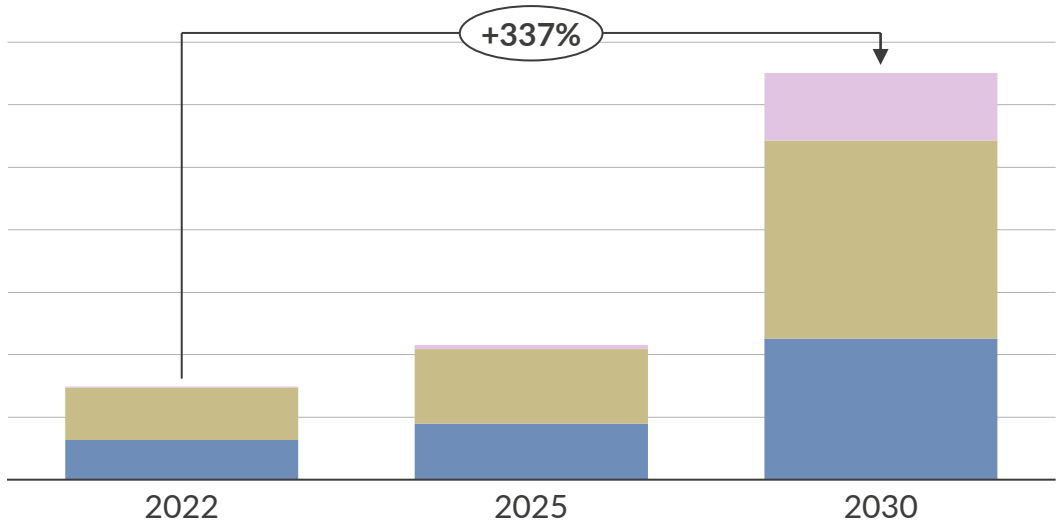
Rising PPA demand from utilities & corporates provides an opportunity for new build renewables to secure stable revenues

AURORA

Detailed country data available in Aurora's European PPA Report (available in June).

New build renewables PPA demand in Europe[1]

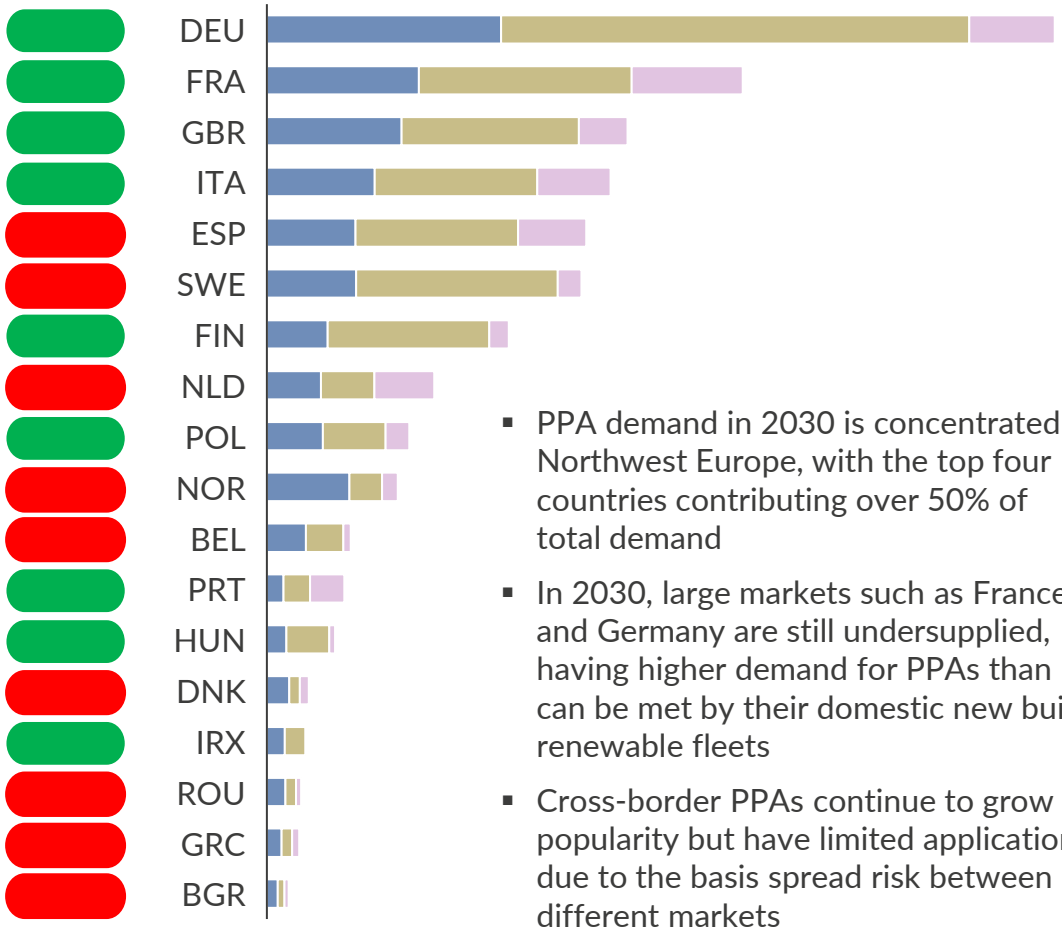
TWh



- PPA demand today is derived from Aurora's own PPA database, while future demand is estimated based on Aurora's forecast of sectoral power demand growth combined with assumptions around the share of each sector that will require a PPA and have the necessary creditworthiness ratings
- PPA demand is expected to quadruple over the next decade, driven by Europe's strengthening decarbonisation targets and an increasingly discerning green consumer base

New build renewables PPA demand in 2030*

TWh



- PPA demand in 2030 is concentrated in Northwest Europe, with the top four countries contributing over 50% of total demand
- In 2030, large markets such as France and Germany are still undersupplied, having higher demand for PPAs than can be met by their domestic new build renewable fleets
- Cross-border PPAs continue to grow in popularity but have limited application due to the basis spread risk between different markets

Electrolyser | Utility | Corporate | Oversupplied | Undersupplied

1) Across Aurora's 18 modelled countries in Europe. Electrolyser demand estimated based on country targets.

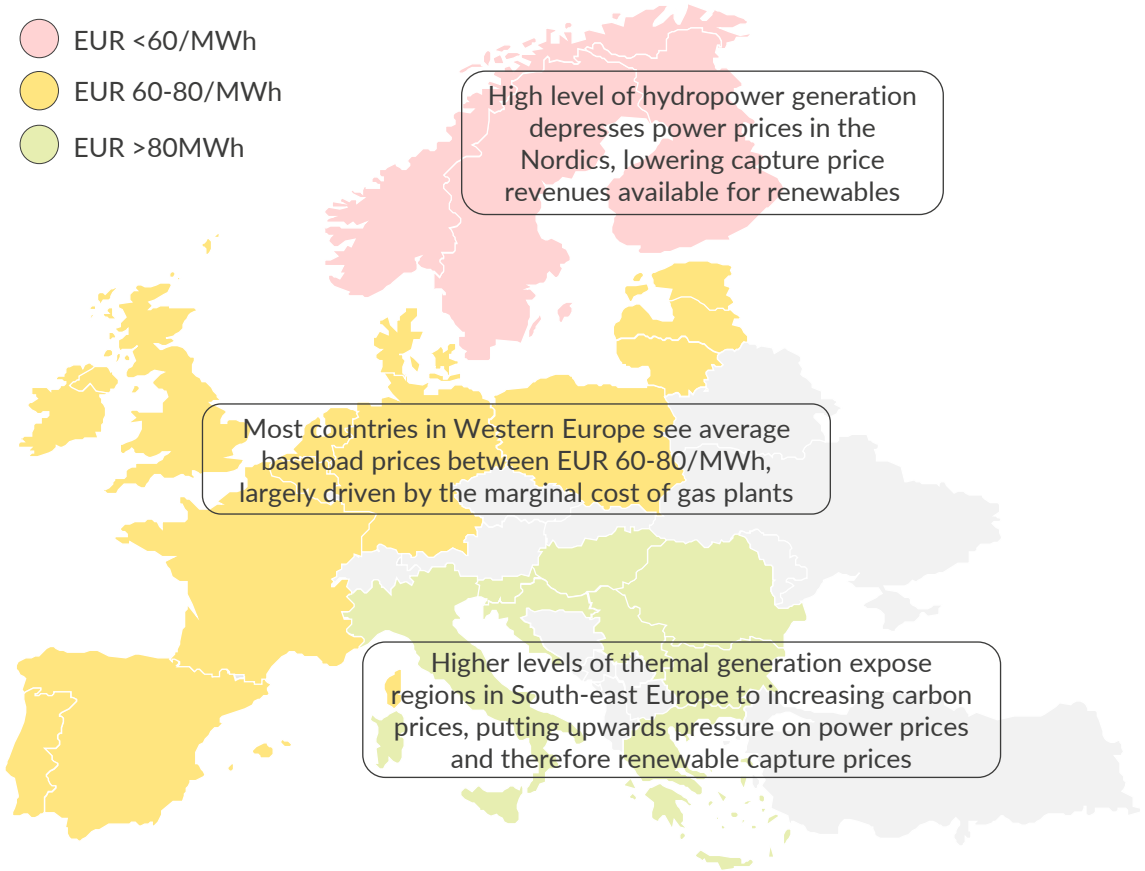
Source: Aurora Energy Research

The generation mix and load factors affect baseload market prices and capture price discounts across Europe

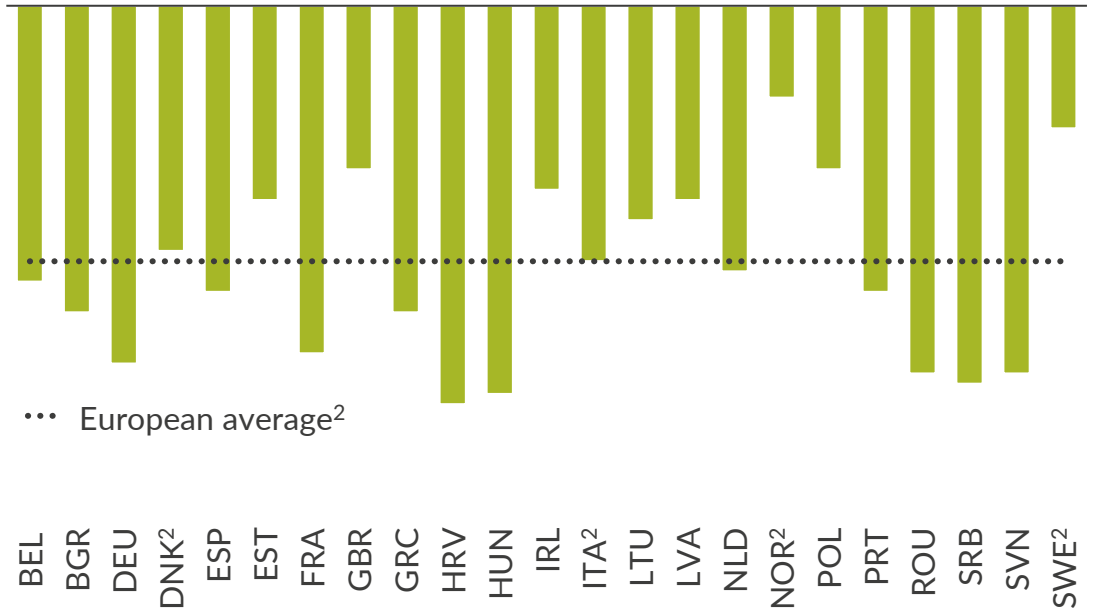
AURORA

Detailed country data available in Aurora's Power and Renewables Market subscriptions.

