

An aerial photograph of a solar farm. The image shows several long, parallel rows of solar panels installed on a dirt ground. The panels are dark blue with a white grid pattern. In the lower-left quadrant, a group of about five workers wearing high-visibility yellow vests and hard hats are gathered around a section of the panels, possibly performing maintenance or installation. The background shows a mix of green grass and brown soil. A large, semi-transparent red shape is overlaid on the bottom-left corner of the image.

Your Solar Partner for Life

SHARP Energy Solutions Europe

www.sharp.eu

SHARP
Be Original.

Get the SHARP benefits

#1: Longest experience

- Leverage the industry's longest-standing experience.

#2: Financial stability

- Secure your customer's investment.

#3: Innovative power

- Be ahead of your competition with advanced products.

#4: Best guarantees

- Start the guarantee period with the handover to the end customer.

#5: Strong product portfolio

- Open up every market segment to generate new business.

#6: Proven quality

- Provide reliable products which passed the hardest tests.

#7: Highest performance

- Achieve ROIs quickly.

#8: Reliable Service & Support

- Contact us and we will be happy to assist.

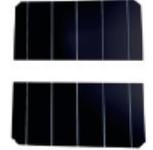
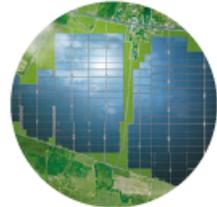
Benefit #1: Longest experience

Leverage the industry's longest-standing experience



SHARP has been in the PV business longer than competitors

60 Years of Solar Expertise



1912
Foundation
of SHARP

1953
Mass prod
of TVs

1959
Dev of solar
cells begins

1970
Start producing
space-use PV cells

1976
First calculators
with solar cells

2000
World leading
PV manufacturer

2018
48 cell:
Back-Contact: 20%

2020
Half-cut cell
introduction

Based on decades of expertise we focus on proven technology and long-term reliability.

PV competitors
starting from 1997

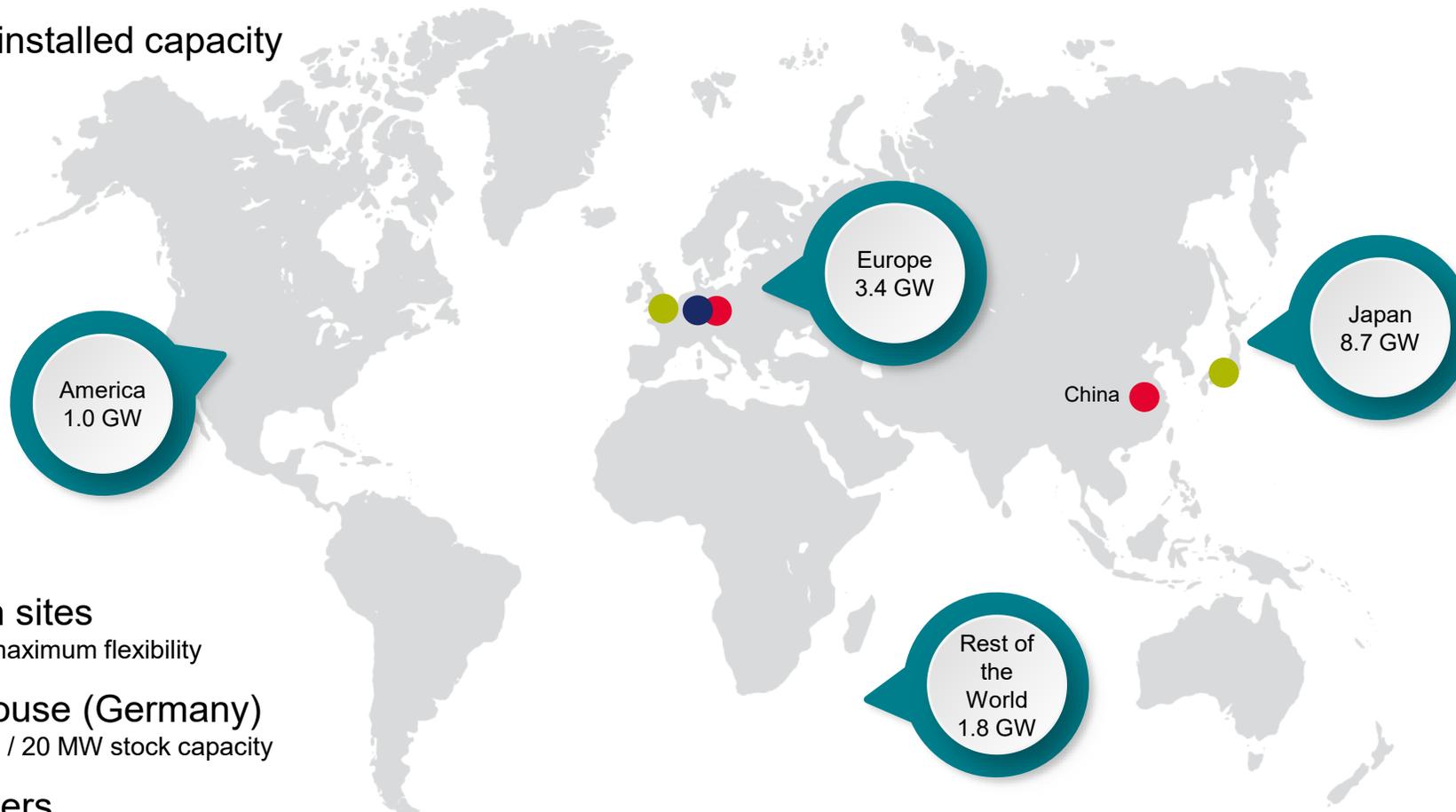
- 1997 Trina
- 1999 Qcells
- 2000 Longi
- 2001 Aleo, Heckert, Canadian
- 2003 Winaico
- 2005 Ja Solar
- 2006 Jinko, Bisol, Astronergy
- 2010 LG, Talesun
- 2011 Brukbet
- 2012 Selfa

PV companies gone out of business in the past:
Bosch, Sovello, Schüco, Solon, Solarworld, Sunways, BP, Shell, Siemens, Schott Solar, Siliken, etc.



Our track record speaks for itself

- Over 1 million satisfied customers worldwide
- 14.9 GW installed capacity



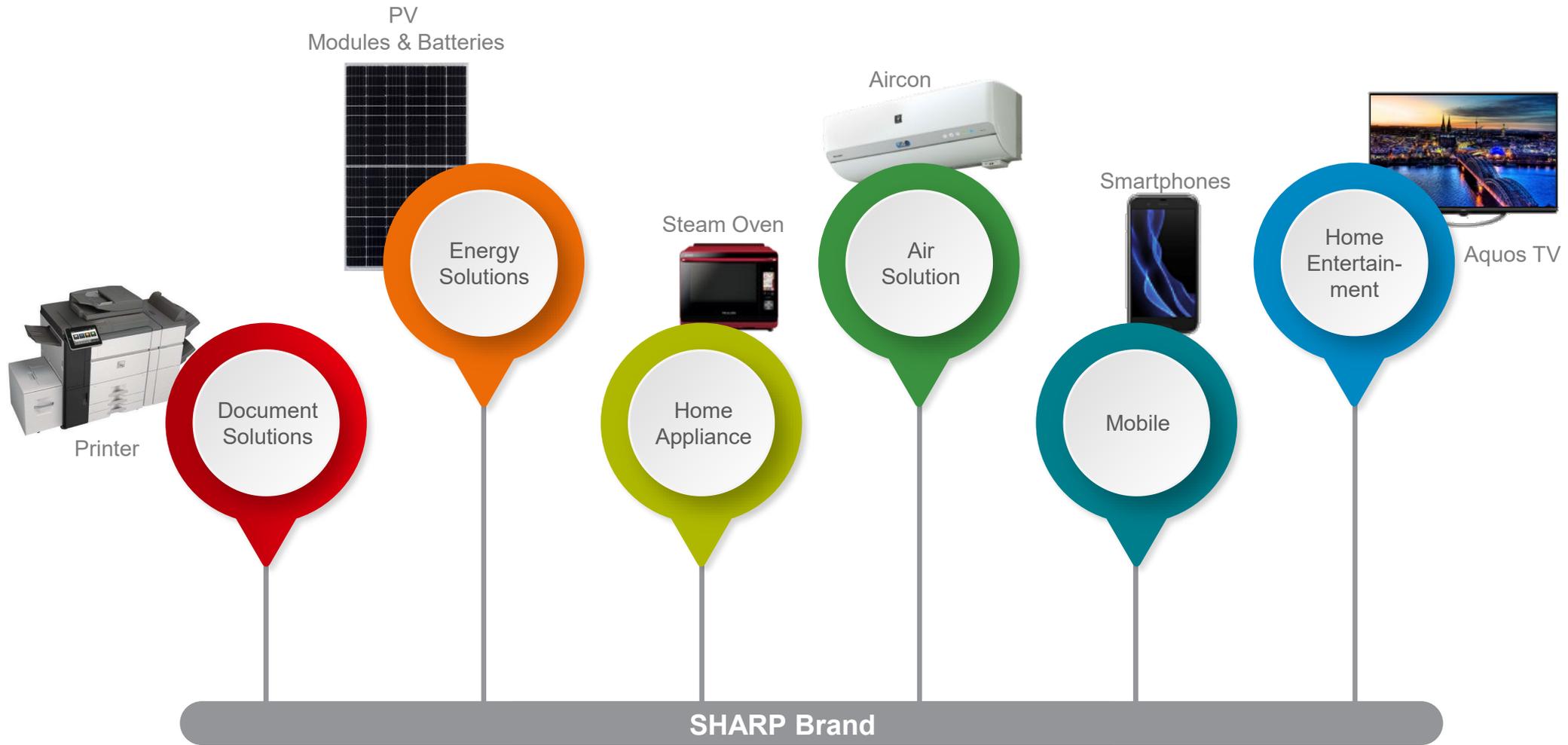
- Production sites worldwide for maximum flexibility
- EU warehouse (Germany) for fast delivery / 20 MW stock capacity
- Headquarters
European headquarters are in London, the corporate headquarters are in Osaka

Benefit #2: Financial Stability

Secure your customer's
investment



Benefit from a globally known and popular consumer brand

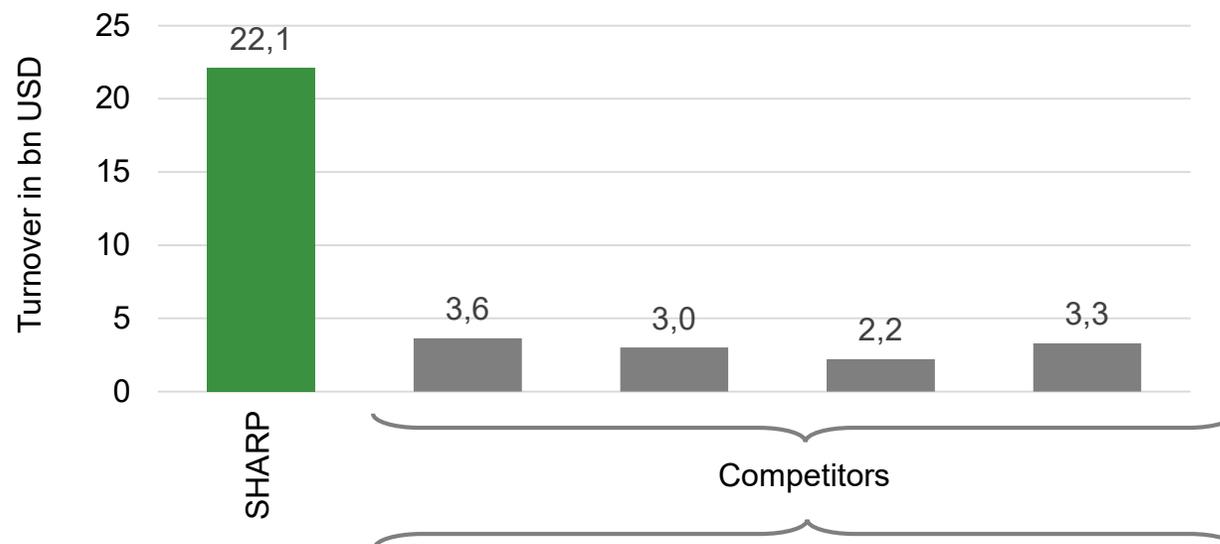


Our solar business is part of a large corporation with a strong financial backbone

- Global electronics company, no pure PV player
- Risk diversification through various business segments
- 21.4 bn USD net sales (FY 2018)
- Strategic investment in SHARP by Foxconn in 2016
- Successful realignment: SHARP is profitable



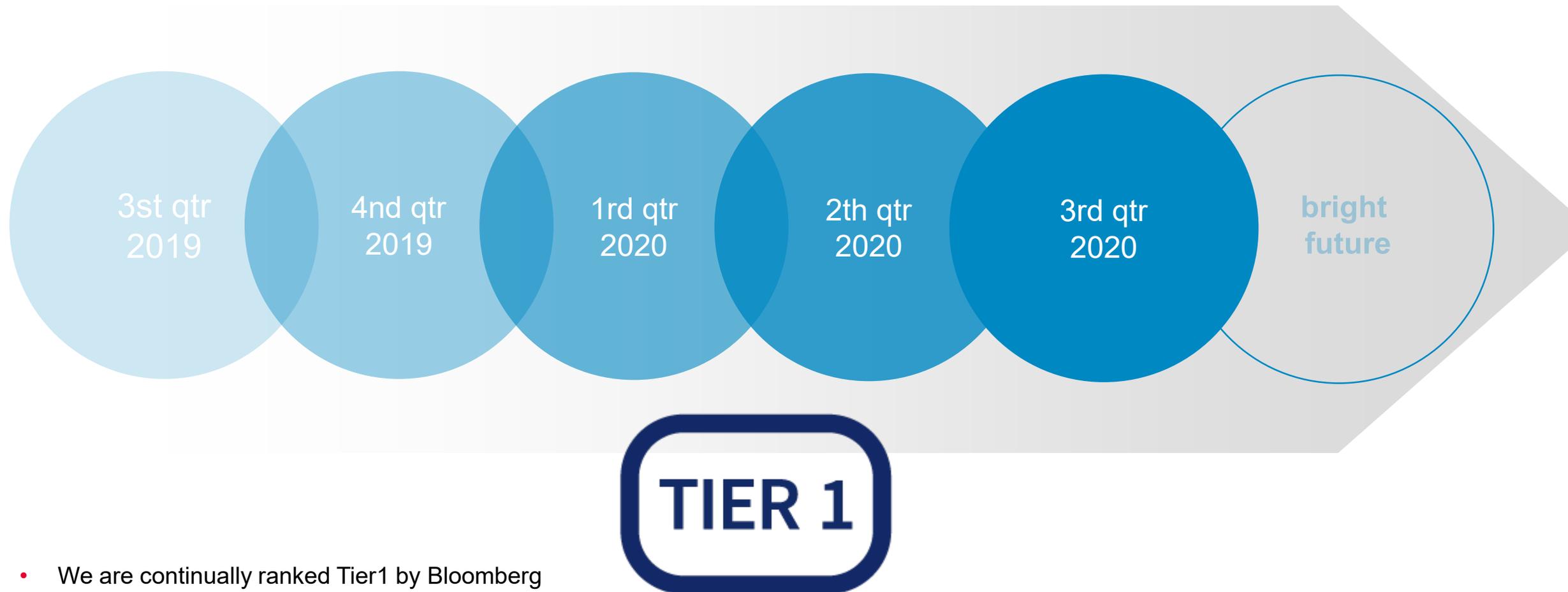
Net sales comparison with pure PV companies in 2018



