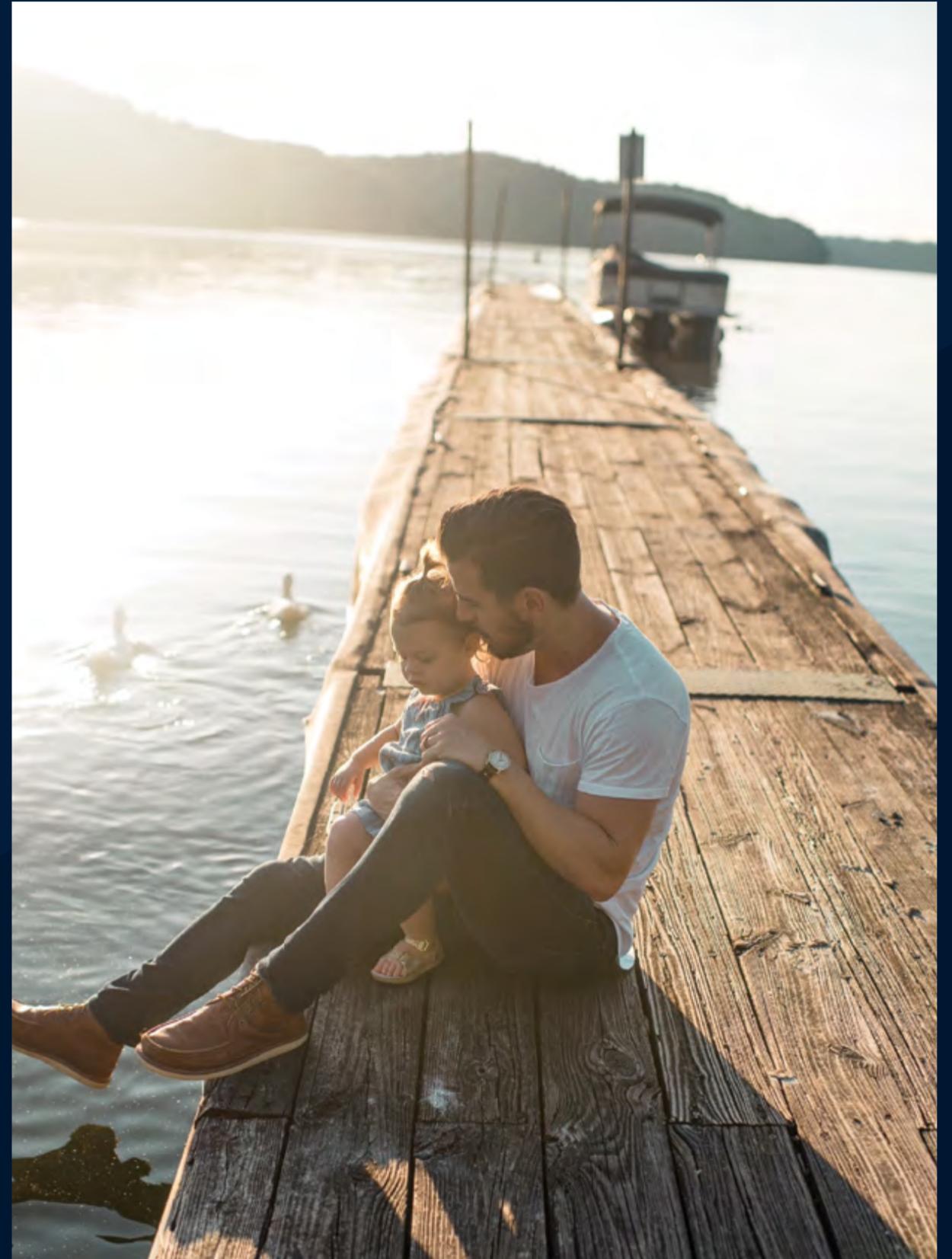


# COMPANY BROCHURE 2019

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# AFFORDABLE ENERGY FOR OUR PLANET

**Q CELLS provides affordable and smart energy solutions through technology and innovation to create a sustainable future for the planet.**