Average baseload price (2025 – 2040)*
EUR/MWh (real 2021), Central scenario



Solar capture price[1] discount to baseload price in 2030*
%, Central scenario



- Due to the high correlation of solar generation, solar capture prices see a significant discount to baseload prices by 2030 across most of Europe
- The capture price discount is the highest in countries with relatively high shares of solar generation combined with high levels of thermal generation, leading to higher rates of cannibalisation (e.g. South-Eastern Europe)

1) Using capture prices assuming no economic curtailment i.e. plants continue to generate during negative price periods 2)Average across price zones 3) Average across Aurora's 24 modelled countries in Europe

Sources: Aurora Energy Research

European Solar Market Attractiveness report: Assisting you with market entry and pre-feasibility activities in 24 European markets

AURORA

European Solar Market Attractiveness report offerings

Outline of the European Solar Report

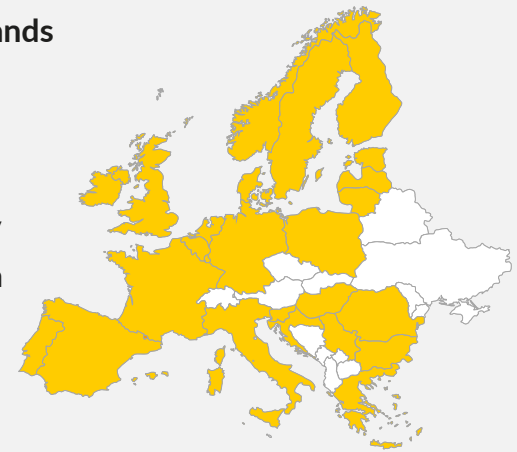
- ✓ **Overview of 18 European power markets and the economics of utility-scale solar PV**
- ✓ **Forecasts of major trends important to opportunity for solar** including demand growth, commodities, hydrogen
- ✓ **Market attractiveness overview** of market and policy indicators (inc. strength of subsidy schemes, permitting risk, grid connection costs/ease, locational signals, attractiveness for co-location)
- ✓ **Market sizing** including total demand, solar capacity growth and solar capacity growth under Net Zero-aligned policies, by country
- ✓ **Power Purchase Agreement** market sizing and supply/demand balance by country
- ✓ **Heatmaps** taking into account forecasted baseload prices and solar capture prices to quickly see the best market opportunities
- ✓ **Summary of key policies & subsidy schemes** by country and their differences for utility-scale solar PV
- ✓ **Forecasted returns for utility-scale solar PV** for fully merchant commercial operation starting in 2025 and 2030
- ✓ **Summary of renewables investment trends** to have a view of which markets capital is being allocated to
- ✓ **One one hour call with our European research team** to discuss the report

Changes since prior year report

- ✓ Updated rankings based on 2023 fundamentally-modelled price forecasts with commentary on year-on-year changes
- ✓ **(new!)** Attractiveness of co-location business models across markets
- ✓ **(new!)** Analysis of locational signals within markets
- ✓ **(new!)** Analysis of behind-the-meter solar PV

Supported by fundamental modelling in 24 European markets

- **Baltics** (Estonia, Latvia, Lithuania)
- **Croatia**
- **GB**
- **I-SEM**
- **Germany**
- **France**
- **Iberia** (Portugal, Spain)
- **Poland**
- **Nordics** (Denmark, Finland, Norway, Sweden)
- **Netherlands**
- **Italy**
- **Belgium**
- **Greece**
- **Hungary**
- **Romania**
- **Bulgaria**
- **Slovenia**
- **Serbia**



Source: Aurora Energy Research

Disclaimer and Copyright

AURORA

General Disclaimer

This document is provided "as is" for your information only and no representation or warranty, express or implied, is given by Aurora Energy Research Limited and its subsidiaries Aurora Energy Research GmbH and Aurora Energy Research Pty Ltd (together, "**Aurora**"), their directors, employees agents or affiliates (together, Aurora's "**Associates**") as to its accuracy, reliability or completeness. Aurora and its Associates assume no responsibility, and accept no liability for, any loss arising out of your use of this document. This document is not to be relied upon for any purpose or used in substitution for your own independent investigations and sound judgment. The information contained in this document reflects our beliefs, assumptions, intentions and expectations as of the date of this document and is subject to change. Aurora assumes no obligation, and does not intend, to update this information.

Forward-looking statements

This document contains forward-looking statements and information, which reflect Aurora's current view with respect to future events and financial performance. When used in this document, the words "believes", "expects", "plans", "may", "will", "would", "could", "should", "anticipates", "estimates", "project", "intend" or "outlook" or other variations of these words or other similar expressions are intended to identify forward-looking statements and information. Actual results may differ materially from the expectations expressed or implied in the forward-looking statements as a result of known and unknown risks and uncertainties. Known risks and uncertainties include but are not limited to: risks associated with political events in Europe and elsewhere, contractual risks, creditworthiness of customers, performance of suppliers and management of plant and personnel; risk associated with financial factors such as volatility in exchange rates, increases in interest rates, restrictions on access to capital, and swings in global financial markets; risks associated with domestic and foreign government regulation, including export controls and economic sanctions; and other risks, including litigation. The foregoing list of important factors is not exhaustive.

Copyright


AURORA
ENERGY RESEARCH

this webinar is powered by GoodWe

pv magazine webinars

Best Practices for Module Technologies and Applications

7 March 2023

2:00 pm – 3:30 pm | GMT, London
3:00 pm – 4:30 pm | CET, Berlin, Madrid, Paris
4:00 pm – 5:30 pm | EET, Athens

Marjia Maisch
Editor
pv magazine

Mark Hutchins
Editor
pv magazine

Peijun Shen
Senior Manager Product Marketing
LONGI

Customer-driven Value Creation

Best Practices for Module Technologies and Applications

The World Leading Solar Technology Company

Propelling the transformation

Milestones of LONGi

Each milestone has become a key force to promote the development of the industry

2000

The beginning

The era of semiconductor technology accumulation

2000
LONGi was established

2005
Formation of annual production capacity of 30 tons silicon ingot

2005

Technological revolution

The era of technological revolution in the monocrystalline silicon wafers

2012
A-share market listing

2014
World's No.1 in production of monocrystalline silicon wafer
- RCz Ingot pulling
- Diamond Wire Slicing Technology
- M1/M2 Silicon standard

2014

Industrial upgrading

The era of promoting monocrystalline back to the mainstream

2015
Entered solar cell and module market
World's No.1 in shipment of monocrystalline module

2018
The world's most valuable PV manufacturer
- PERC Trend
- LIR Technology
- Bifacial Technology

2019

Energy transformation

The era of utilizing solar technology to change the earth

2019
Certified the low carbon footprint by CERTISOLIS
Set another standard for ultra high efficiency module
- M6 Silicon Wafer Standard

2020
Set a brand new industry standard
- M10 Silicon Wafer Standard

2021

2021
LONGi established the Hydrogen BU

LONGi Lifecycle Quality
- Product lifecycle quality management

LONGi broke three more world records for solar cell efficiency
- N-type TOPCon Solar Cell Efficiency
- P-type TOPCon Solar Cell Efficiency
- HJT Solar Cell Efficiency

70GW+
Wafer Shipment (2021)

38.52GW
Module Shipment (2021)

2022

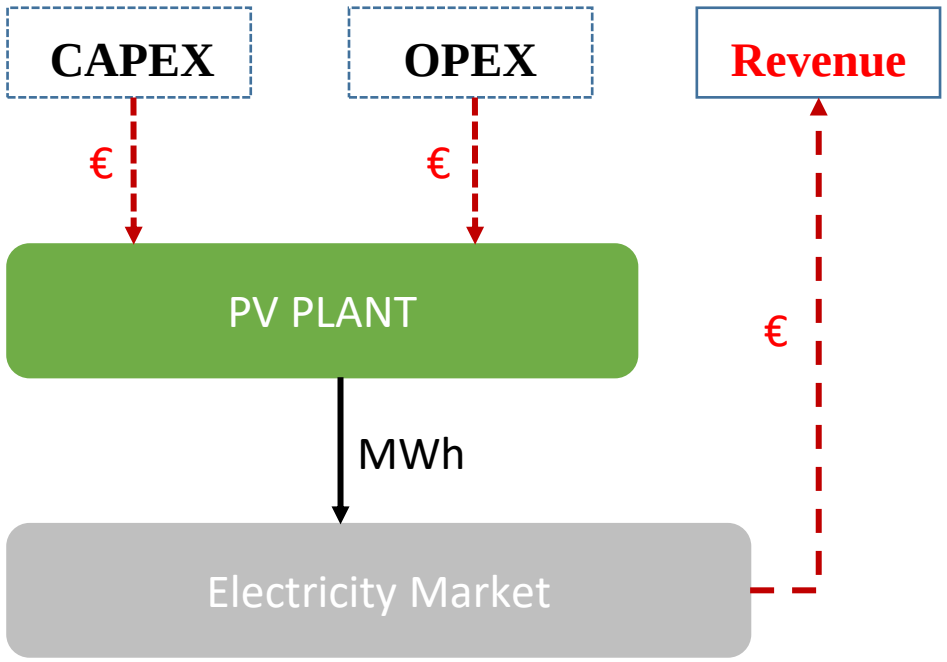
Solar for solar, Solar for all

Everyone should be able to benefit from clean energy

2022
LONGi introduced the Hi-MO 6, its first module designed exclusively for the global distributed consumer market.
- LONGi's high-efficiency HPBC cell technology