	SHARP	A	B	C	D
Tier 1 BNEF	YES	YES	YES	YES	YES
Consumer brand	YES	NO	NO	NO	NO
Financial stability	YES	Limited	Limited	Limited	Limited
EU full scale operation	YES	Limited<10	YES	YES	Limited<10
EU service	YES	Limited	YES	YES	NO
EU guarantee	YES	YES	YES	YES	NO
EU solar history	>20yrs	<7yrs	<7yrs	<11yrs	<4yrs

Tier 1: We are fully bankable

We are a reliable partner



- We are continually ranked Tier1 by Bloomberg
- This means we are a stable company and non recourse financing SHARP solar projects is no issue

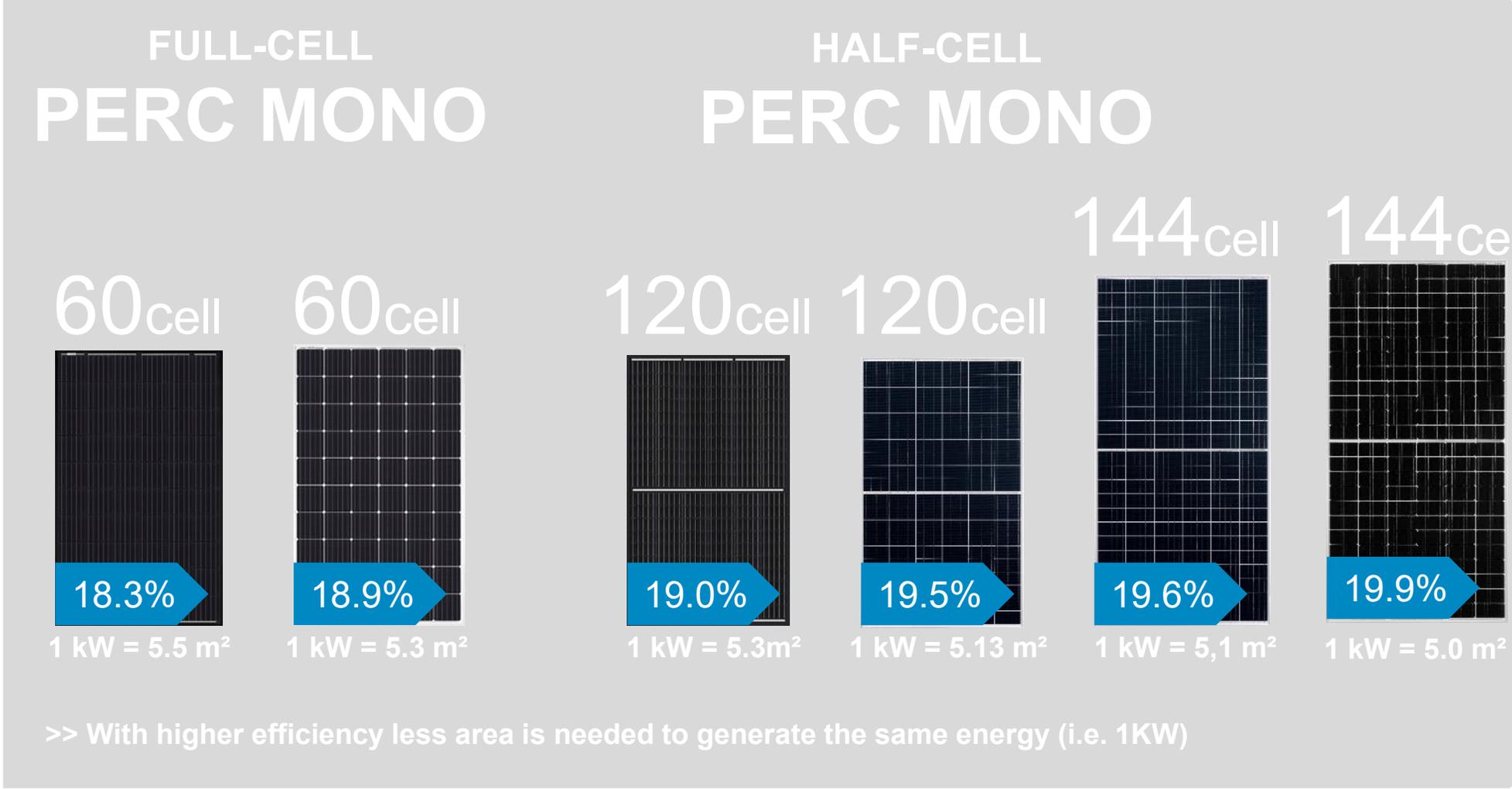
Benefit #3: Innovative Power

Be ahead of the competition with
advanced products



We cover all applications

Our portfolio offers the efficiency that suits your needs



>> With higher efficiency less area is needed to generate the same energy (i.e. 1KW)

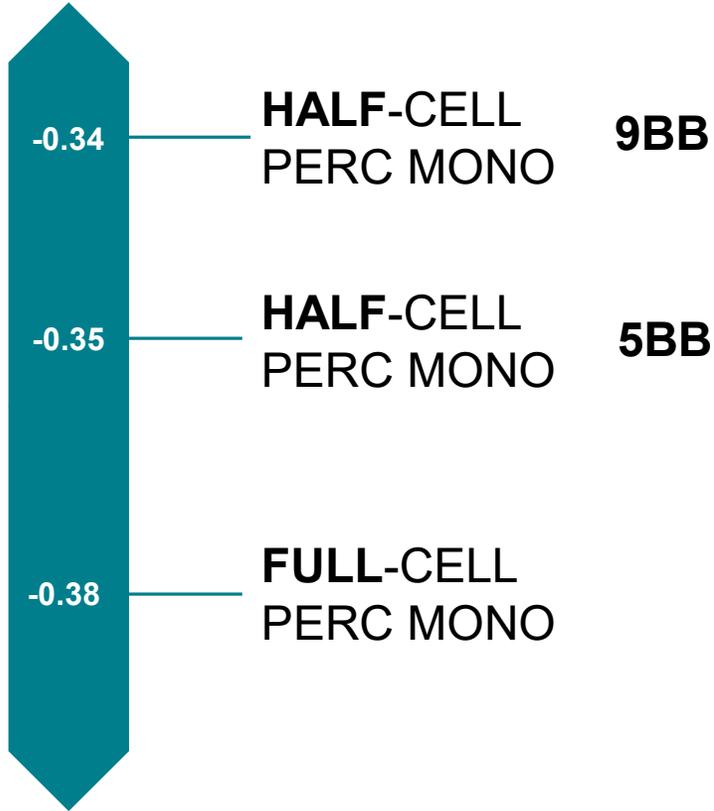
Our modules perform reliably

Ongoing improvement of temperature coefficients

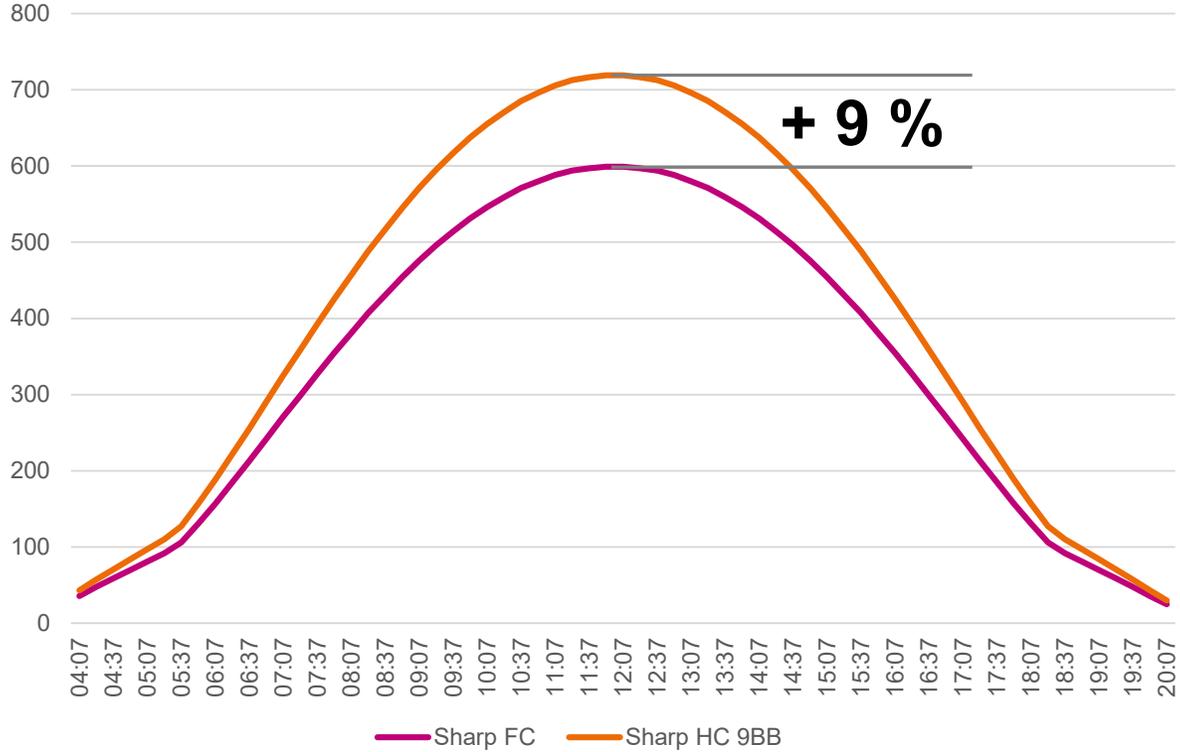
TEMPERATURE COEFFICIENT
%/°C

Our 144 HC modules with coefficient of just -0.34%/°C. That is 10 % better than a full-cell module

WEAKER NEGATIVE CORRELATION



HIGHER DAILY YIELD

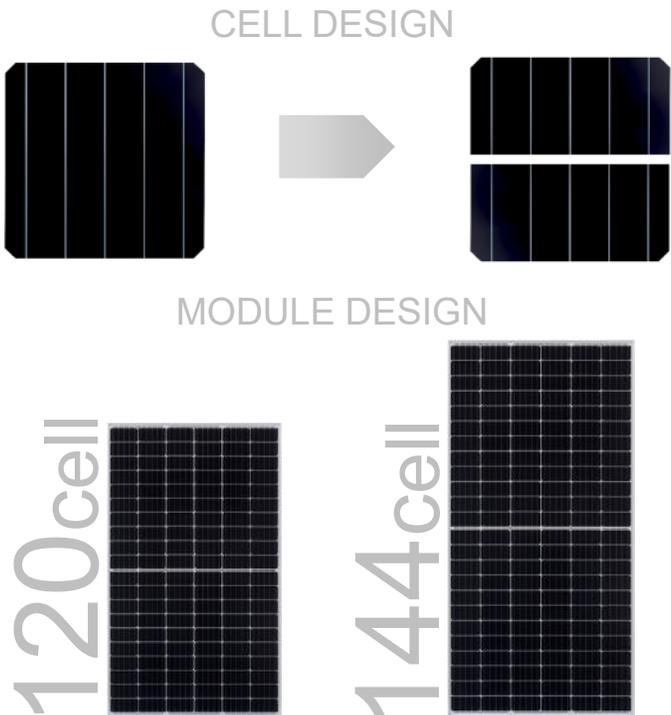


Half-cell modules | Differences

DIFFERENCE 1

The **cells are cut in half**, as a result:

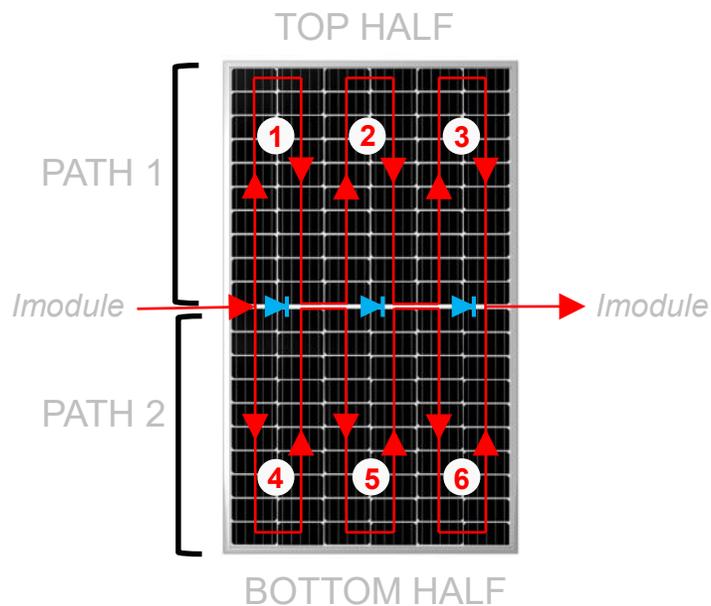
- 60 full-cell module → 120 half-cell module
- 72 full-cell module → 144 half-cell module



DIFFERENCE 2

Cell string design:

- Two module halves which are connected in parallel (like mirrored)
- 6 cell strings
- 2 current paths

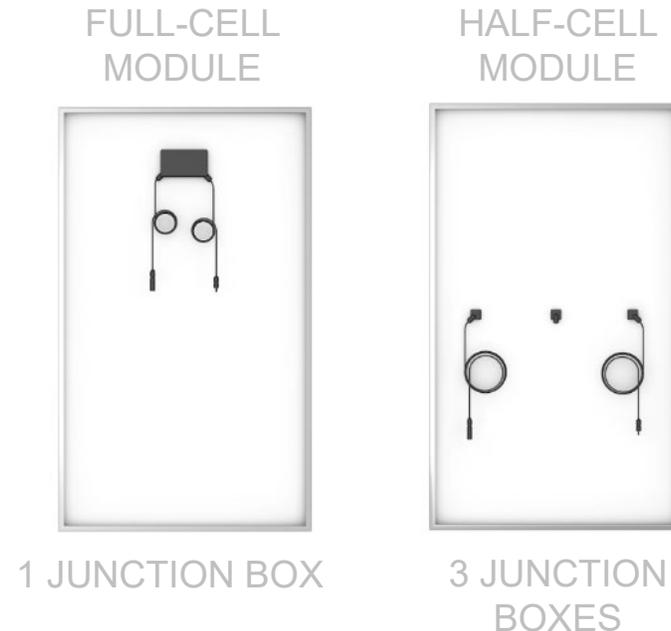


➤ Electrical parameters remain the same as for full cell modules. Thus, no changes in powerplant design needed!