How do we think on the ‘Best Practice’

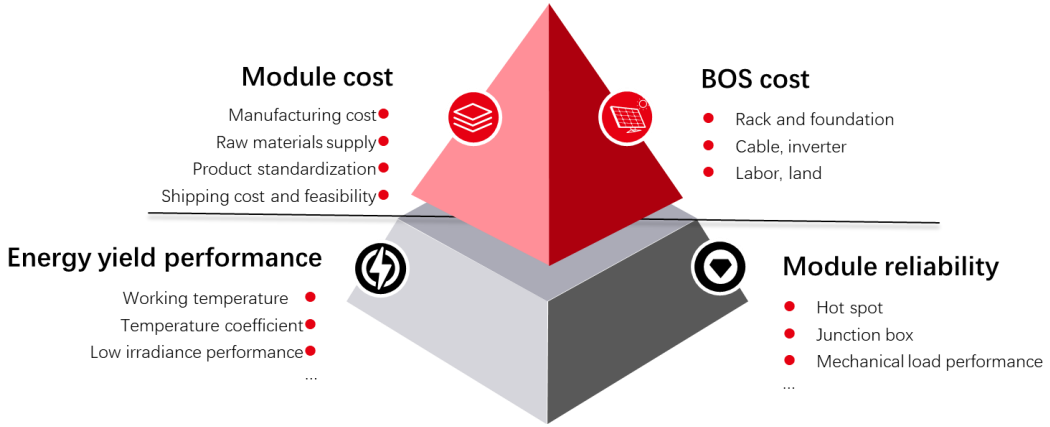
In the Eyes of Investor, the Plant is an Investment



So, LCOE is the anchor for ‘best practice’

$$\text{LCOE} = \frac{\text{Capital Cost + Operating Cost of asset}}{\text{Generated Energy (kWh)}}$$

Module is the most important component in system to drive the LCOE down.



What another beautiful thing of higher module efficiency, it can drive down the BOS cost of the whole system

Hi-MO5 → Hi-MOx

Increasing 0.8% efficiency can save BOS cost 0.42c ¢ /W

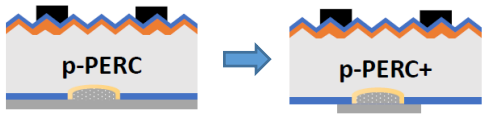
Spanish; 2P Tracker

540W
21.1%

	Cost saving ratio	
	Mounts and foundation	-2.8%
	Combiner box	/
	Cables	-1.1%
	Labor	-3.3%
	Land	/

560W
21.9%

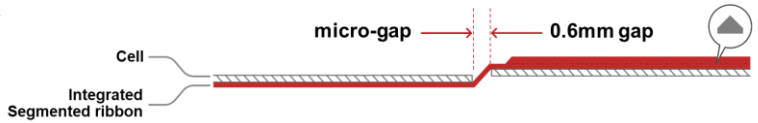
What LONGi did to BOOST the Module Efficiency and Yield



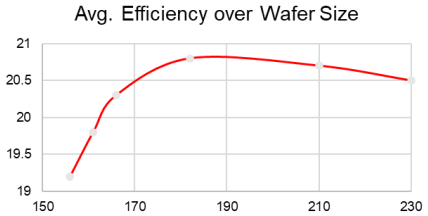
Bifacial

Smart soldering

Gain in module efficiency **0.3%**

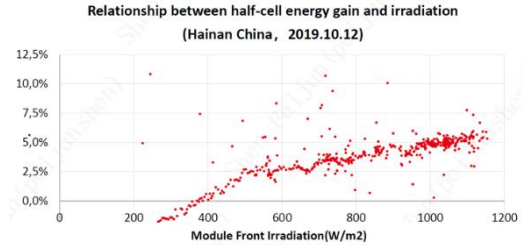


Optimum Cell Size

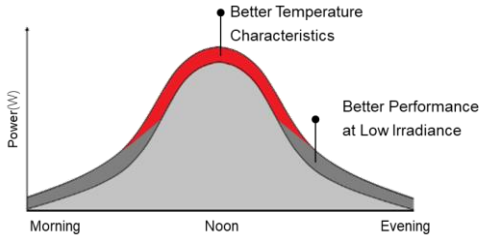


Efficiency & Yield

Half cut



Ga Doped



Wafer Quality

Ocontent **-34%**

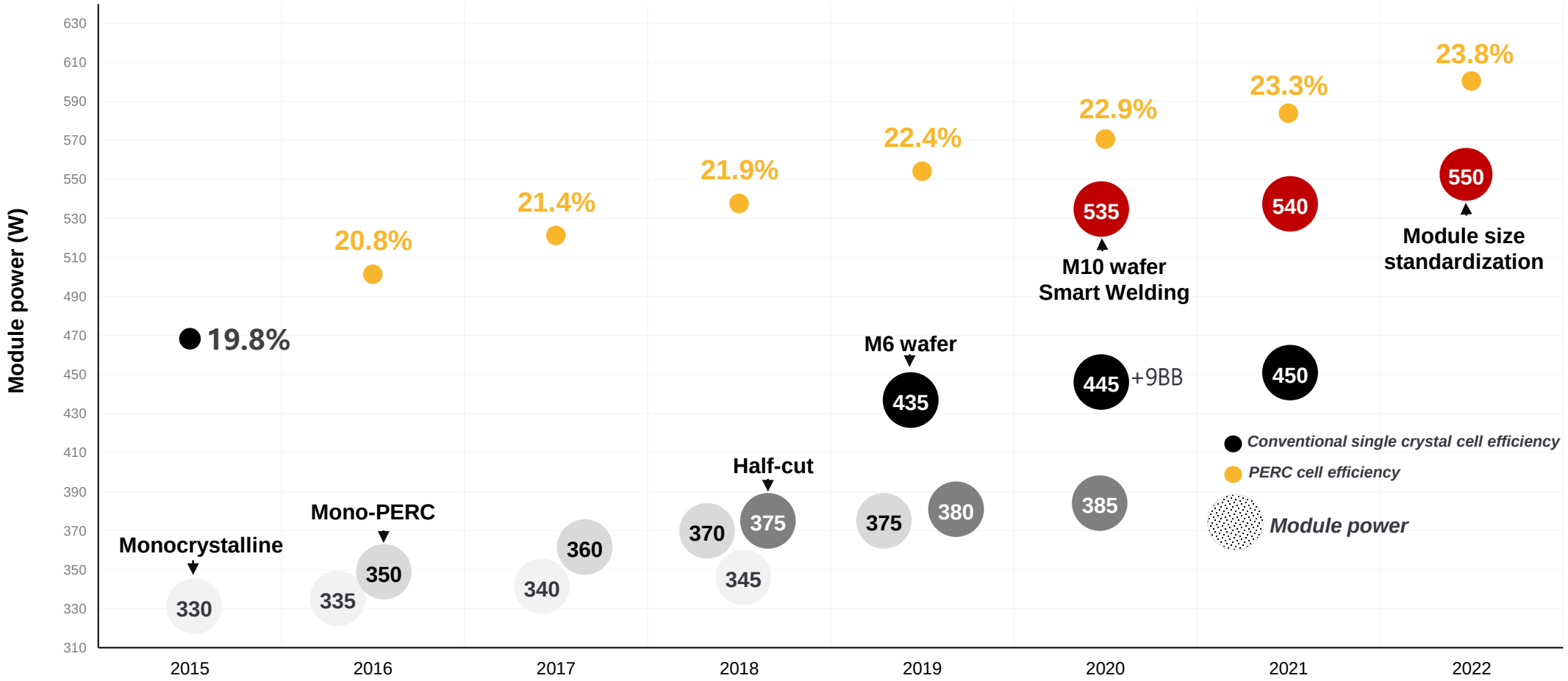
2011~2020

Minority Carrierlifetime **+18%**

2014~2020

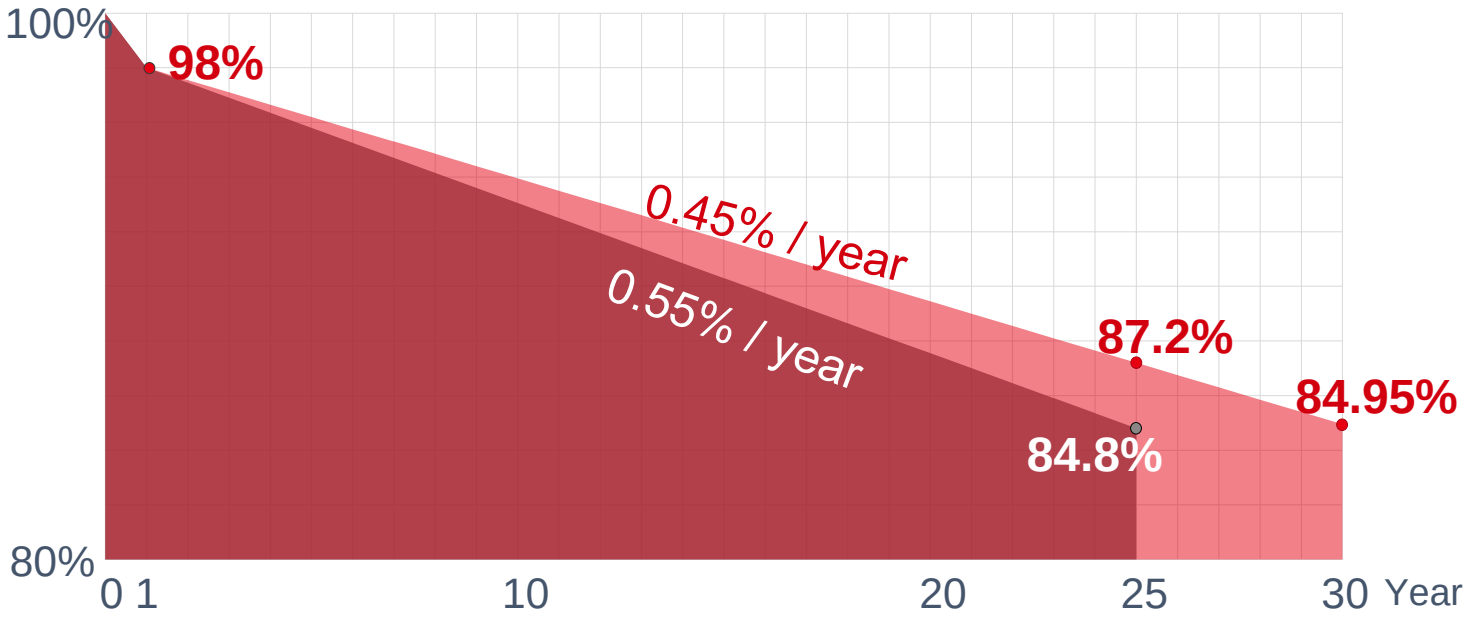
Propelling the transformation

In past 7years, LONGi promoted the PERC modules and Make it the most competitive product on Market



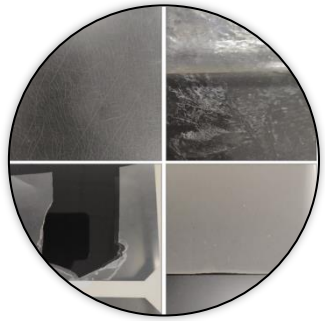
THEN Reliability and Lifetime are Matter for Best Practice

>19% additional Yield because of lower degradation and longer lifetime.



Application Example

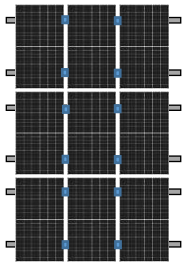
Transparent Backsheet



Module Current Margin

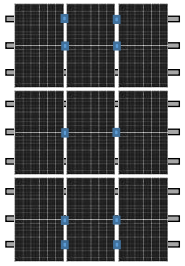
Cell size	Isc(A)	Max. diode current (A)	Current factor	Required safety factor (1+30%×75%*)×1.25	Safety margin
156.75	10	18	1.800	1.531	17.6%
166	11.6	22	1.897		23.9%
182	13.9	25	1.799		17.5%
210	18.4	25	1.359		-11.3%
		30	1.630		6.5%

Mechanical Loads



Design with 182 mm modules
6 rails

Design with 210 mm modules
9 rails



Professional Reliability Assessment Methods

Based on the research results of well-known research units and third-party institutions in the industry, LONGi has established a variety of differentiated reliability testing methods to evaluate product and material reliability more quickly and effectively.

Full-Scenario Reliability

Diverse Climate conditions

Highly Accelerated Thermal Cycling (HATC)	DH +UV Aging	TC + UV Aging
Performance at Low Irradiance	Cold conditioning + Dry heat + HF sequence test	UV + TC + HF sequence test
LeTID	PID	Salt Mist Ammonia Corrosion
.....		

Catastrophic Conditions

Hail Test

Enlarge the hailstone to 35mm during hail test,
Verify the module reliability in extreme weather.

Low-temperature Mechanical Load Performance

Apply low temperature and static mechanical load to modules simultaneously. Accurately verify the product reliability

Wind Tunnel Thresher Test

Subjected to a maximum wind speed of 60m/s (~17 magnitude hurricane) for Module design and installation validate.

Fire Resistance Test

LONGi modules can pass the highest fire resistance test (Italy UNI 9177 Class1)

The Third-party Evaluation of Product Quality & Performance

RETC High Achiever for 4 years

LONGi is recognized as a 2022 Top Performer, gaining the High Achiever status in RETC (Renewable Energy Test Center)'s PV Module Index Report for the fourth consecutive year.

In RETC's "Photovoltaic Module Index Report" (PVMI) for 2020, LONGi's results in the three key indicators of reliability, performance and quality identified it as only company to achieve an award. LONGi also became the only manufacturer to perform well in all 8 individual tests, underlining the high reliability and excellent performance of its modules.

Reliability

- DH2000 Test
- DML Test
- PID-Free
- TC

Performance

- Module Efficiency
- PTC-to-STC Ratio
- PAN File
- LID Test

Quality

- Thresher Test (HF30, TC600, DH2000, DML, UVSoak)
- Hail Test

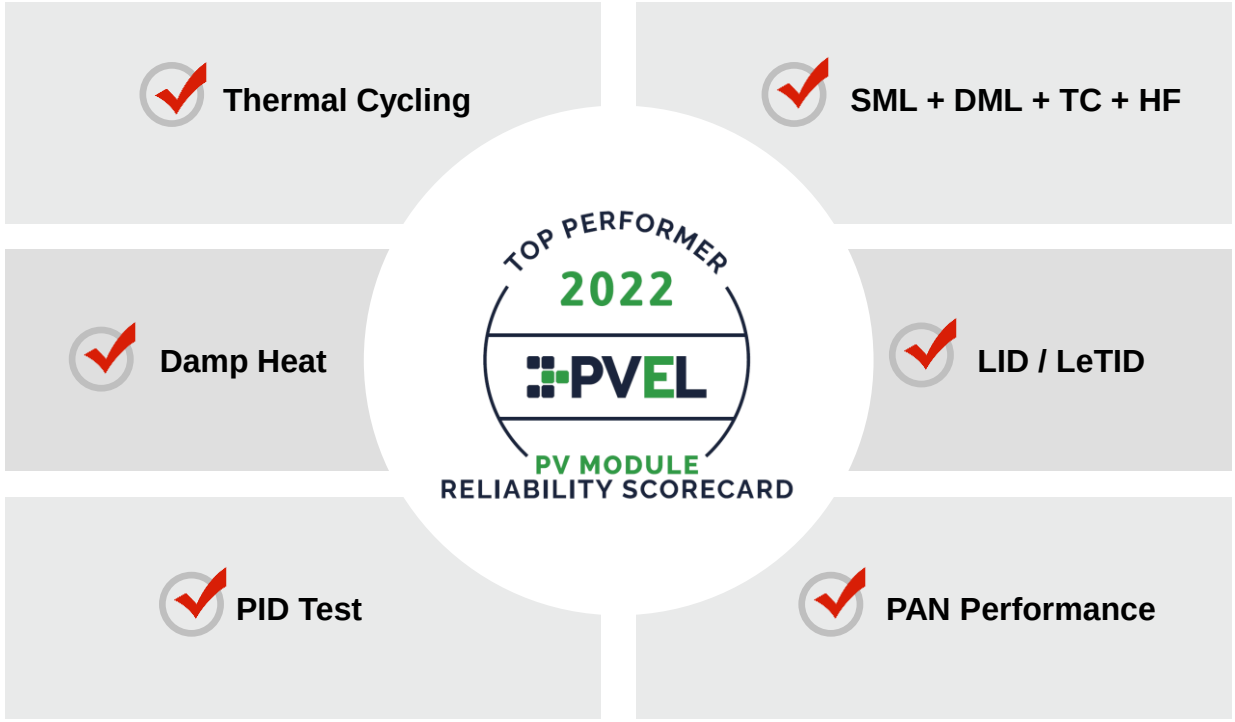
The Third-party Evaluation of Product Quality & Performance

Top Performer in PVEL's PV Module Reliability Scorecard 6 Times (2017 - 2022)

Achieving Top Performer in all 6 test programs (2022)

PVEL's PV Module Reliability Scorecard provides the industry with an important reference vis-a-vis long-term reliability and performance data. The 2022 PVEL Product Qualification Program (PQP) test comprised of six elements, including 600 cycles thermal cycling, 2,000 hours of damp heat, mechanical stress sequencing, 192 hours of potential-induced degradation, LID+LeTID and Panfile (representing power generation capability).

In 2022, LONGi's models was named a Top Performer in all six testing categories.



The Third-party Evaluation of Product Quality & Performance

Then Which Technology will be the future ‘Best Practice’?

26.81%
LONGi HJT silicon solar cell Efficiency
(November, 2022)

26.56%
LONGi P-type HJT Solar Cell Efficency
(December, 2022)

26.50%
LONGi HJT Solar Cell Efficiency
(June, 2022)

26.09%
LONGi Indium-free HJT
Solar Cell Efficiency
(December, 2022)

25.21%
LONGi N-type TOPCon
Solar Cell Efficiency
(June, 2021)

25.19%
LONGi P-type TOPCon
Solar Cell Efficiency
(July, 2021)

24.06%
LONGi P-type PERC
Solar Cell Front Efficiency
(January, 2019)

Ranked first in TÜV Rheinland
Power generation simulation: 2017, 2018, 2021, 2022
Outdoor empirical: 2019, 2020, 2021

All Quality Matters
TÜVRheinland

TOP PERFORMER
in PV Module Reliability Scorecard
2017-2022

TOP PERFORMER 2022 PVEL PV MODULE RELIABILITY SCORECARD

HIGH ACHIEVER
in PV Module Index
2019, 2020, 2021

2019 PV Module Index HIGH ACHIEVER LONGi Solar RETC

PV MODULE INDEX REPORT 2022 HIGH ACHIEVER RETC

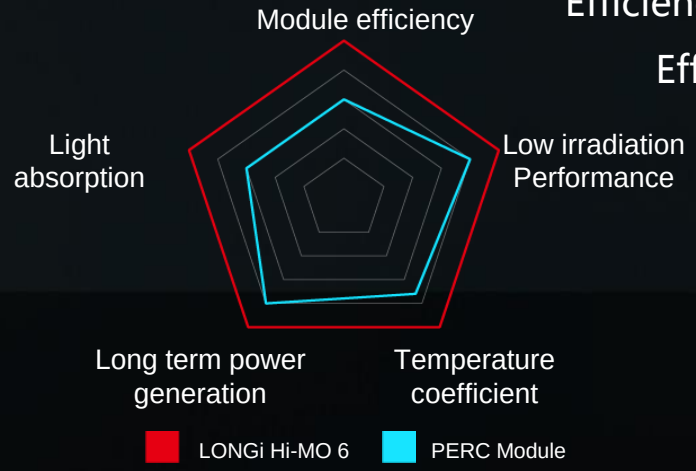
Highest Power Generation
PV Magazine Test
Since June 2018