DIFFERENCE 3

Decentralized junction boxes:

- Each junction box contains one bypass diode
- diodes bypassing one top and one bottom cell string

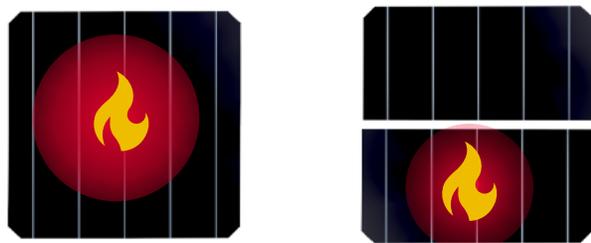


➤ better heat dissipation

Half-cell modules | Advantages

ADVANTAGE 1

Lower Hot Spot Risk



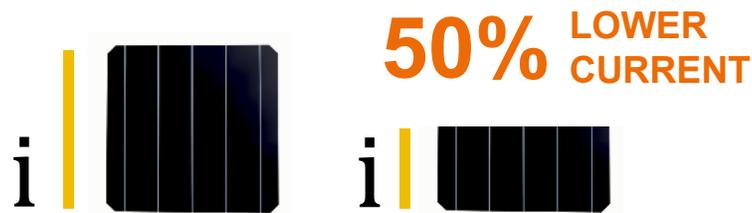
- In case of a hot spot, less power is dissipated on shaded cell >> less severe impact
- Hot spot temperature decreased by 10°C – 20°C compared to full cell



➤ Lower risk for system operation

ADVANTAGE 2

Lower Resistance Losses



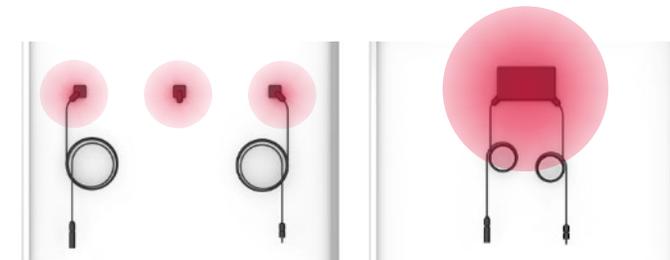
- Lower current
- Shorter busbars
- Because the current of half-cell is 50% that of a full-cell, the resistance losses are reduced to 25% compared to a full-cell.



➤ Higher yield, 3% or up 15 W more power

ADVANTAGE 3

Lower Temperature



- Lower cell temperature
- Decentralised junction boxes / each with one diode > better heat dissipation



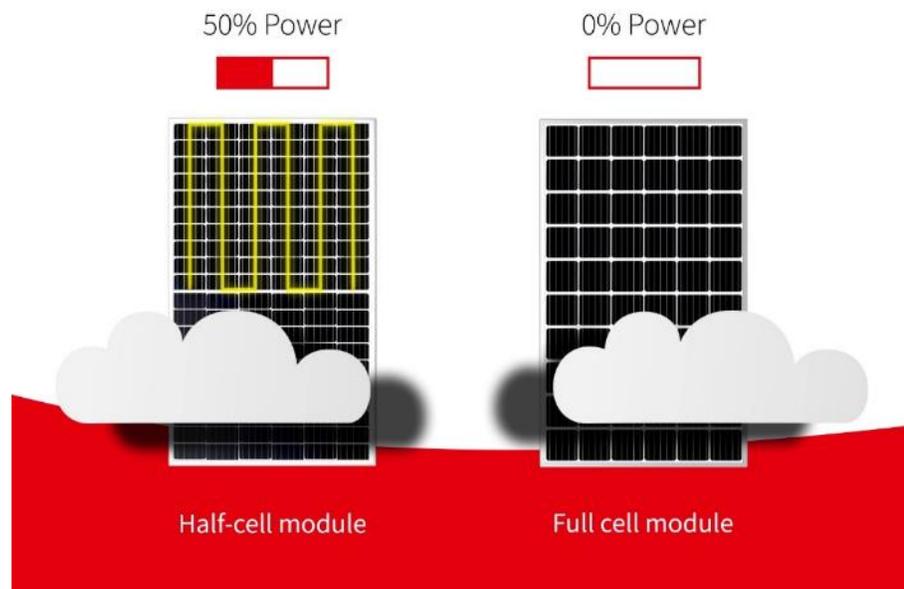
➤ Higher yield, faster ROI

Half-cell modules | Advantages

ADVANTAGE 4

Comparison full-cell vs half-cell module:

- When one half (top or bottom) of the module is shaded the other half can still generate energy because the cell strings on the other half are not affected.
- 50% power generation at sunrise and sunset mounted in portrait



INTER-ROW SHADING SCENARIO:
SUNRISE and SUNSET



➤ **Lower land lease cost**
Shorter row distance in free-field possible,
therefore less land required and more MW/ha

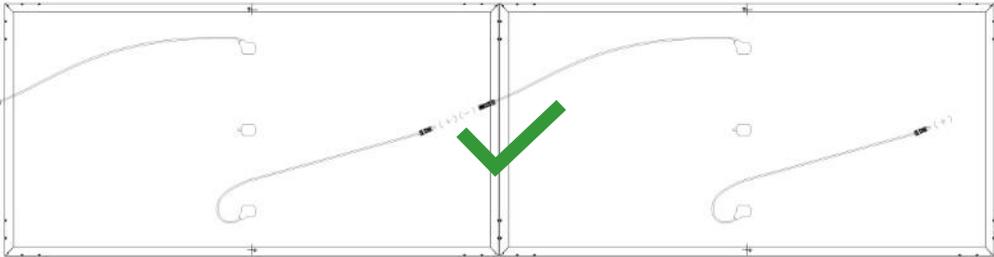


Half-cell modules | Cabling

All SHARP half-cell modules come with long enough cables for landscape installation

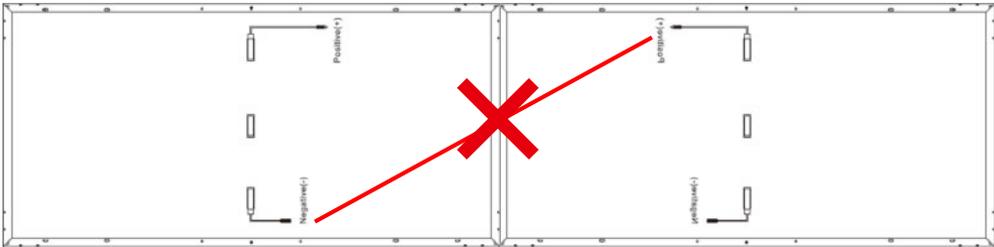
Landscape installation with SHARP:

The half-cell modules from SHARP are equipped with sufficient cable length for easy landscape installation



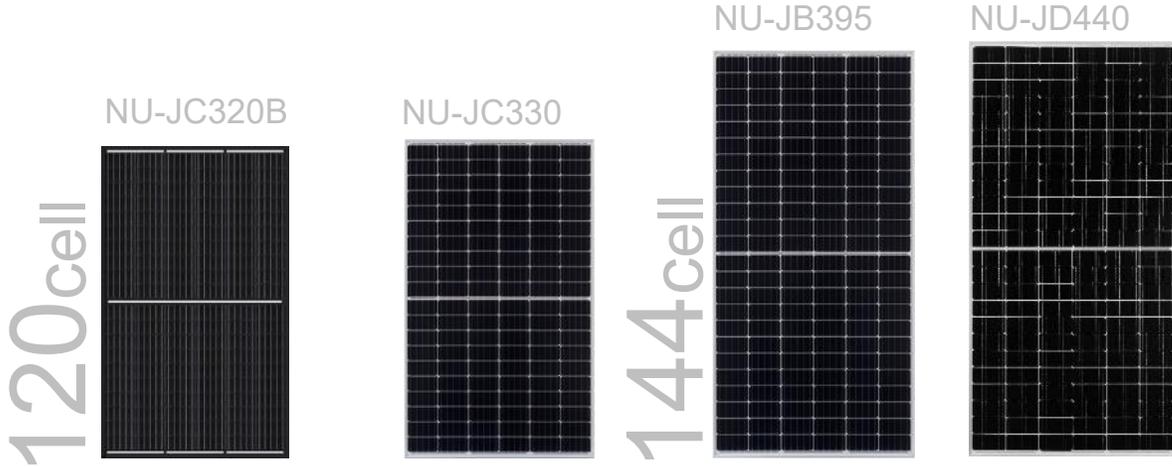
Landscape installation using modules from manufacturers who use shorter cables:

➤ Extension cable is needed



— Missing cable length

SHARP Half-cell modules	Standard cable length (can be shorter on request)
NU-JD440	1.7 m
NU-JB395	1.4 m
NU-JC330	1.2 m
NU-JC320B	1.2 m



➤ All our modules have long enough cables for landscape installation (also the full-cell modules)

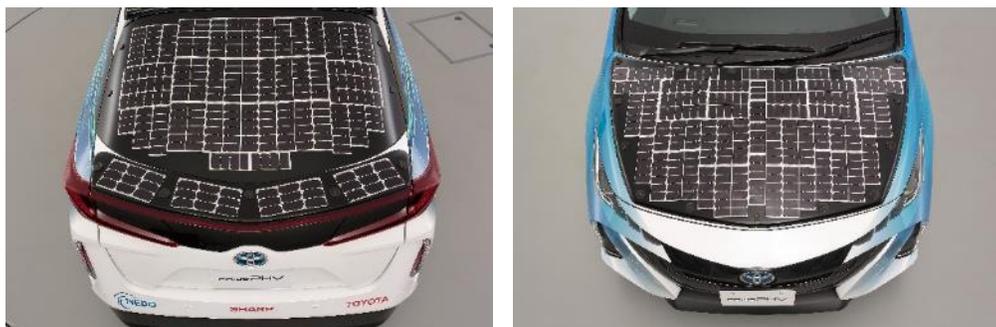


New applications for PV | Toyota collaboration

Solar powered Toyota Prius

About the collaboration:

- SHARP is collaborating with Toyota and NEDO (a national research and development organization) on developing a car that runs on solar power.
- SHARP's modularized high efficiency thin film modules (Triple-junction compound technology) are only 0.03mm thick and have a conversion efficiency of over 34 percent, generating approximately 860 W of power.
- The Prius' hood, roof and rear hatch door are equipped with the flexible and lightweight modules from SHARP.
- Read the Toyota press release:
<https://global.toyota/en/newsroom/corporate/28787347.html>



Triple-junction module:



SHARP
Be Original.

Benefit #4: Best Guarantees

Start the guarantee period with
the handover to the end-user



The SHARP guarantee for the EU

SHARP guarantee terms:

15 years product guarantee*

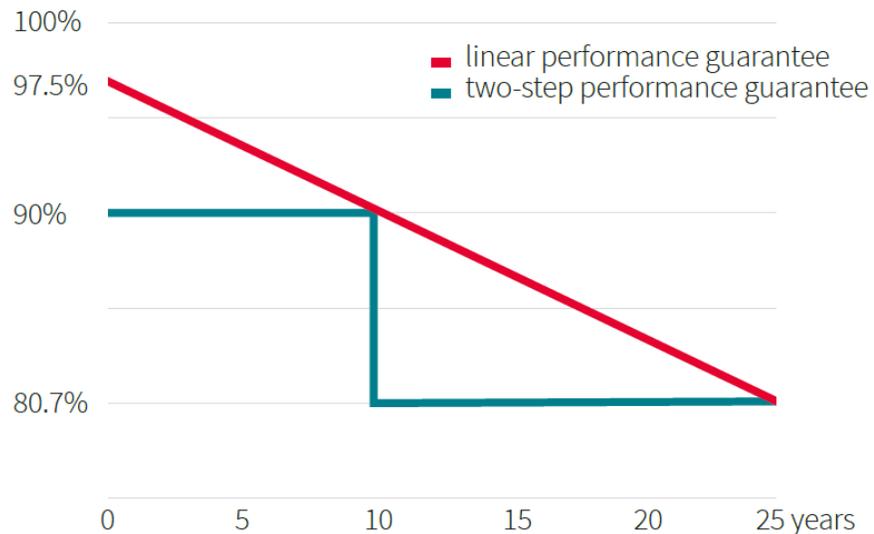
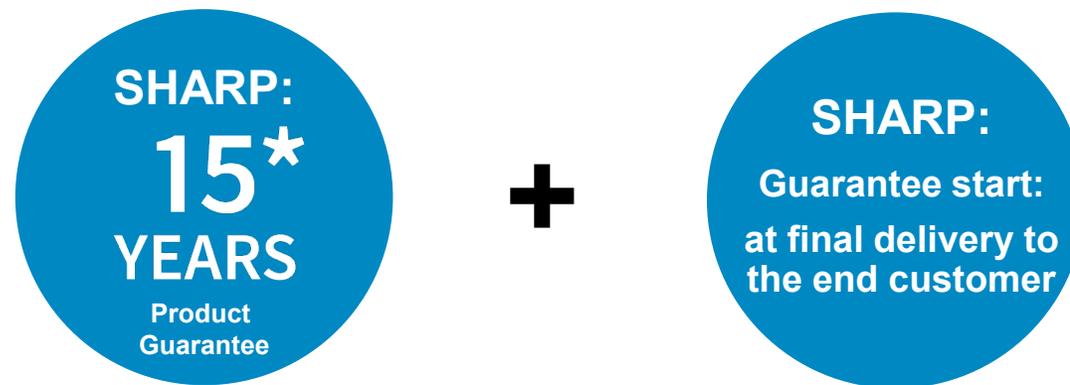
25 years linear power output guarantee

Place of Jurisdiction: Germany, governed by German law

Guarantor: SHARP Electronics GmbH

Service: Local support team in Europe, multi language

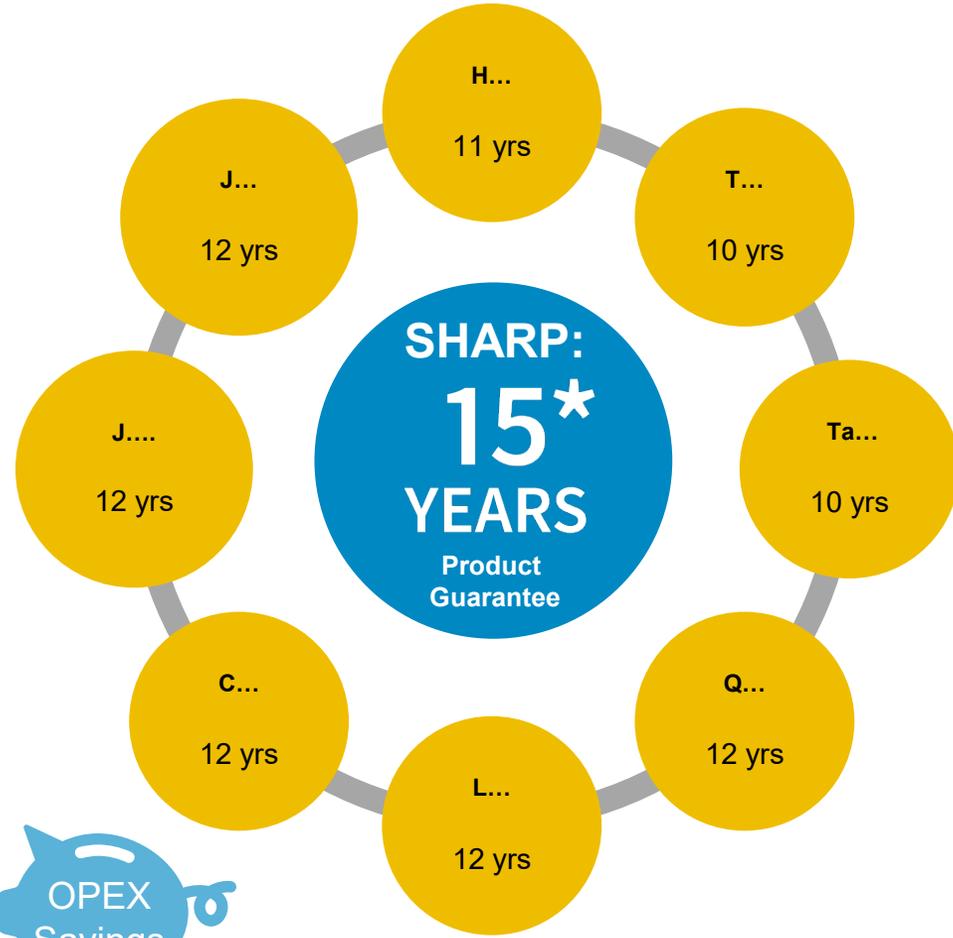
Global consumer brand guarantee for any product segment



*Applicable for NUJB, NUJC, NUAC and NUJD series installed within the EU and additional listed countries. Please check the guarantee conditions for your area before purchasing..

The SHARP guarantee stands up to the competition

Guarantee period:



Start of guarantee time:



Get more value with lower OPEX

*Applicable for NUJB, NUJC, NUAC and NUJD series installed within the EU and additional listed countries. Please check the guarantee conditions for your area before purchasing..

EU guarantee terms comparison

PERC MONO P type Monofacial & Poly Monofacial

Company	Product Guarantee (yrs)	Power output warranty (yrs)	Degradation over first year (%)	Effective date	Global consumer brand	Full scale EU rooted operation	Service location EU	Place of jurisdiction	Governed by
SHARP	15	25	2.5	Delivery to the final end customer	YES	EU Solar department gross: >30 EU total employees: >2000	Hamburg, Germany	Germany	German law
Q...	12	25	3.0	delivery to the final end customer	NO	<120	Thalheim, Germany	Germany	German law
T...	10	25	2.5	installation date or latest 90 days after delivery to the buyer	NO	<40	Switzerland	court at installation site	country law at installation site
C...	12	25	2.5	installation date or latest 90 days after delivery to the buyer	NO	<10	Munich, Germany	court at installation site	country law at installation site
J...	12	25	2.5	delivery date or latest 180 days after production	NO	<20	Unterschleissheim, Germany	not mention	country law at installation site
J...	12	30	3.0	sale to first buyer or latest after 6 months	NO	<10	no contact	agreed in sales contract	country law agreed in sales contract
L...	12	25	2.0	delivery date incoterms 2010 or latest after 6 months	NO	<10	unkown	agreed in sales contract	country law agreed in sales contract
R...	12	25	2.5	shipment to the buyer	NO	<10	Nürnberg, Germany	court at installation site	country law at installation site
R...	20	25	2.5	purchase of the final end customer	NO	<10	Munich, Germany	Germany	German law
T...	10	25	2.5	sale to the first buyer or 90 days after delivery to the buyer	NO	<10	Munich, Germany	not mentioned	not mentioned
G...	12	25	2.5	delivery date or 12 months after production	NO	<10	no contact	not mentioned	not mentioned

Better than SHARP

Worse than SHARP

Equal to SHARP

neutral

The competitor comparison was carried out in CW18 / 2020.

SHARP
Be Original.

The SHARP guarantee for MEA (Middle East / Africa)

Our **MEA** guarantee starts with the delivery to the first buyer

SHARP guarantee terms:

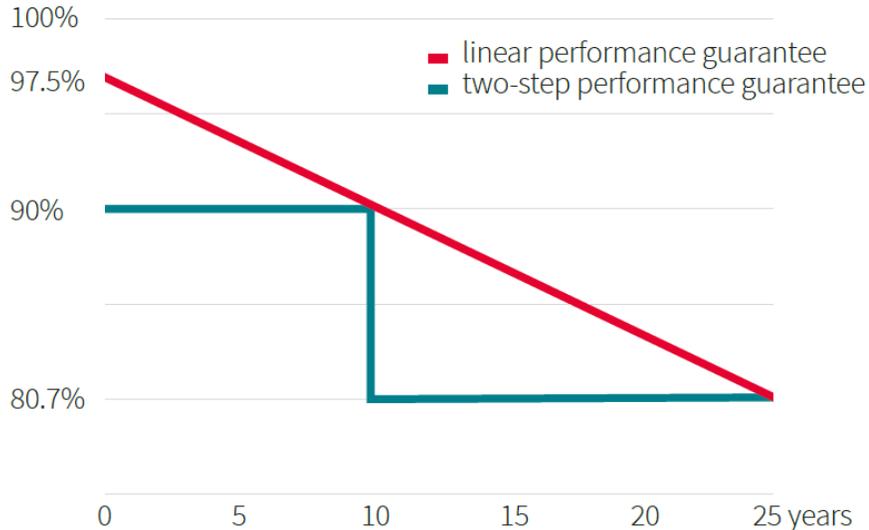
10 years product guarantee*

25 years linear power output guarantee

Place of Jurisdiction: Germany, governed by German law

Guarantor: SHARP Electronics GmbH

Service: Local support team in Europe, multi language



Compare the start of guarantee time:



*Applicable for NU and ND series installed within the countries of Africa and additional listed countries. Please check the guarantee conditions for your area before purchasing..

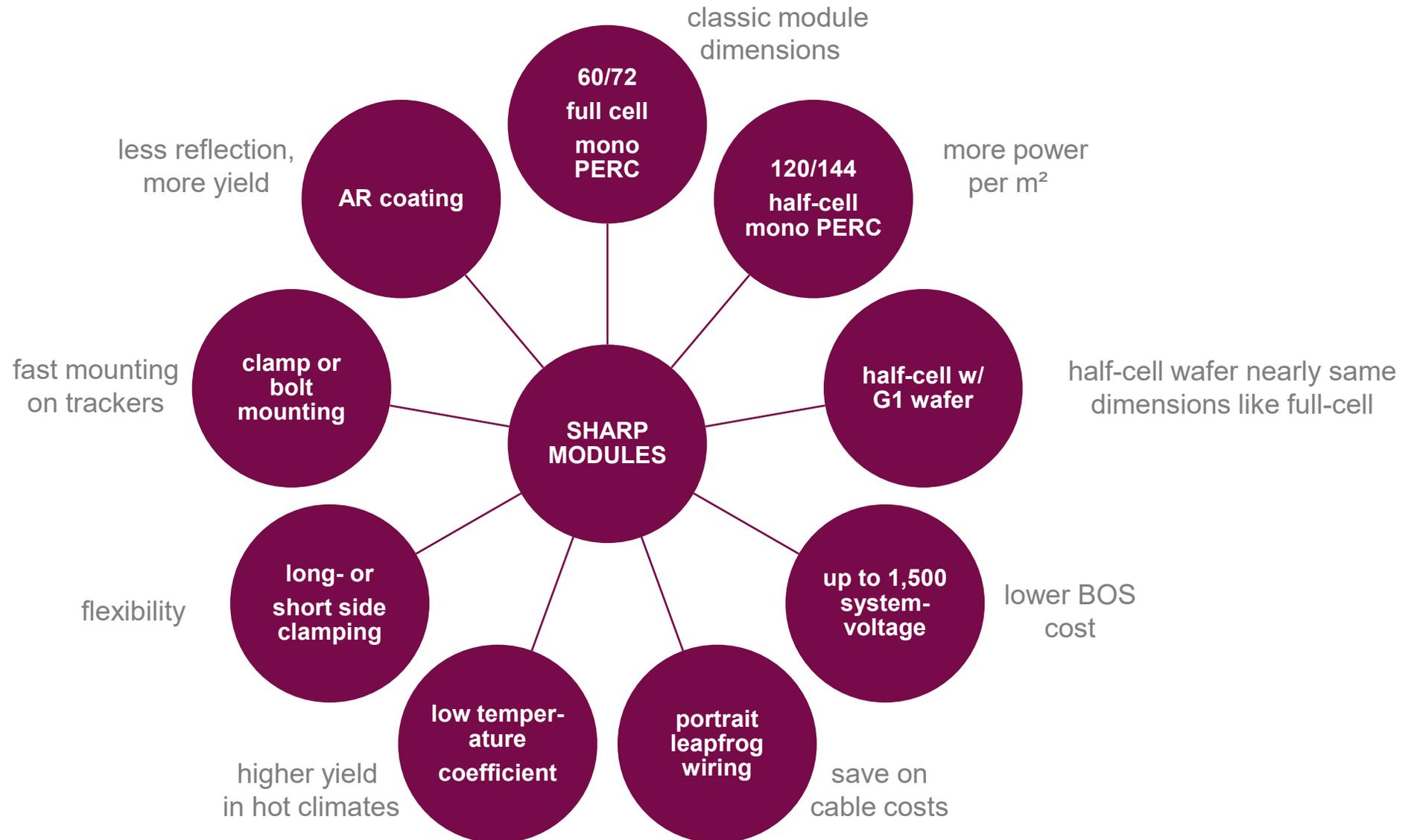
Benefit #5: Strong Portfolio

Open up every market segment
to generate new business



Our product line up has the best features

We have the right module for your needs

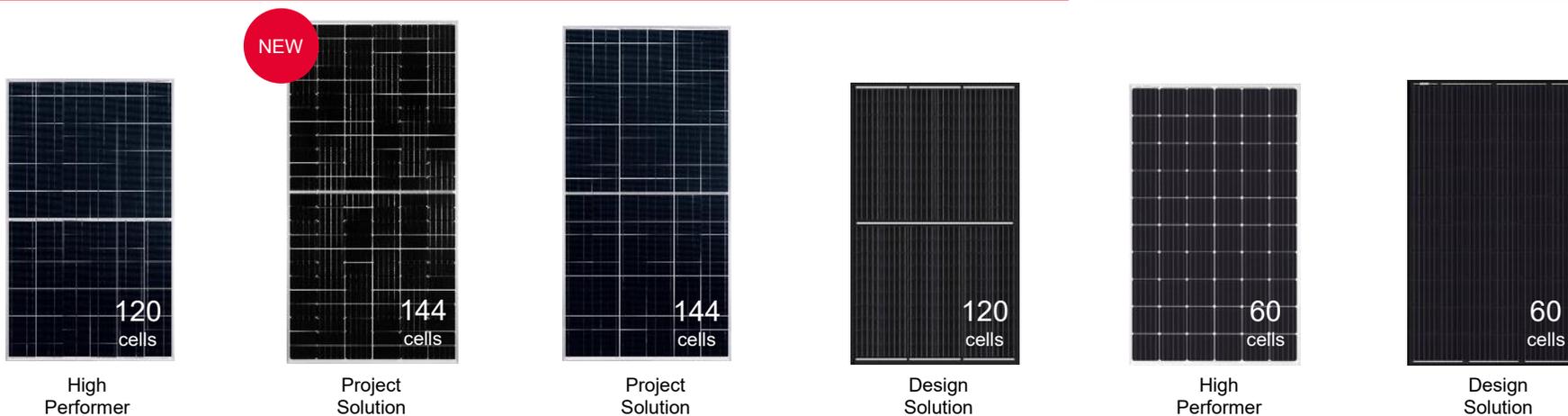


Large module range

Covering all applications

Half-Cell Modules

Full-Cell Modules



Half-cut cell technology

Half-cut cell 9 busbars

Half-cut cell technology

Half-cut cell technology

High 60 cell output

Stylish black roof

Output	330 W	440W	395 W	320 W	310 W	300 W
Type	NU-JC330	NU-JD440	NU-JB395	NU-JC320B	NU-AC310	NU-AC300B
Cells	PERC Mono	PERC Mono, M6	PERC Mono	PERC Mono	PERC Mono	PERC Mono
Module efficiency	19.5%	19.9%	19.6%	19%	18.9%	18.3%
System Voltage	1,000 V	1,500 V	1,500 V	1,000 V	1,000 V	1,000 V