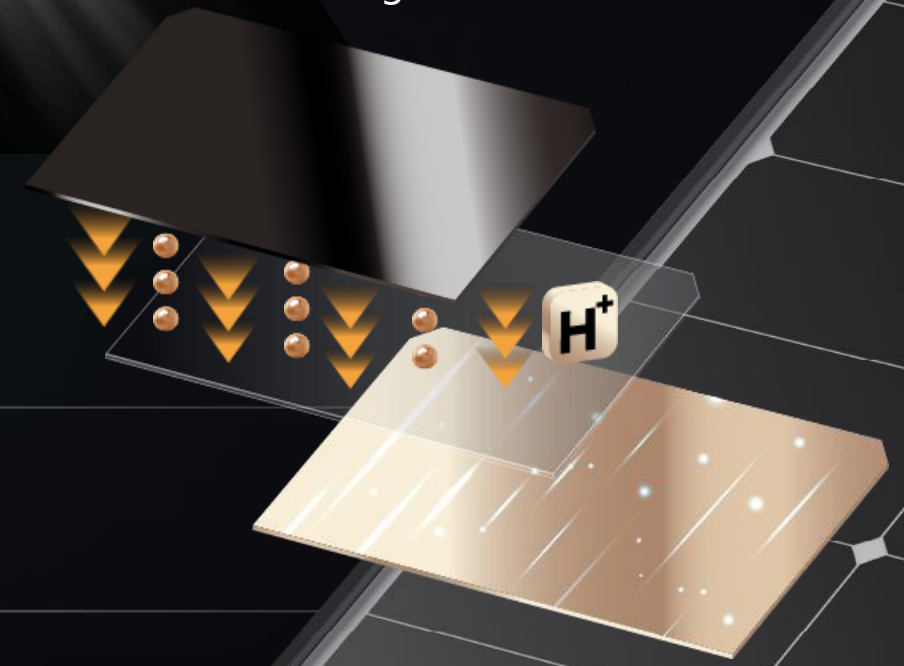
VERY GOOD pv magazine test MODULE

Keep Product Innovation，Towards Terawatt Era

Efficiency of conventional **HPBC cells** exceeds 25%

Efficiency of PRO version **HPBC cells** break through 25.3%





Light absorption

Multi-layer anti-reflection film and absence of front grid increase light absorption

Light absorption

Photoelectric conversion

Multi layer passivation reduces impurity recombination and improves photoelectric conversion efficiency

Photoelectric conversion

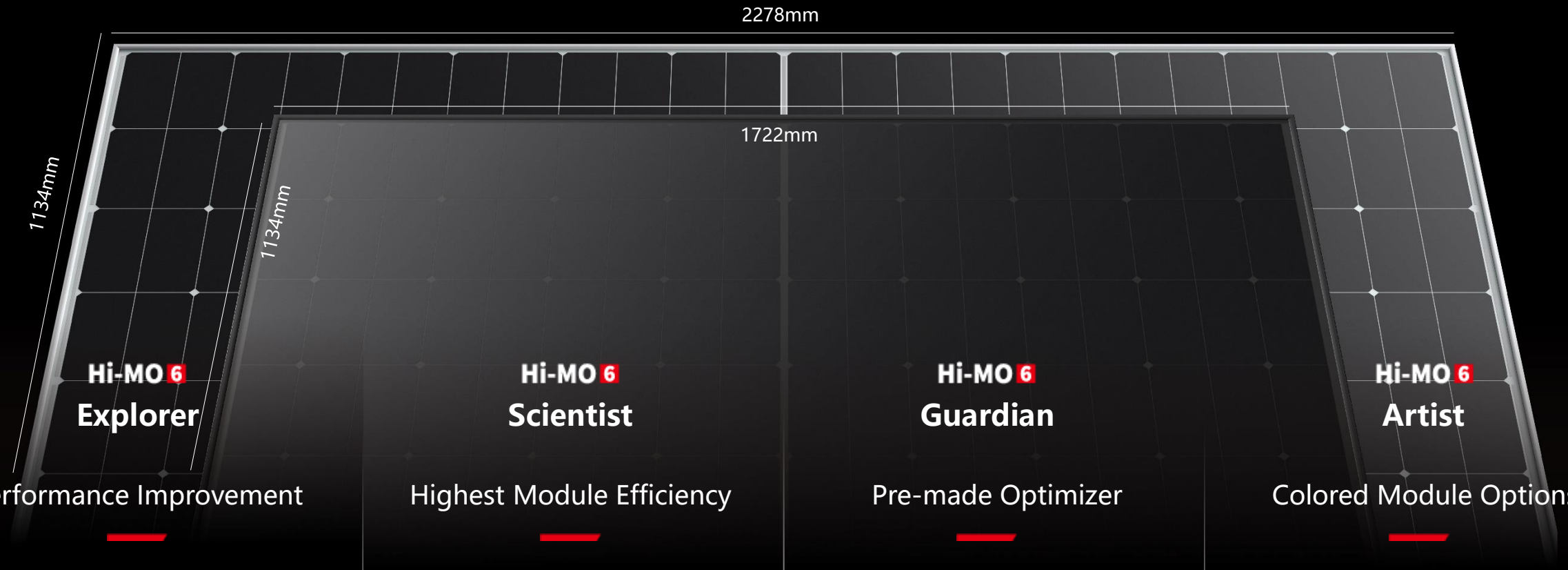
Electric transmission

Innovative all-back welding technology stabilizes the current transmission

Electric transmission

Hi-MO 6 Product Family

Four product series，all adhering to the 182mm standard



Hi-MO 6 Explorer

Performance Improvement

HPBC

Hi-MO 6 Scientist

Highest Module Efficiency

HPBC PRO

Hi-MO 6 Guardian

Pre-made Optimizer

HPBC
+
optimizer

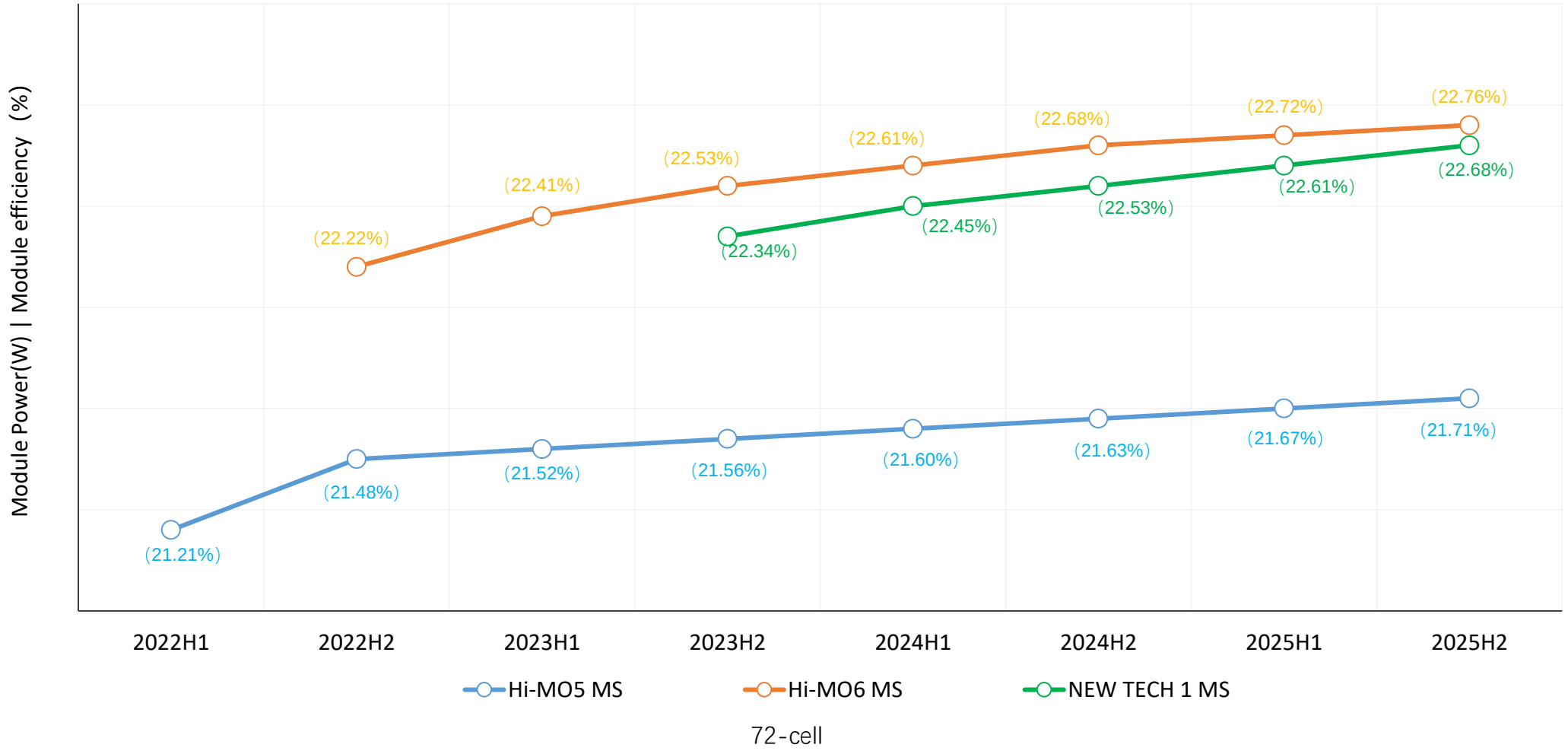
Hi-MO 6 Artist

Colored Module Options

HPBC
+
Colored design

*All series including 72 cells，66 cells，60 cells，54 cells，etc.

2022-2025 Module Power Roadmap



Dr. SHEN,PEIJUN
Europe Sr. Product Marketing Manager
LONGi Solar Technology Co., Ltd.
Add.: Germany
Email: peijunshen@longi.com

- **https://en.longi-solar.com**
-

this webinar is powered by GoodWe

pv magazine webinars

Utility scale solutions and progress in market trends with string inverters

7 March 2023

2:00 pm – 3:30 pm | GMT, London
3:00 pm – 4:30 pm | CET, Berlin, Madrid, Paris
4:00 pm – 5:30 pm | EET, Athens

Marjia Maisch
Editor
pv magazine

Mark Hutchins
Editor
pv magazine

David Sánchez
Sales Director EMEA – Utility & Large Scale
GoodWe

GOODWE | GOODWEEK 2023

Intelligent Solution of Utility Scale Station

Academy@goodwe.com

Community.goodwe.com

GoodWe Solar Community

DEEP IN SOLAR

01

Company Introduction

GOODWE

GOODWE FAMILY

4000+
Number of Employees

800+
R&D Staff

150+
Oversees Employees

München, Deutschland
HQ EMEA

Suzhou, China
HQ

About GoodWe

GOODWE
Smart Energy Innovator

Vision:

Driving the world's smart energy future

Mission:

We are determined to be the main driving force in the global energy transition, create a sustainable future for earth, for mankind, and for future generations.