LG Chem battery range

Covering all applications

Low Voltage

High Voltage



RESU6.5



RESU10



RESU7H
Type-R



RESU10H
Type-R

Total Energy (kWh)	6.5	9.8	7.0	9.8
Usable Energy (kWh)	5.9	8.8	6.6	9.3
Nominal Voltage (V)	51.8		-	-
Weight (kg)	52	75	75	97
Dimension (W x H x D, mm)	452 x 656 x 120	452 x 484 x 227	744 x 692 x 206	744 x 907 x 206
Enclosure Protection Rating	IP55			
Communication	CAN2.0B		RS485	

Certificates	Cell	UL1642
	Product	UL1973 / TUV (IEC 62619) / CE / FCC / RCM

UL1973 / TUV (IEC 62619) / CE / FCC / RCM



Module data at a glance

Technical data

Module	Cell type	System-voltage (Volt)	Cable length (mm)	Leapfrog wiring	Connector	IP-protection connector	IP-protection Junction Box	Junction box filled with resin	Short / long side clamping
NU-JC330	Mono Half-cell (G1)	1,000	1,200	yes	MC4 Stäubli	IP 65/IP 68 (1h/1m)	IP 68	yes	yes
NU-JD440	Mono Half-cell (M6)	1,500	1,670	yes	C1 Series	IP 68	IP 68	yes	yes
NU-JB395	Mono Half-cell (G1)	1,500	1,400	yes	C1 Series	IP 68	IP 68	yes	yes
NU-JC320B	Mono Half-cell (G1)	1,000	1,200	yes	MC4 Stäubli	IP 65/IP 68 (1h/1m)	IP 68	yes	yes
NU-AC310	Mono Full-cell (M2)	1,000	1,000	no	MC4 Stäubli	IP 65/IP 68 (1h/1m)	IP 67	yes	yes
NU-AC300B	Mono Full-cell (M2)	1,000	1,000	no	MC4 Stäubli	IP 65/IP 68 (1h/1m)	IP 67	yes	yes

Explanation IP protection:

IP (Ingress Protection) ratings the first numeral refers to the level of dust resistance and the second numeral refers to the level of water resistance.

Sharp junction box IP classes:

IP68: totally protected from dust, durable protection against >1m/1h under water

IP67: totally protected from dust and can be submerged in water to 1 m (3ft) for up to 30 minutes without any leakage

IP65: totally protected from dust and against hose water from any direction

Sharp connector IP classes:

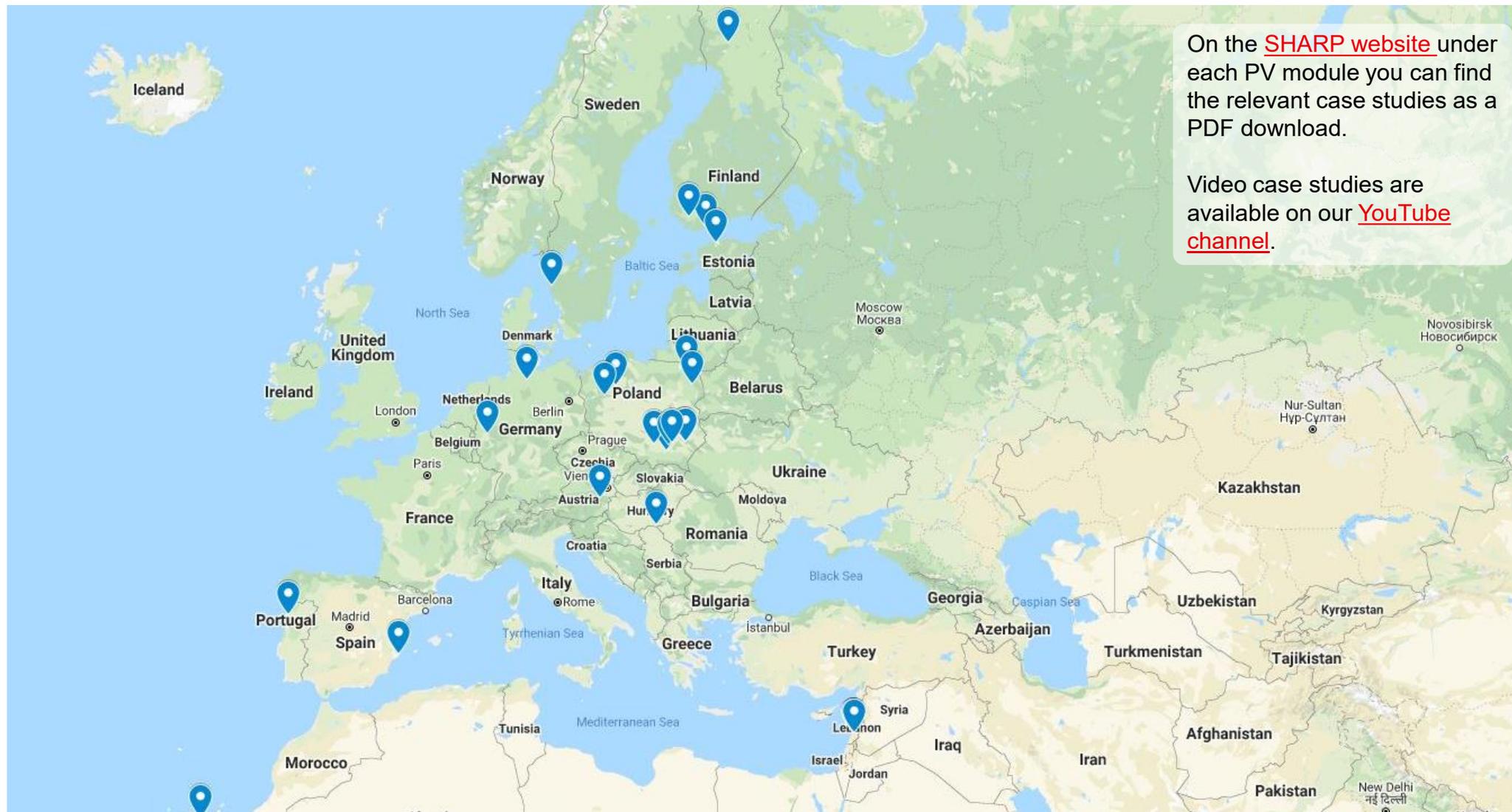
IP 65/68: totally protected from dust and against hose water from any direction and durable protection against >1m/1h under water

IP 67: totally protected from dust and can be submerged in water to 1 m (3ft) for up to 30 minutes without any leakage

IP 67/68: totally protected from dust and can be submerged in water to 1 m (3ft) for up to 30 minutes without any leakage and durable protection against >1m/1h under water

Case studies

Read our case studies to get real performance data on SHARP installations worldwide



Wind or snow: our modules can bear loads

60-cell load comparison, mounting with 4 clamps on long or short side

Provider	 Snow load clamping long side	 Snow load clamping short side	 Wind load clamping long side	 Wind load clamping short side
SHARP	5,400	2,400	2,400	2,400
Ji..	5,400	2,400	2,400	2,400
Al..	5,400	2,400	2,400	2,400
Bi...	5,400	2,400	2,400	2,400
Ta...	5,400	no	2,400	no
Se...	3,600	no	2,400	no
Ja...	5,400	2,000	2,400	2,000
Wi...	5,400	no	2,400	no
L...	5,400	no	5,400	no
Ca...	5,400	2,000	2,400	2,000

*all figures in Pascal

Mounting methods

Single axis tracker

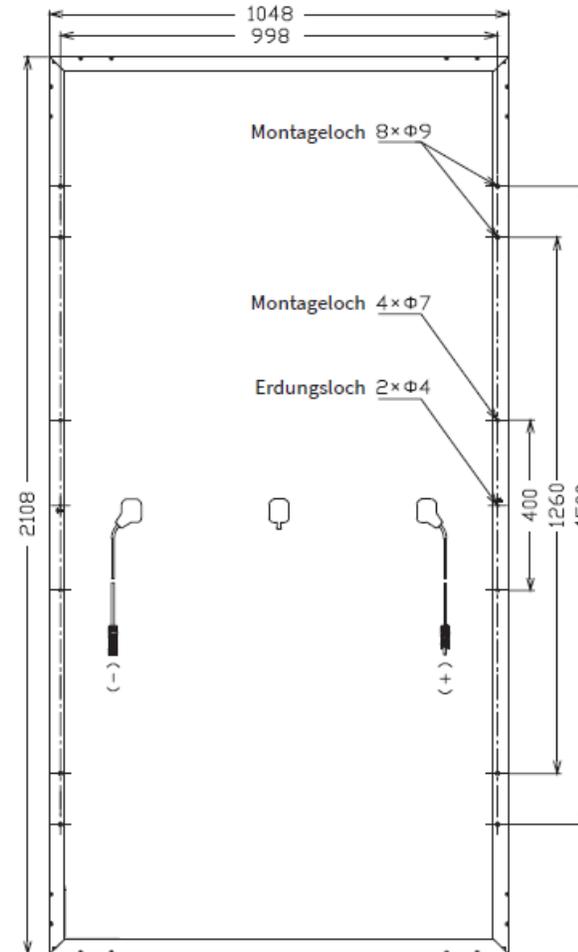
- Preferred mounting method of the top 15 tracker manufacturers for the PV module is by bolts. See table below.

Bolts	Speed clamp
nextracker	Array
PV Hardware	Arctech
Soltech	Game Change Solar
Convert Italia	
STI norland	
Solar Steel	
Ideematec	
Braux	
Sun Action Trackers	
Mecasolar	
Scorpius Tracker	
Industrias Duero	



- Our 144 HC allow mounting by bolt or clamp. Including long enough cables BOS saving is your benefit

NU-JD 440



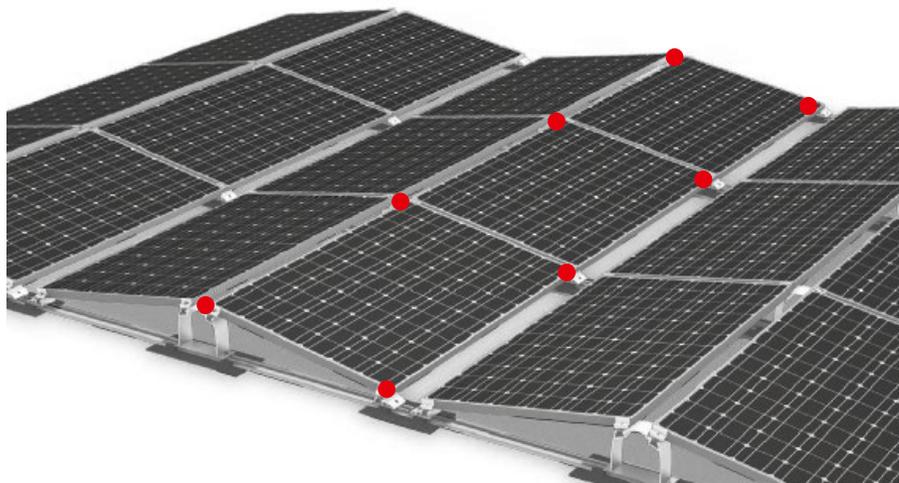
BOLT MOUNTING

PORTRAIT LEAPFROG WIRING



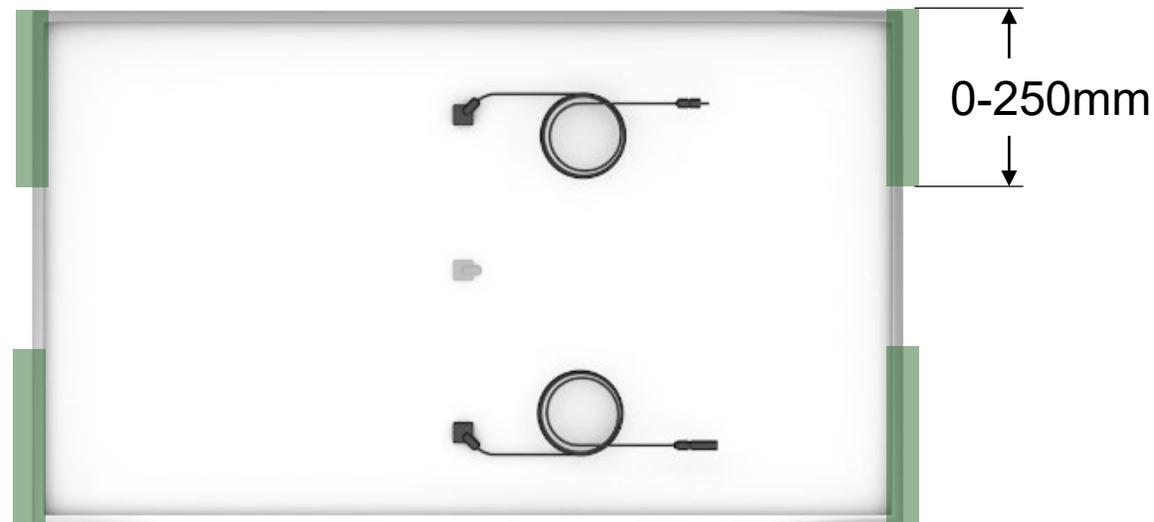
Mounting methods

Aerodynamic systems



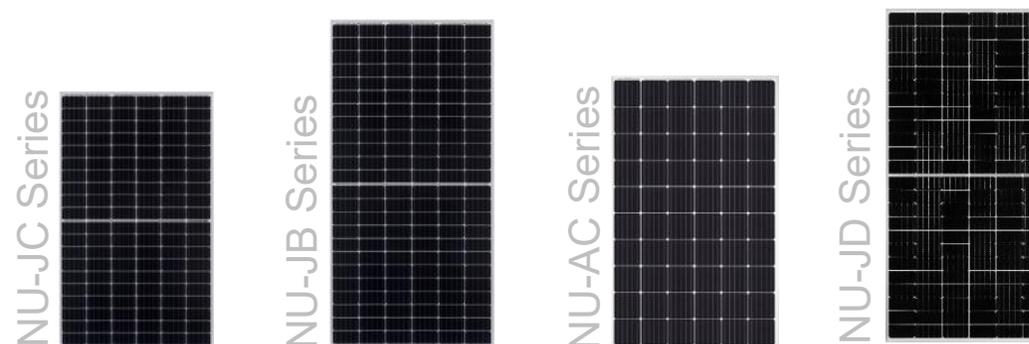
Manufacturer	Short side clamping/close to the module corner
Sflex	Yes
Mounting Systems	Yes
Renusol	Yes
Lorenz	Yes
B&K	Yes
MSP	Yes
MPtec	Yes
Soltop	Yes
Triton	Yes

➤ Short side clamping is the preferred mounting method by manufacturers of aerodynamics mounting system



COMPATIBLE MODULES

FOR MENTIONED CLAMPING AREA & AERODYNAMIC SYSTEMS



Benefit #6: Proven Quality

SHARP modules pass the
most rigorous tests



SHARP modules are tested and approved

Our modules have earned numerous awards and certificates



IEC / EN 61215

- Test of degradation under exposure to standard climates



Company audit for environmental management



IEC / EN 61730

- Test for the safe electrical and mechanical operation



Blowing sand test (IEC 60068)



MCS

- The certification mark for onsite sustainable energy technologies



5,400 Pa tested snow load (IEC 612015)



CE

- Conformity with health, safety, and environmental protection standards for products sold within the EU



Ammonia test



EUPD Research Top Brand PV Award

In several countries and years



Salt mist test (IEC61701)



Robust product design

- PID resistance
- Comprehensive SHARP test procedures

Testing: we set a higher standard for our modules

SHARP product tests are much more rigorous than IEC standards

IEC

Temperature test:

- 85°C → -40°C
- 200 cycles



Damp heat test:

- 85°C & 85% humidity
- 1000 hours



SHARP

Temperature test:

- 85°C → -40°C
- **1025** cycles



Damp heat test:

- 85°C & 85% humidity
- **1250** hours
(equal to 30 years lifetime)



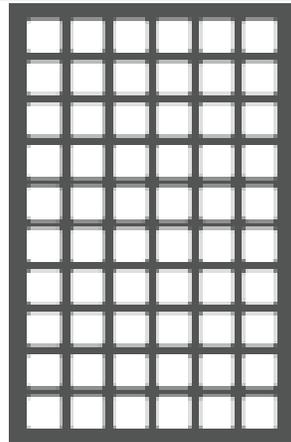
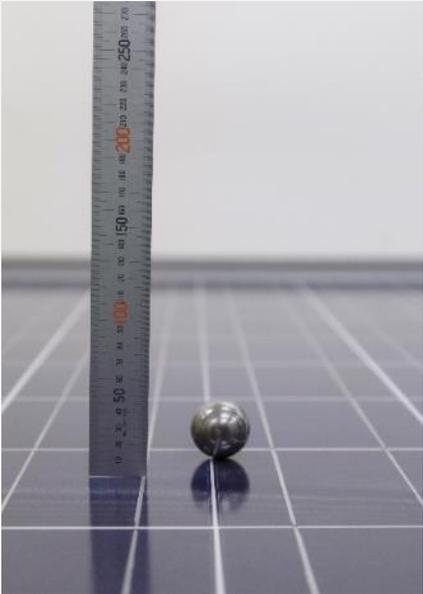
SHARP test procedures are more rigorous than what is required because our products are designed for minimum 30 years of use in mind!

Our modules withstand high loads

Long or short side clamping

Hailstone test

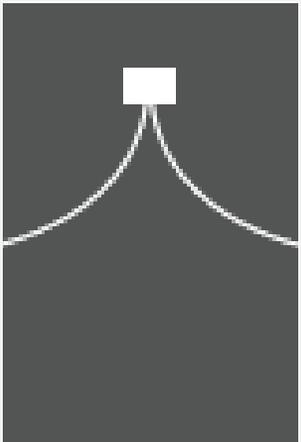
Withstanding the impact of large hailstone



Snow load
5,400 Pa = 550
kg/m²

Wind & load change

Repeated pressure change simulates wind at storm range (not part of IEC testing)



Wind load
2,400 Pa = 245
kg/m²

Hardest load testing at SHARP

Strict SHARP test procedures QTSS (Quality Test Standard of SHARP). Significantly more stringent in parts than IEC (International Electrotechnical Commission).

We're sticklers for details

Because details make all the difference

SHARP junction boxes

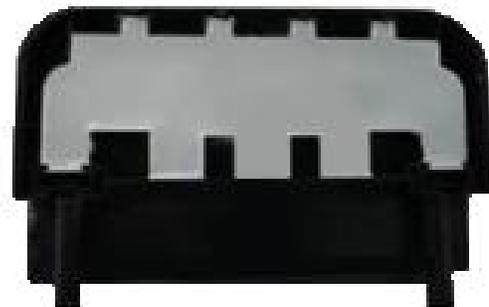
Busbar is soldered onto J-box through holes

Diode with heat sink

Cable is locked to J-box



Waterproofing:
Filled with Silicone



Other junction boxes

Busbar is clipped into J-box (easily disconnected)

Diode without heat sink (easily damaged by heat)

Cable is screwed on (may loosen)



No waterproofing



SHARP bypass diodes can take the heat

We test durability above and beyond standards

IEC

IEC 61215

Bypass diode thermal test:

- 75°C ± 5°C module temperature
- 1.25 Isc factor
- 1h
- ≤ Tjmax of diode



SHARP

Thermal runaway test:

- 1.25 Isc factor
- 1h
- 75 °C (free-field) / 90 °C (roof mounted) module temperature



Cycle test on / off:

- 25°C - 90°C module temp.
- 1.25 Isc factor
- 1h
- **10,950** x equal to 30 years



SHARP test procedures are more rigorous than what is required because our products are designed for minimum 30 years of use in mind!

We work with the best connector suppliers

Connectors for system voltage up to **1,000 Volt**

Stäubli is the most reputable connector producer in the market.

- 125 years industry experience
- Over 120 GW connected PV power in the last 20 years (50% market share)
- Connecting **original MC4s** with **MC4-compatible** connectors results in lower IP rating with corrosion and risk of fire.
- Stäubli strongly advises against using MC4 compatible connectors with original MC4.



MC4 connector:



About Stäubli:

- Founded in 1892
- Headquarter in Switzerland
- Global market leader and industry pioneer

➤ **Connector cut of at the module doesn't affect the SHARP warranty!**

SHARP
Be Original.

We work with the best connector suppliers

Connectors for system voltage of **1,500 Volt**

- We do rigorous testing before a connector is approved for our modules
- These selected connectors made the cut

IEC 61852 Criteria	SHARP Criteria*
✗	PCT 105°C, 100%RH, 200h
✗	HF -40°C/+85°C, 63 cycles
DH 85°C/85%RH, 1,000h	DH 85°C/85%RH, 1,500h
TC 85°C/-40°C, 200 cycles	TC 85°C/-40°C, 1,025 cycles



For our 144 half-cells project modules we are using these 2 connectors to secure long-term reliability

*PCT: Power Cooker Test / RH: Relative Humidity / HF: Humidity Freeze / DH: Damp Heat / TC: Thermal Cycle

Only two connectors pass the SHARP test:

C1 Holysun



Twinsel PV-SY02



➤ Connector cut of at the module doesn't affect the SHARP warranty!

SHARP
Be Original.

Our modules keep their output high, long-term

SHARP modules are PID resistant

PID (Potential Induced Degradation):

Degradation of a solar module's electrical output due to the effect of high temperatures, high humidity and high voltage.

The SHARP advantage

- Proven PID resistance
- SHARP internal tests under high voltages and extreme humidity (above IEC)
- No need for extra minus pole grounding for SHARP modules to prevent PID
>> Lower BOS costs

*"This is a very pleasing result for us, which clearly shows that there are **major differences between the module manufacturers**. At the same time it confirms the reliability of our own PID quality tests that are conducted in accordance with the stringent National Renewable Energy Laboratory (NREL) standards. NREL standards are in excess of 96 hours at 60°C (140°F), 85% humidity and 1000 volts (V) on each new product"*

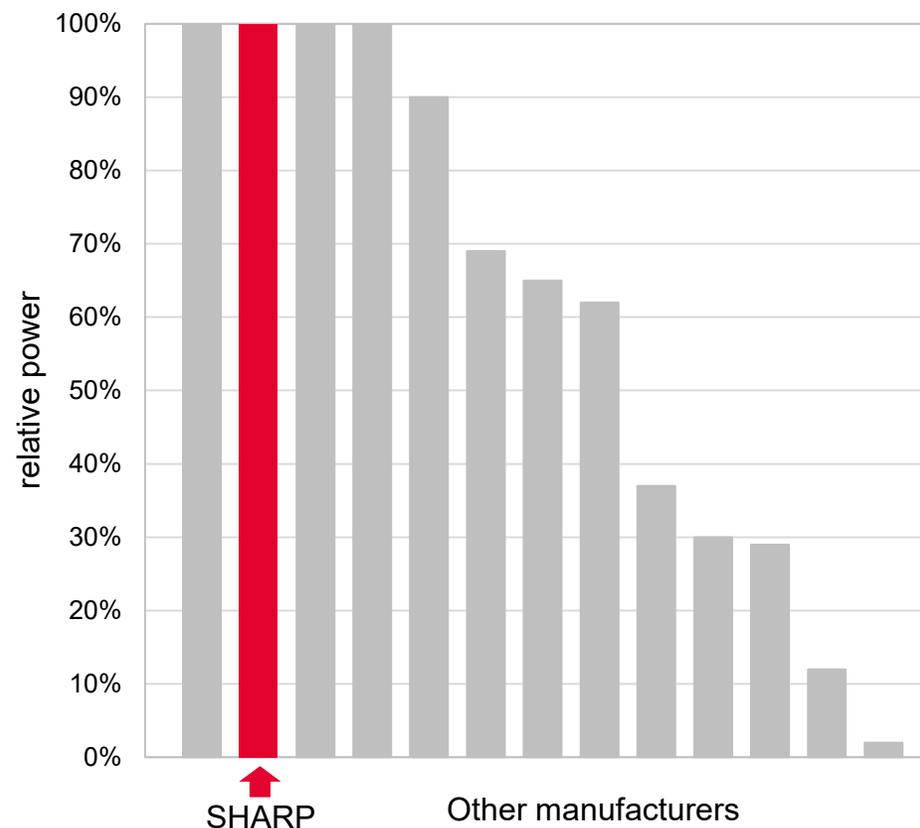
Peter Thiele

President of Sharp Energy Solutions Europe

Sources: glasstec-online.com, Sharp

Fraunhofer Institute's reported data:

- Only 4 out of 13 manufacturers showed no performance decline



Still highly efficient after all these years

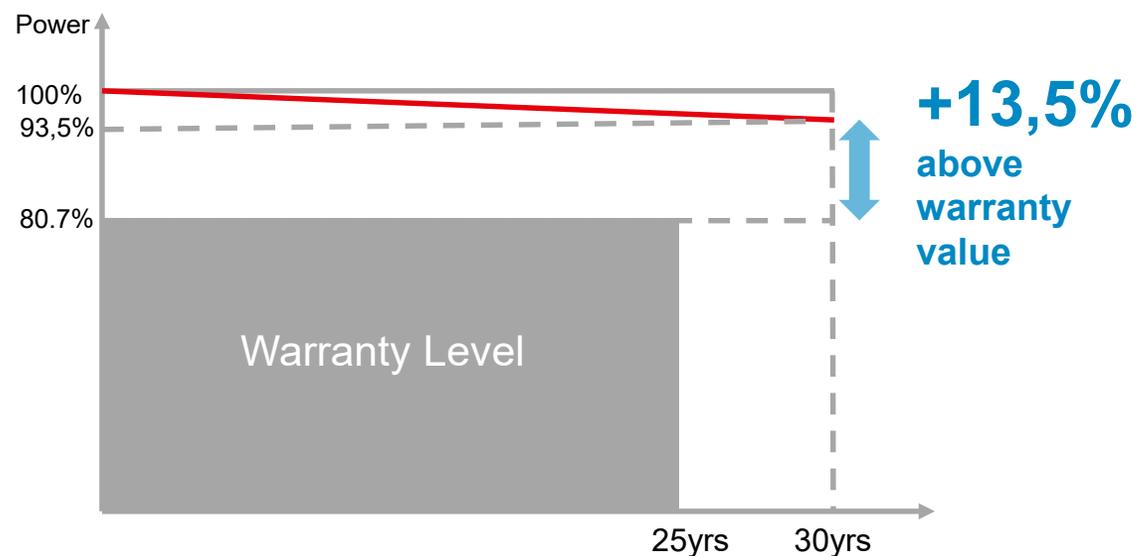
Our modules virtually won't degrade, even after 30 years

Tsubosaka temple

- The installation at Tsubosaka temple in Nara pref., Japan, was completed in 1983.

Module performance:

- The 35 W modules still had an output of 32.75 W after 30 years
- That is a degradation of only -6.43% overall or -0.22% annually



SHARP
Be Original.