11%
R&D investment (Q1,2022)

The Best Employer of Greater Suzhou for 5 consecutive years

US LEED Gold Level Green Building
Also the highest Green Building Standard in China

GoodWe is a leading, strategically-thinking enterprise which focuses on research and manufacturing of inverter-centric renewable energy solution products

GLOBAL PRESENCE

Branches

Hong Kong (China), Australia, Germany, United Kingdom, Belgium, Japan, United States, South Korea

Sales & Service Centers

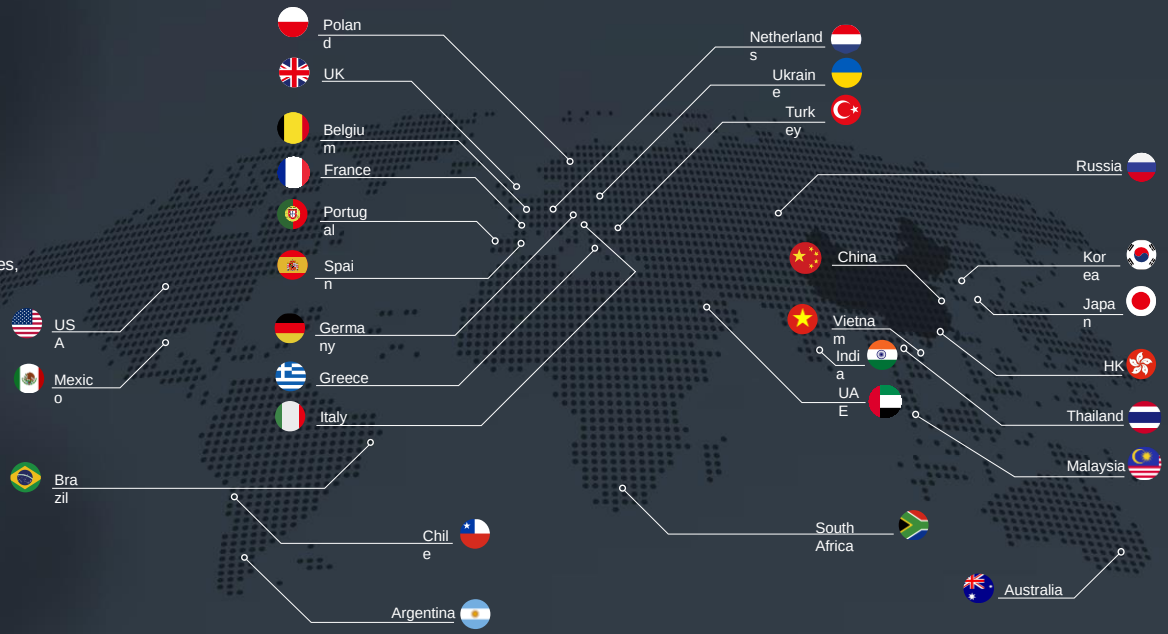
Australia, United Kingdom, Netherlands, Germany, Mexico, Brazil, Poland, Spain, Italy, South Africa, Chile, Argentina, Portugal, Greece, India, Turkey, Japan, Ukraine, United States, Vietnam, Thailand, Malaysia, Russia, UAE, France

R&D Centers

Suzhou R&D center,Shenzhen R&D center

Production Facilities

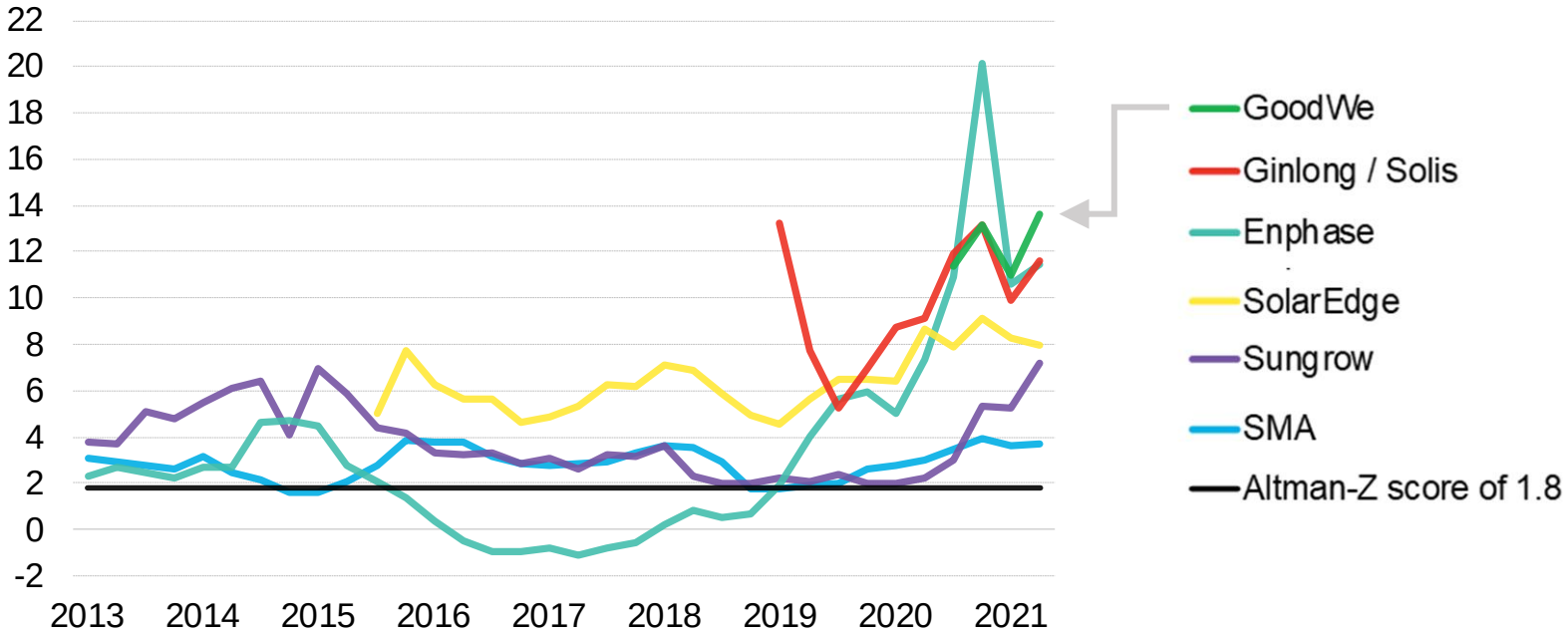
Suzhou Manufacturing base
Guangde Manufacturing base



MOST BANKABLE INVERTER BRAND 2021

Source: Bloomberg Terminal, Bloomberg NEF

Altman-Z scores of selected pure-play publicly listed inverter manufacturers



GOODWE´S HIGH QUALITY RECOGNITION

2018
Reddot Design

2017-2021
EuPD Top Brand for 5 Consecutive Years
(AU & NL & PL & ES & PK & RSA & BR & VN)

2015-2020
The Sole
Inverter Brand to Have Won the Award for
6 Consecutive Years

2019
World's No.1 Hybrid
Storage Inverter Supplier

2019
PV Magazine Award

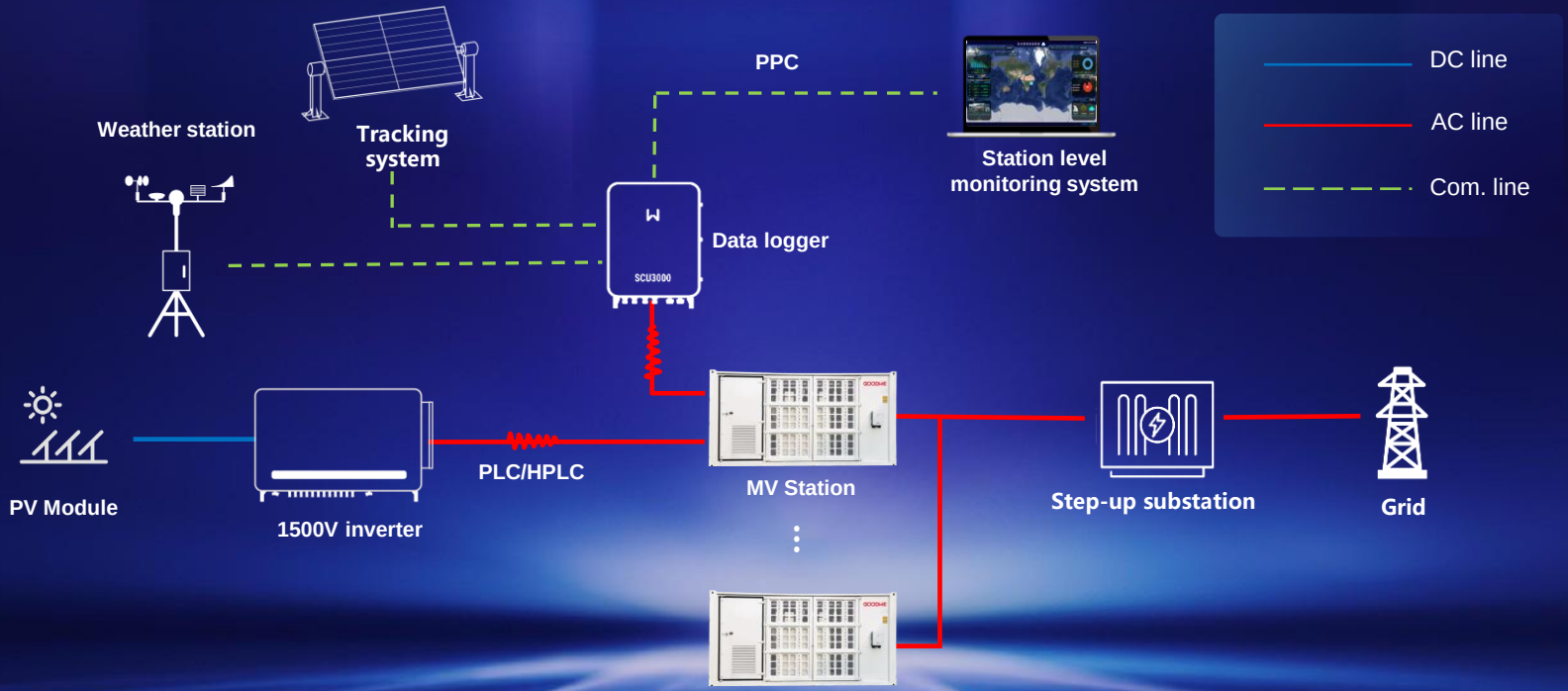
2021
EH Series 5kW No.2
ET Series 10kW No.5

2021
The Most Financially
Stable Inverter Company

02

Solution Introduction

Overall Solution



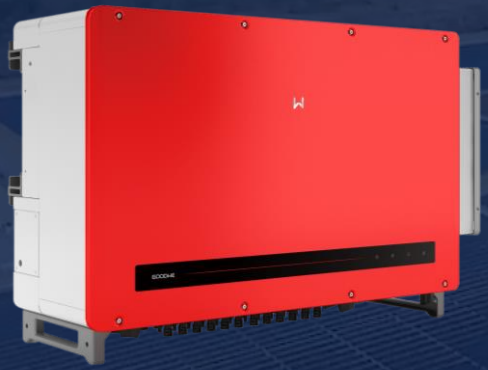
LCOE in Utility-Scale PV Systems

Inverters accounts ~5% of the system cost but have the largest impact on the overall BOQ, Labor and Yield

$$LCOE = \frac{CAPEX + OPEX^{*}}{EOH^{*}} \left[\frac{\$}{MWh}\right]$$

- LCOE: Levelized Cost of Electricity
- CAPEX: Capital Expenditure
- OPEX: Operating Expenses
- EOH: Equivalent Operating Hours (Yield)