We prevent product problems from occurring

Typical module failures over time and SHARP countermeasures

Inherent failure	10 YEARS	Midlife failure	25 YEARS	Wear-out-failure	
String interconnectors	✗	Glass AR degradation	✗	Corrosion of cell & interconnect	✗
We use only SHARP approved connectors	✓	Long term tests: damp heat / temperature cycle test	✓	Execution of damp heat test factor 1.25 times longer than our competitor = 30 yrs. Lifetime Execution of Snail Trail Test (Combination test of moisture and UV irradiance)	✓
Glass breakage	✗	PID (potential induced degradation)	✗		
Sourcing from renowned glass manufacturers	✓	100% PID resistance (certificate)	✓		
Contact failure J-Box	✗	Diode failure	✗		
We use 4x junction box protection	✓	thermal runaway and cycle test (not part of IEC)	✓		
LID (light induced degradation)	✗	Cell interconnect breakage	✗		
More intensive testing SHARP: about 100kWh IEC / Competitor: just 60kWh	✓	Execution of 100% EL inspection	✓		
		EVA discoloring	✗		
		Execution of long term test (damp heat/temperature cycle test). Adhesive test as sampling inspection.	✓		
		Delamination, cracked cell isolation	✗		
		Execution of SHARP specific test combination: ML+DML+TC+ML, ML+DH+ML IEC, competitors: Only TC, DH+ML	✓		
		<ul style="list-style-type: none"> ML : Mechanical Load, DML: Dynamic Mechanical Load DH: Damp heat, TC: Temperature Cycle 			

Certificates

PV modules

	IEC 61730 IEC 61215	CE	Ammonia Test IEC 62716	Salt Mist Test IEC 61701	PID Test	Sand Test IEC 60068	MCS	Factory Inspection	DEWA
Modules	Certificate	Sharp DoC	Certificate	Certificate	Certificate	Certificate	Certificate	Certificate	Listed
NU-JC330	x	x	x	x	x	x	x	x	-
NU-JD440	x	x	x	x	x	x	-	x	-
NU-JB395	x	x	x	x	x	x	x	x	-
NU-JC320B	x	x	x	x	x	x	x	x	-
NU-AC310	x	x	x	x	x	x	x	x	x
NU-AC300B	x	x	-	-	x	-	x	x	-

Benefit #7: Highest Performance

Achieve ROIs quickly



SHARP modules have a positive percentage power tolerance

Exceeding performance expectations:

- SHARP is the only company with up to 5% more power. Most other competitors specify a lower tolerance that can even be negative.
- All 60/120 or 72/144 cell SHARP modules have a 0 to 5% tolerance.
- Up to 5% tolerance is more than up to 5 W.
- For example 5% for a 440 W module is 22 W.

5% ≠ 5W

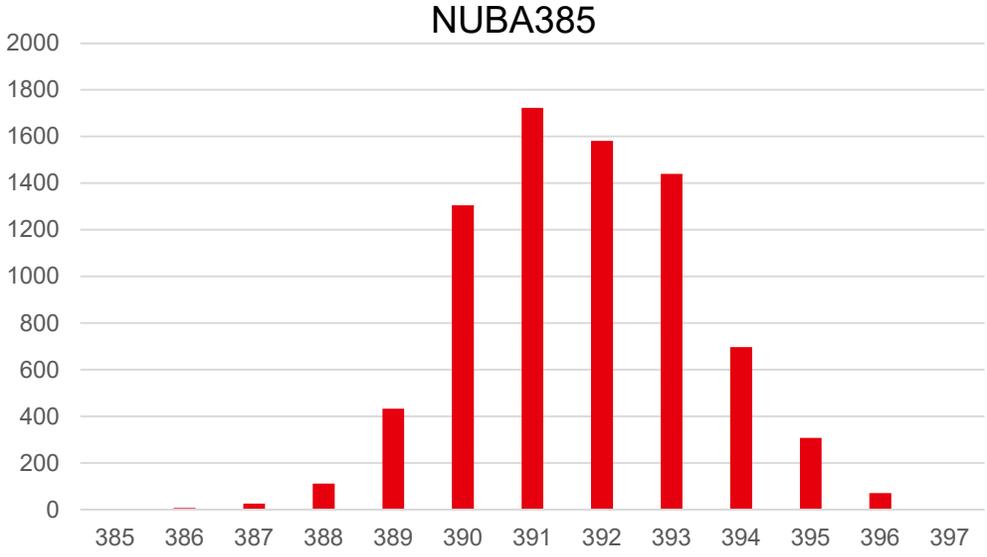
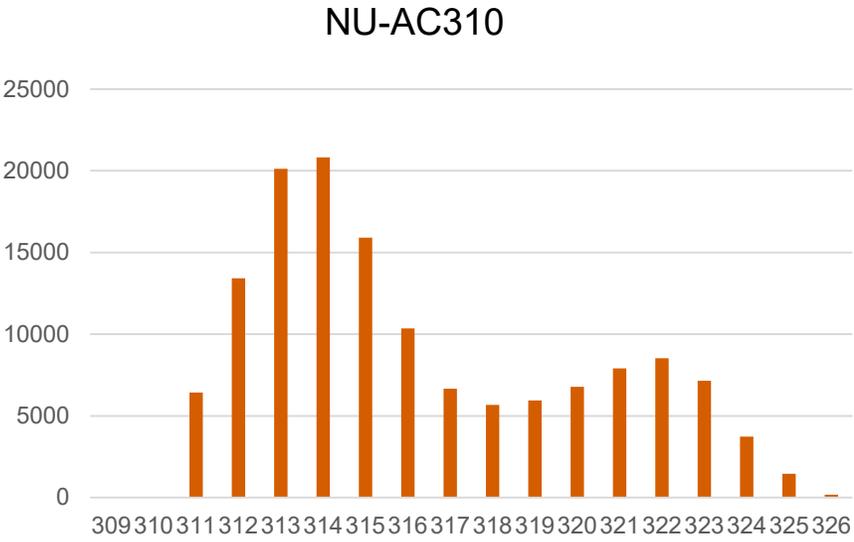
SHARP Modules	Nominal Power (W)	Power Tolerance up to	Max Power (W)	Max Power (W) if tolerance only up to 5W more
NU-AC310	310	+5%	325	315
NU-JC320B	320	+5%	336	325
NU-JC330	330	+5%	346	335
NU-JB395	395	+5%	414	400
NU-JD440	440	+5%	462	445

Positive percentage power tolerance

Flashdata analysis

Random flashdata analysis of 141,120 pcs 310 W modules

Random flashdata analysis of 7,704 pcs 385 W modules



RESULT

Pmax=	325.49 Watt
Pmin=	310 Watt
Pavg=	315.82 Watt
n=	141,120

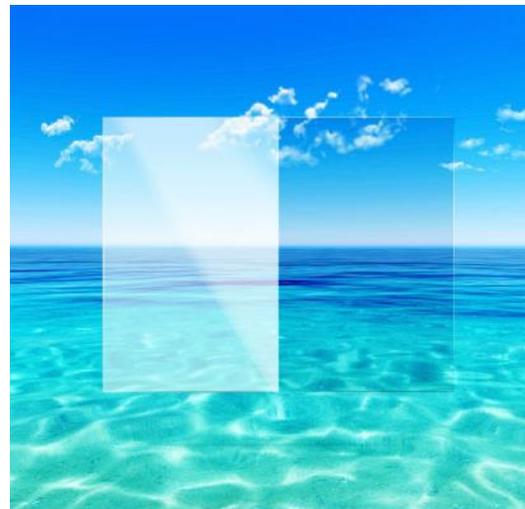
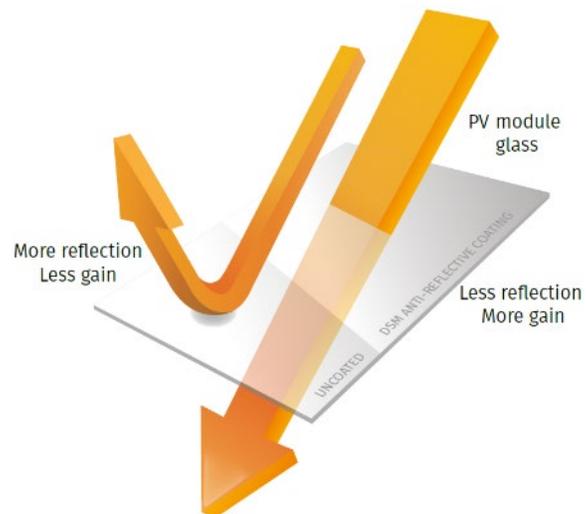
**MORE THAN
5W ON
AVERAGE**

RESULT

Pmax=	396.51 Watt
Pmin=	385.11 Watt
Pavg=	391.23 Watt
n=	7,704

Our coating generates more power with the same amount of sunlight

Less reflections for highest yield



➤ **+ 1.2% MORE YIELD**
COMPARED TO
STANDARD AR COATING



Sharp with AR Coating from DSM

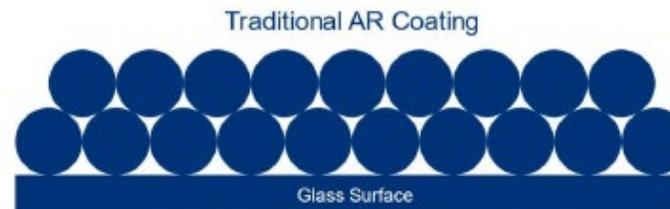


Low surface roughness - Closed surface

Coating **in** the glass structure
 Less reflection, more gain

VS

Standard Anti-Reflecting Coating

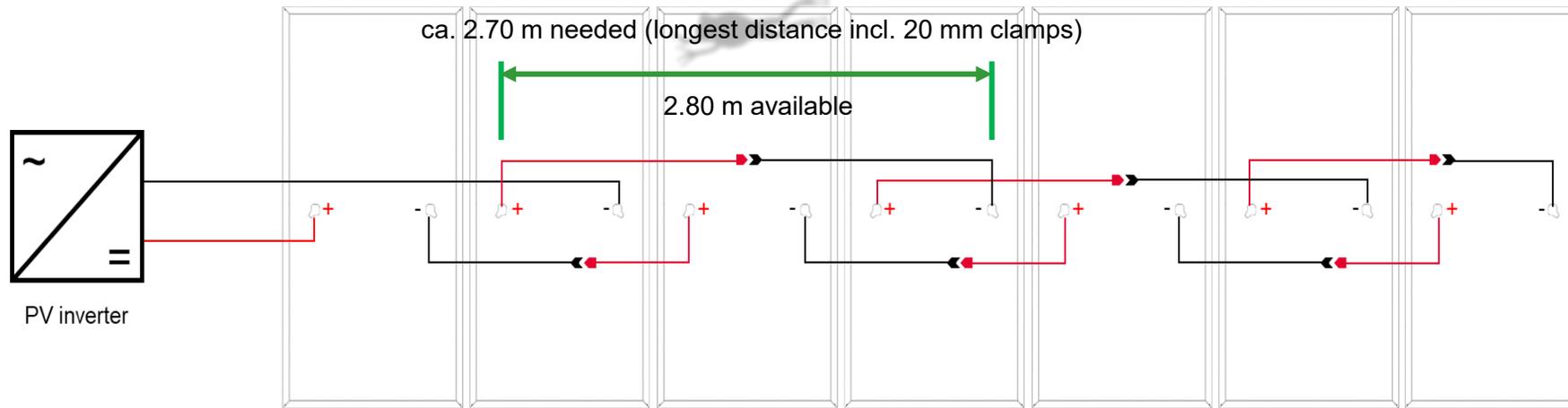


High surface roughness - Open pore structure

Coating **on** the glass structure
 More reflection, less gain

Smart leapfrog wiring lowers your BOS costs

Solution for half-cell modules with **>1,400 mm cable**



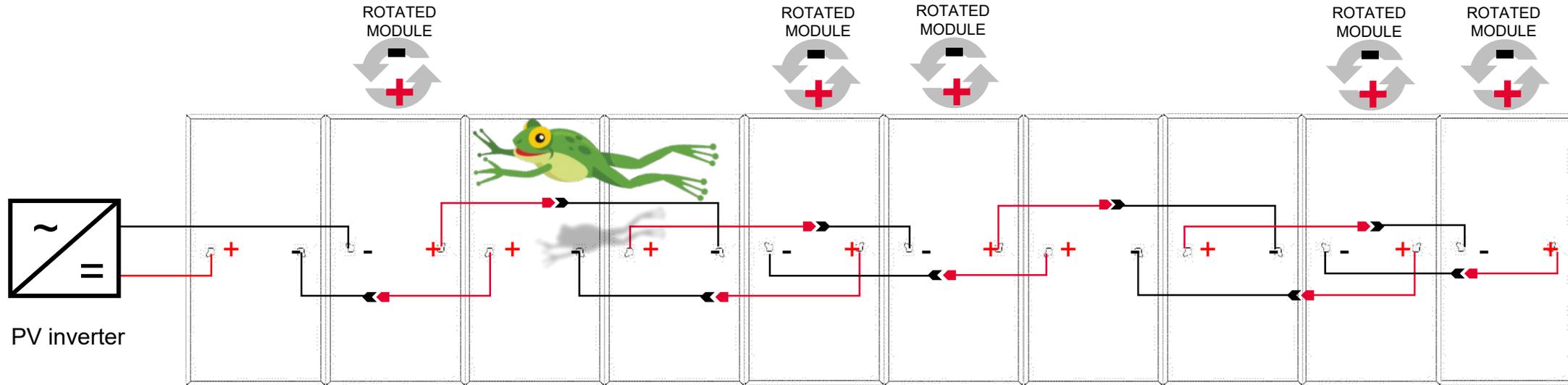
SHARP Modules	Cable length (mm)	Leapfrog wiring	Cells
NU-JD440	1,670	YES	Mono PERC HC (144)
NU-JB395	1,400	YES	Mono PERC HC (144)

- No extra home-run cable necessary
- Our 395/440 Watt module with extra long cables for easy portrait leapfrog wiring