  * at Net Present Value



HT Series 250kW

15/12 MPPTs

15/20A per string

DC Input Current
15A/20A

PLC

PLC communication

Support 400mm²
Diameter AC Cable

Type II SPD
Integrated

IV

IV Scan & Diagnosis

String Current
monitoring

98.5%

European
Efficiency

IP66 & C5

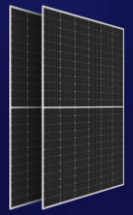
IP66 Overall Protection
C5 for option

PID Solution

PID recovery, Anti PID

Compatible with 182 & 210mm PV module

GOODWE



182mm module

~ 14A Input current

GW250K-HT

Max. 15A

210mm module

~ 18.5A Input current
~ 20 A Input current with bifacial gain

GW250KN-HT

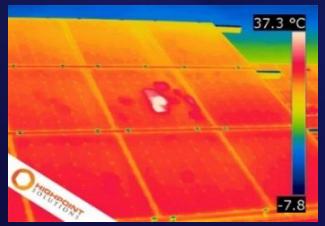
Max. 20A

Product Feature - Intelligent DC Switch

GW250KN-HT

- Fuse-less design
- Intelligent break and arc extinction
- Directly controlled by DSP

Multi-MPPT Design Minimizing Bifacial Mismatch



Hot Spot

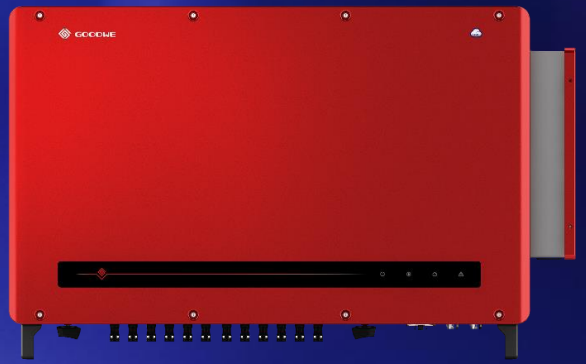

Different tilt and azimuth


Breakage


Dust

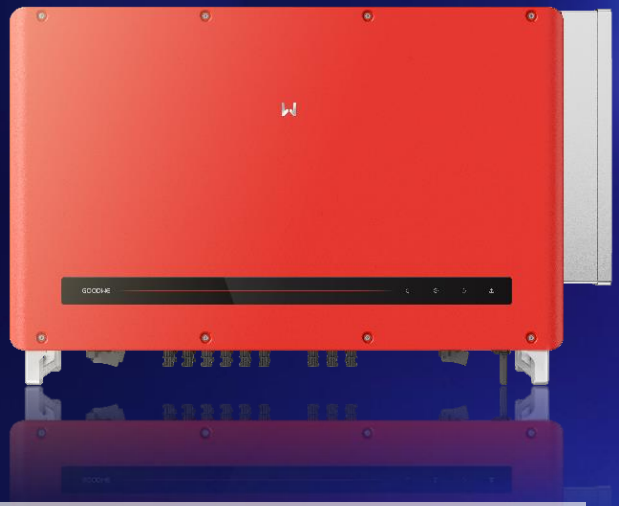

Module Mismatch


Shadow

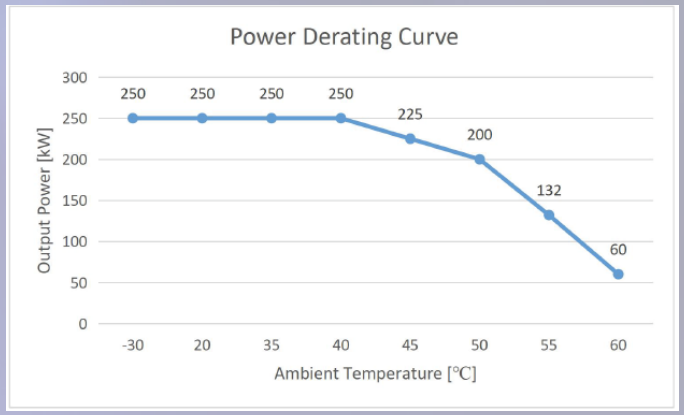


Up 12 MPPT´s allow HT PV Inverters to reduce significatlly mismatch losses of the DC PV Array. Especially critical when using bifacial modules.

Advanced Thermal Design

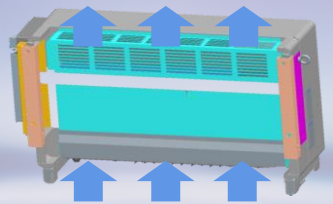


Full power generation up to 40°C



Superior thermal design allowing:

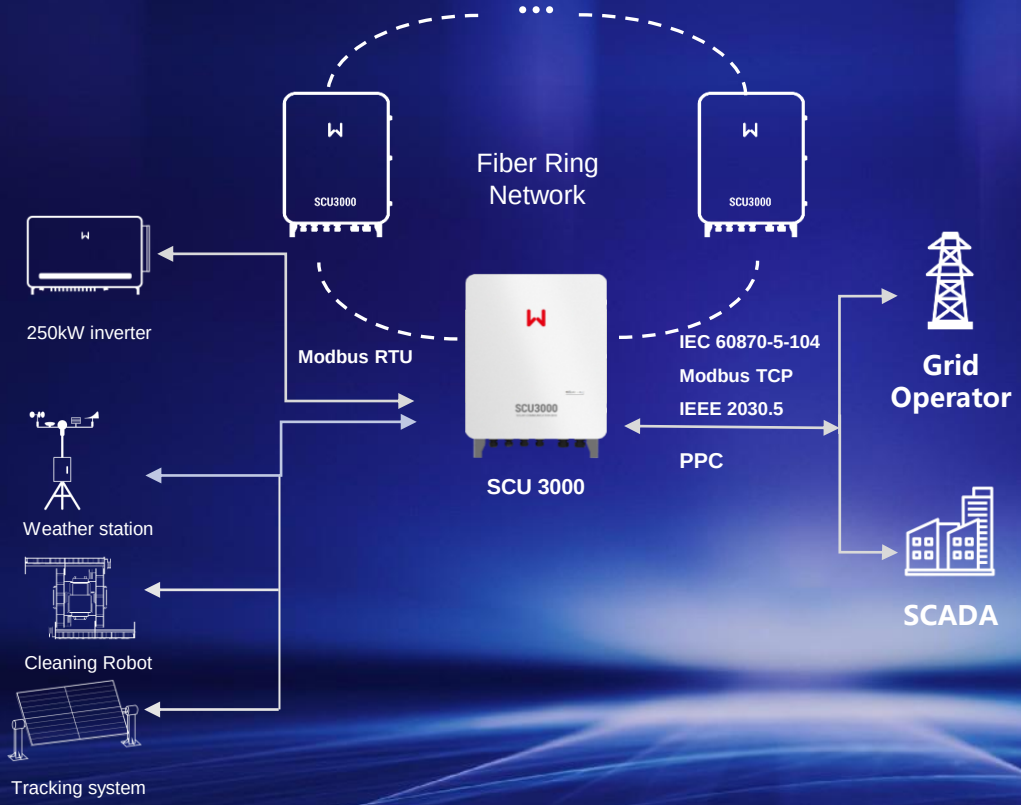
- Higher power generation
- Longer lifespan



Optimized heat dissipation path

Set of 6 replaceable fans (NMB, IP68)