Smart leapfrog wiring lowers your BOS costs

Solution for half-cell modules with >1,200 mm cable: PV panel rotation



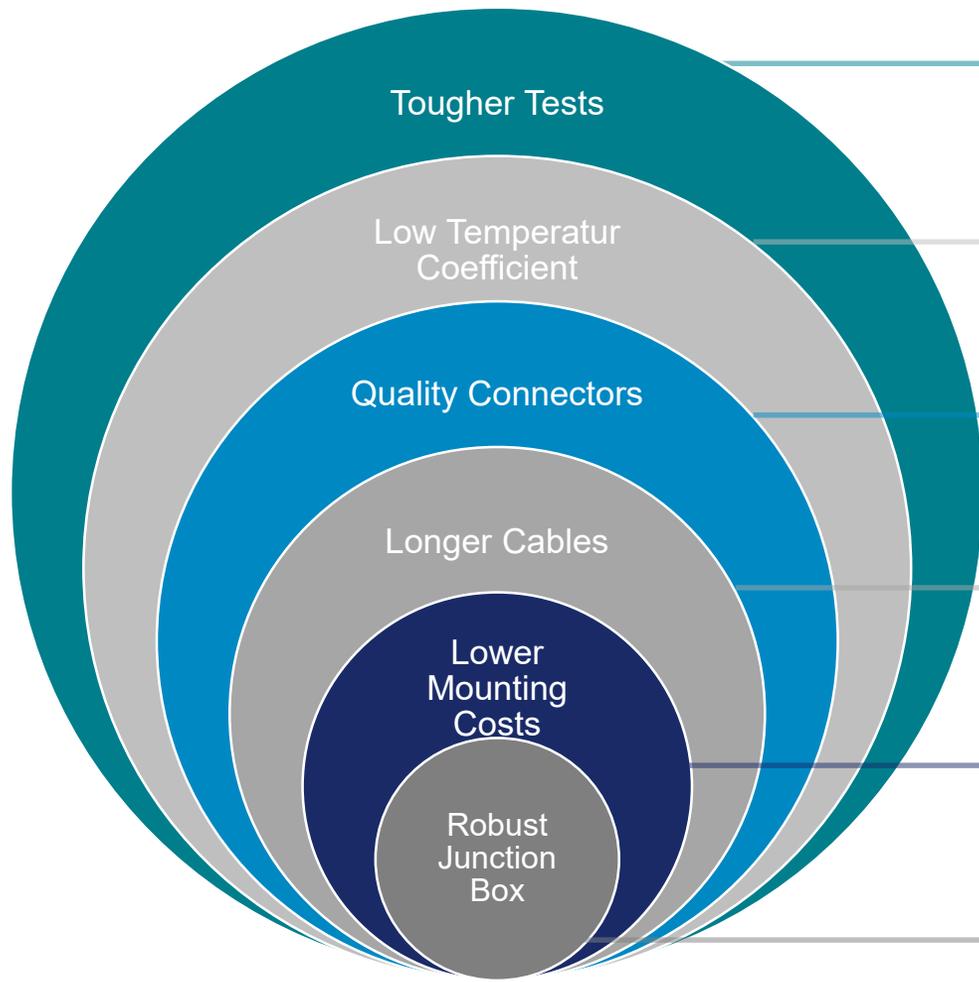
SHARP Modules	Cable length (mm)	Leapfrog wiring	Cells
NU-JC320B	1,200	YES	Mono PERC HC (120)
NU-JC330	1,200	YES	Mono PERC HC (120)

➤ No extra home-run cable necessary



Advantage Summary

360° approach for reducing LCOE & increasing lifetime



- Tougher Tests
- Temperature test 5 times longer than IEC
- Damp-heat test 1.25 times longer than IEC
- Equivalent to 30 yrs. lifetime

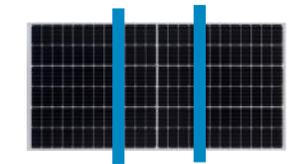
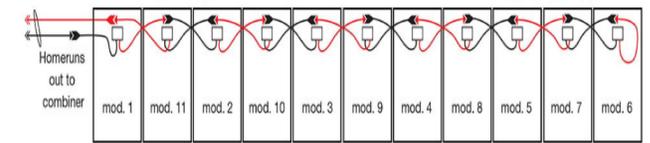
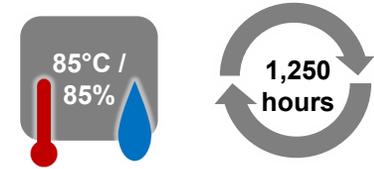
- Low Temperature Coefficient
- Temperature coefficient <math><0.34\%/^{\circ}\text{C}</math> for better yields

- Quality Connectors
- SHARP approved connectors
- Up to 1000 Volt System Voltage: MC4
- Above 1500 Volt System Voltage: Twinsel or C1

- Longer Cables
- All SHARP 72/144 cell modules are leapfrog compatible
- Cost savings: approx. 20\$/string or up to 20,000\$ for a 5 MW plant

- Lower Mounting Costs
- Bolt mounting around the centre line for lower mounting costs

- Robust Junction Box
- Busbar is soldered onto J-box through holes
- Diode with heat sink
- Cable is locked to J-box
- Waterproof: filled with silicone



SHARP
Be Original.

Benefit #8: Reliable Service & Support

Contact us and we will be
happy to assist



SHARP is rooted in Europe

SHARP Energy Solutions Europe has been based in Hamburg for decades



Milestones:

- 1968 SHARP opened offices in Hamburg
- 1994 SHARP starts selling PV components in Europe



We focus on our customers

Take advantage of our range of services

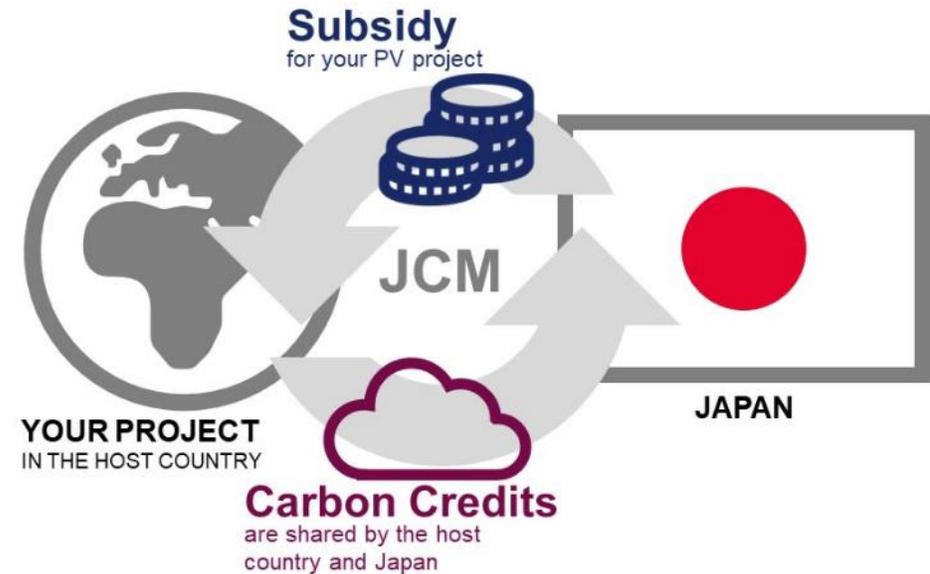


Project development for solar power plants

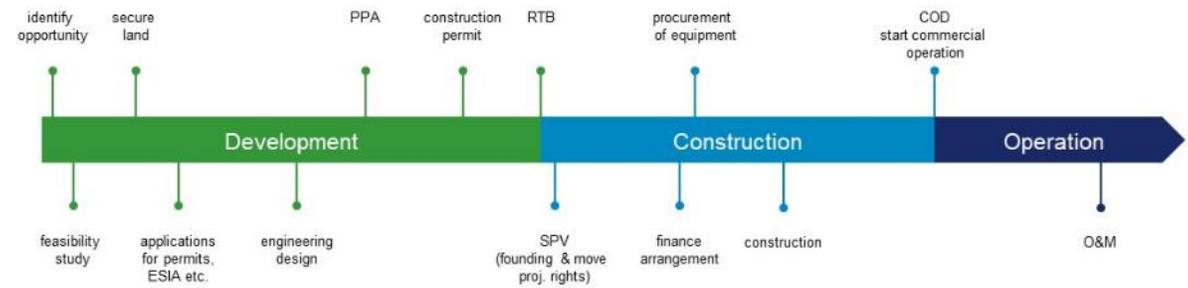
Up to 50% subsidy on PV panels and BOS articles

Joint Crediting Mechanism (JCM)

- The Joint Crediting Mechanism is a project-based crediting mechanism initiated by the Government of Japan to facilitate the diffusion of low-carbon technologies in 17 different countries
- The Japanese Ministry of the Environment provides the subsidy for the PV installation and in return they receive part of the carbon credits generated by the project.
- As a Japanese company SHARP is your door opener to obtain the subsidy for your project
- Benefit from up to 50% cost reduction on modules and BOS articles



We offer support during all project phases:



Marketing support

Assets for your website:

- SHARP logo / SHARP partner logo



- Product information
 - PDF brochure, datasheets and certificates
www.sharp.co.uk/solar-panels
- Product images (download via photo database)
<https://www.sharp.co.uk/cps/rde/xchg/gb/hs.xsl/-/html/photo-database.htm>
- Online banners
- Product descriptions

Order and use these materials:

- Printed PV panel brochure
- Beach flags & roll-ups
- Polo shirts & caps
- Pens & pads
- Giveaways



SHARP news:

Social media

- Share our posts on your own channels!



[@SHARPSolarEMEA](https://www.linkedin.com/company/sharp-solar-emea)



[@SHARPSolarEMEA](https://twitter.com/SHARPSolarEMEA)



[@SHARPSolarEMEA](https://www.youtube.com/channel/UCSHARPSolarEMEA)

Press releases

- <https://www.sharp.co.uk/cps/rde/xchg/gb/hs.xsl/-/html/press-releases.htm>

Newsletter registration form

- www.sharp.eu/solar-newsletter

SHARP promotion support:

- Ask for our support for fairs and promotions

Visit our online shop any time

Order 24 hours, 7 days a week

- Complete PV module range
- Complete battery range
- Marketing materials

Register now!



<https://energystore.sharp.eu/>

- After registering it can take a few days to check your company details and activate your account. Thank you for your patience.
- The shop is for our EU customers only.



Our solar service support is happy to assist

Do not hesitate to contact us

Contact us for:

- Spare modules (also very old types)
- Technical support and consulting
- Claim handling
- Flash data download:

<https://www.sharp.eu/flashdata>



Phone: +49 (0) 40 2376 2650
Fax: +49 (0) 40 2376 15 2920
E-Mail: solarservice@sharp.eu

Become a SHARP
Partner!



See what our customers say about us

Customer quotes

“

*“Our relationship with SHARP Service can be described best by the number of issues we have had with SHARP products in the past 18 years: **ZERO!** This is statistically impossible and yet, true!”*

Christos Pronius
Eurosol

”

“

*All panels were delivered on time, which helped adhering our time schedule a lot and is required when installing 43,000 modules. Furthermore, the SHARP modules have **exceeded our expectations** in terms of quality and reliability. This was also confirmed by the great yields we generated so far.*

Aldo Enerji
Akin Yalçın, Turkey

”

“

*We’ve done more than 70 projects with SHARP modules so far. Their high quality and reliable guarantees give us great **peace of mind.***

Joan Grifé Singla
Seine Tech, Spain

”

SHARP
Be Original.

SHARP international sales team



Andrew Lee
Sales Director EMEA
Andrew.Lee@sharp.eu
+44 (0) 7808 479 037
United Kingdom, Ireland,
Middle East



Simon Betka
Sales Manager
Simon.Betka@sharp.eu
+49 (0) 40 2376 1358
Italy, Romania, Malta,
Ukraine Projects



Andreas Voß
Regional Sales Manager
Andreas.Voss@sharp.eu
+49 (0) 40 2376 2698
Sweden, Denmark, Finland,
Norway



Martin Morschek
Regional Sales Manager
Martin.Morschek@sharp.eu
+49 (0) 40 2376 2711
Hungary, Croatia, Czech R.,
Greece, Serbia, Slovakia,
Cyprus, Albania, North
Macedonia, Montenegro,
BIH, Turkey



Celia Alcaraz
Country Manager
Celia.Alcaraz@sharp.eu
+34 935819700
Spain, Portugal, Southern
France



Baudik de Vries
Country Manager
Baudik.Devries@sharp.eu
+31 (0) 655873634
Benelux, Northern France



Janusz Sobek
Country Manager
Janusz.Sobek@sharp.eu
+48 (0) 22 545 81 92
Poland, Baltics, Bulgaria,
Slovenia, Ukraine, Russia



Barbara Rudek
Business Development
Manager Africa
Barbara.Rudek@sharp.eu
+49 173 6455 965
Africa



Robert Mayr
Sales Austria
Robert.Mayr@sharp.eu
+49 15731023160
Austria

SHARP Service Team



Klaus Schäfer
Manager Solar Service
Support
solarservice@sharp.eu
+49 (0) 40 2376 2650
After Sales Service,
Quality Management



Sven Lorenzen
Service Support Technician
solarservice@sharp.eu
+49 (0) 40 2376 2650
After Sales Service,
Quality Management



Jörg Straßburger
Service Support Technician
solarservice@sharp.eu
+49 (0) 40 2376 2650
After Sales Service,
Quality Management

SHARP Sales Development Team



Klaus Kießling
Manager Sales Development
klaus.kiessling@sharp.eu
+49 (0) 40 2376 2541



Ralf Röckendorf
Sales Development Manager
ralf.roeckendorf@sharp.eu
+49 (0) 40 2376 2705



Bernd Lienemann
Sales Development Manager
bernd.lienemann@sharp.eu
+49 (0) 40 2376 2714

SHARP Marketing Team



Anne Schilling
Marketing and
Communications Manager
Anne.Schilling@sharp.eu
+49 (0) 40 2376 2264



Charlotte Leuchten
Assistant Marketing
Communications
Charlotte.Leuchten@sharp.eu
+49 (0) 40 2376 2223

SHARP Management



Peter Thiele
President SHARP Energy
Solutions Europe
Peter.Thiele@sharp.eu
+49 (0) 40 2376 2677



Akira Sasaki
General Manager Business
Planning & Administration
Akira.Sasaki@sharp.eu
+49 (0) 40 2376 2724

#1 Longest experience

- 60 years of Solar Expertise
- 14.9 GW sales record

#2 Financial stability

- Bloomberg tier1 bankability
- Empowered by Foxconn holding company

#3 Innovative power

- State of the art poly and monocrystalline technology
- Back Contact & Triple Junction modules

#4 Best guarantees

- End customer oriented warranty
- EU service support team

#5 Strong product portfolio

- Broad product range
- Optimal module for every application

#6 Proven quality

- Certificates from independent test institutes
- Additional SHARP test standards (more rigorous than IEC)

#7 Highest performance

- Modules with plus tolerance, up to 5% more
- BOS savings

#8 Reliable service & support

- EU warehouse
- On time fulfilment (Accuracy >95%)

Your Solar Partner for Life.



Thank you

SHARP Energy Solutions Europe, a division of SHARP Electronics GmbH

Registered address:

SHARP Electronics GmbH
Nagelsweg 33-35
20097 Hamburg
Germany

Managing Directors:

Jun Ashida, Seitaro Nomura

Commercial Register:

HRB 125894
Local Court Hamburg