Overall Solution - Communications



Compatibility

-More protocols

-More I/O Ports

8 DI, 4DO, 8 AI, PT100/PT1000

Fast Communication

- HPLC
- Reactive power 30ms
- Active power 80ms

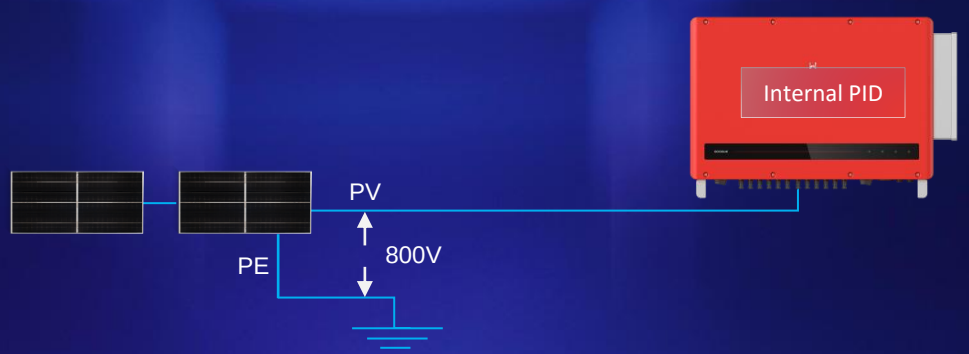
Reliable & Safe

- Optical fiber ring redundancy
- Vertical encryption

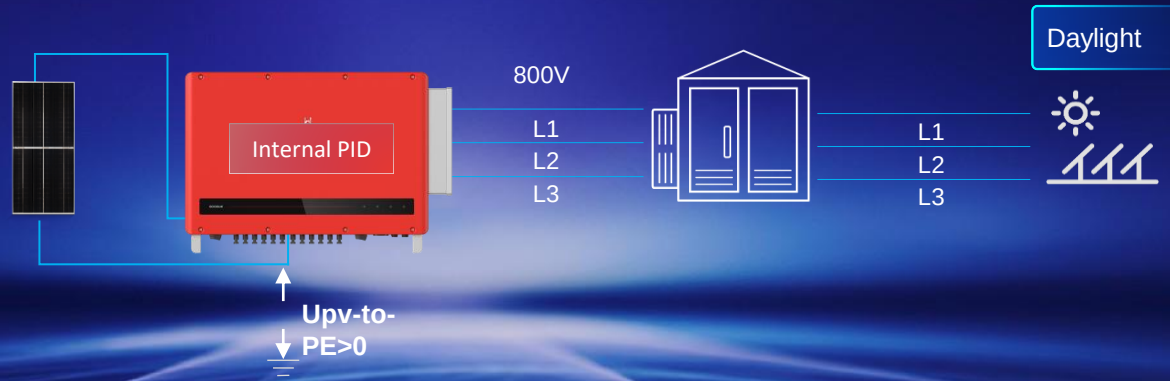
PID Solution

GOODWE

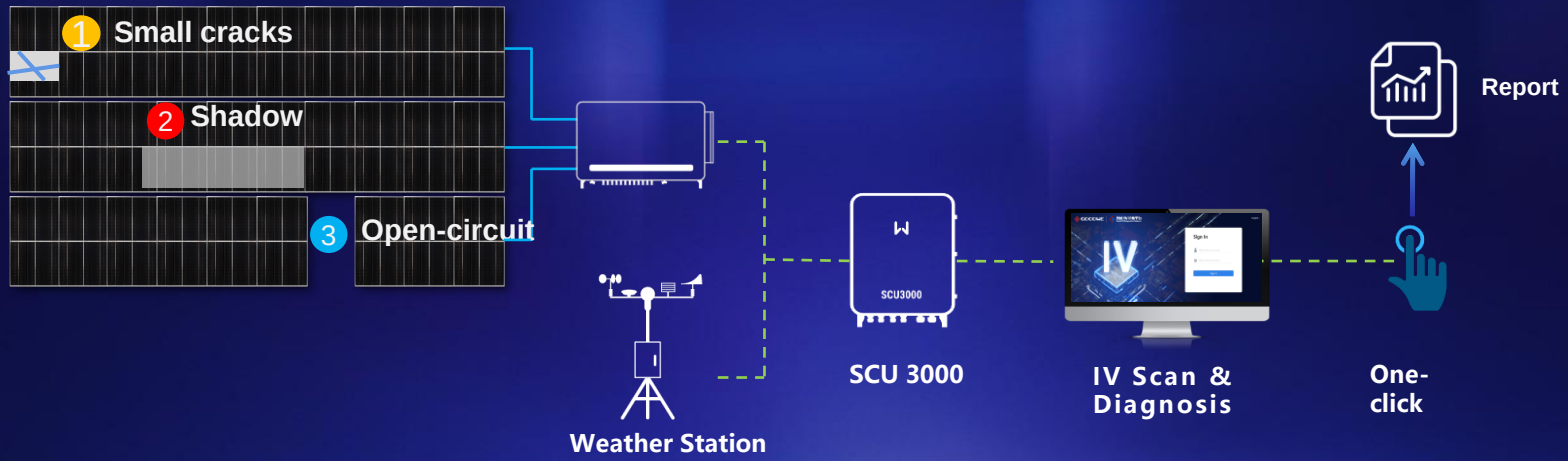
PID recovery



Anti-PID



IV scan & diagnosis



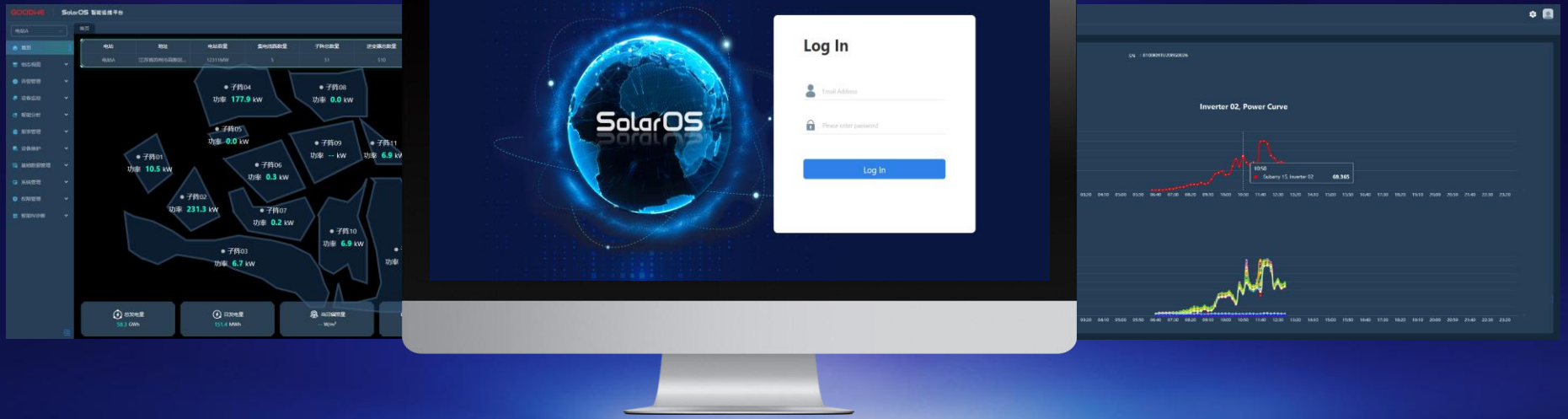
Intelligent

- Failure detection
- Station/sub-array/inverter level diagnosis
- Visualize data

High efficiency

- Diagnosis by one-click
- Diagnostic time less than 10min for 10 MW station
- Diagnostic time less than 30min for 100 MW station

SolarOS station level monitoring system



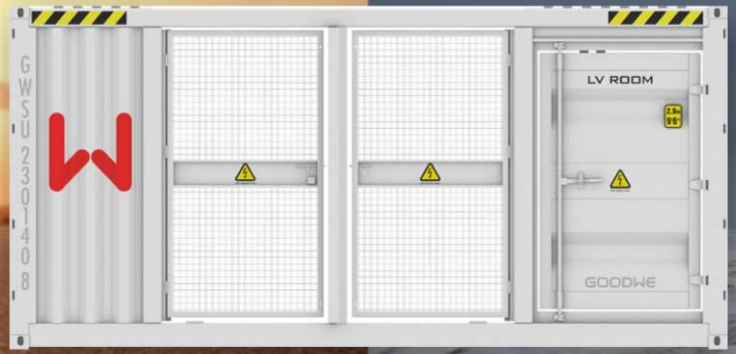
- Digital operation and maintenance
- View visualization
- EOH analysis (Equivalent Operating Hour)
- IV scan and diagnosis
- Customized report
- One-click upgrade

Overall Design of The MV Station

1. *Up to 40.5kV*
2. *Up to 7000kVA*
3. *Double split or double secondary winding*
4. *CVC ring main unit*
5. *Standard 20 ft container design*
6. *Quick installation and convenient transportation*
7. *The LV and MV rooms are IP54 and the transformer is designed for outdoor use*
8. *Peak Efficiency Index (PEI) > 99.58%*

Large Capacity | **Compact Structure** | **Convenient Shipment** | **Comply with IEC 60076, IEC 62271-200**

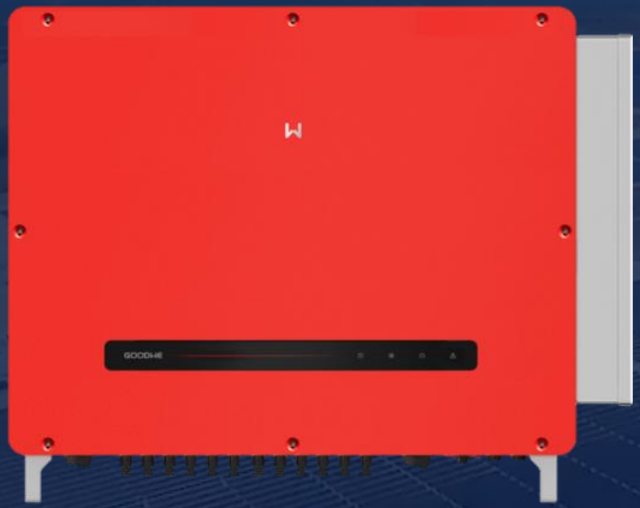
Great performances ensure stability and safety



Can withstand Wind load 1720Pa
Working temperature -30-60℃

IEC 60076

EN 50708



UT Series 350kW

15/12 MPPTs

15/20A per string

DC Input Current
15A/20A

SVG

Reactive power
compensation

Support 400mm²
Diameter AC Cable

Type II SPD
Integrated

IV

IV Scan & Diagnosis

HPLC

Faster
communication

98.8%

European
Efficiency

IP66 & C5

IP66 Overall Protection
C5 for option

PID recovery
& Anti PID

Two functions can coexist

GOODWE | GOODWEEK 2023

THANK YOU

Academy@goodwe.com Community.goodwe.com @GoodWeSolarAcademy

GoodWe Solar Community

DEEP IN SOLAR

this webinar is powered by GoodWe

pv magazine webinars

Utility-scale PV and string inverter market trends

Panel Discussion

7 March 2023

2:00 pm – 3:30 pm | GMT, London
3:00 pm – 4:30 pm | CET, Berlin, Madrid, Paris
4:00 pm – 5:30 pm | EET, Athens

Marjia Maisch
Editor
pv magazine

Mark Hutchins
Editor
pv magazine

Alvaro Zanón
Technical Director EMEA – Utility & Large Scale
GoodWe

Felix Jetter
Team Leader
Power Plant Engineering
BayWa

Alberto Campayo
Head of Operations
Prosolia Energy

Nitish Sinha
Project Engineer and Inverter specialist
Ecorus

this webinar is powered by GoodWe

pv magazine webinars

7 March 2023

2:00 pm – 3:30 pm | GMT, London
3:00 pm – 4:30 pm | CET, Berlin, Madrid, Paris
4:00 pm – 5:30 pm | EET, Athens

Utility-scale PV and string inverter market trends

Q&A

Marjia Maisch
Editor
pv magazine

Mark Hutchins
Editor
pv magazine

pv magazine webinars

The latest news | print & online

10% off your subscription with **Webinars10**

Most-read online!

New thermal battery offers fast, efficient performance at low cost

by Marija Maisch

Viessmann unveils ground-source heat pump for space, water heating

by Beatriz Santos

pv magazine webinars

Coming up next...

Tuesday, 14 March 2023
8:00 am – 9:00 am PDT, Los Angeles
4:00 pm - 5:00 pm CET, Berlin

How energy storage buyers can mitigate upstream supply chain risk

Thursday, 16 March 2023
1:00 pm – 2:00 pm GMT, London
2:00 pm – 3:00 pm CET, Berlin

Quantifying early-stage project development costs & constraints

Many more to come!

In the next weeks, we will continuously add further webinars with innovative partners and the latest topics.

Check out our pv magazine Webinar program at:

www.pv-magazine.com/webinars

Registration, downloads & recordings are also be found there.

this webinar is powered by GoodWe

pv magazine webinars

Marjia Maisch
Editor
pv magazine

Mark Hutchins
Editor
pv magazine

Thank you for joining today!