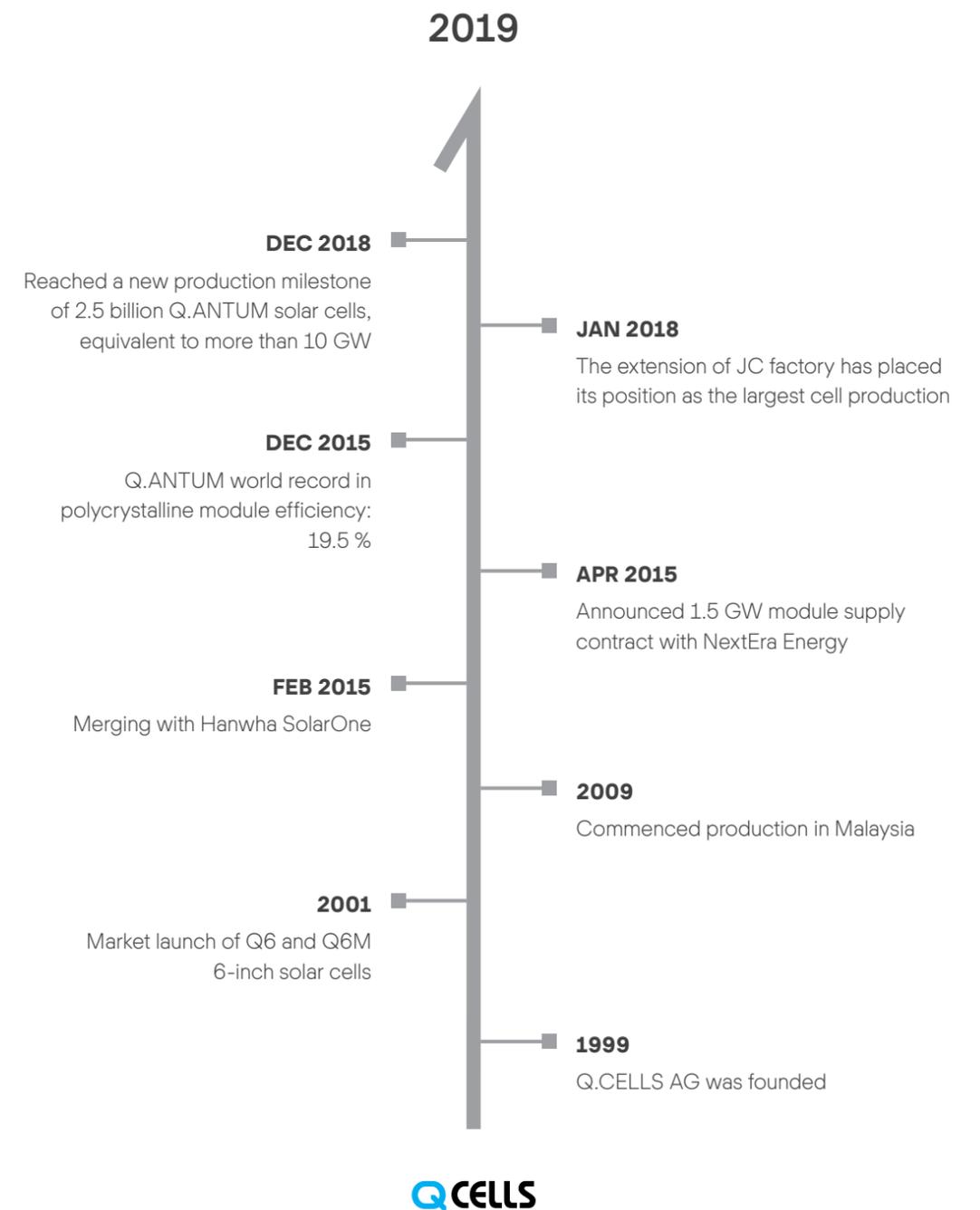
Q CELLS is a pioneer in PV technology and fully bankable solar solution provider with a global footprint and market access. We expect to lead the world's solar industry with our cutting-edge technology and superior product quality. It's why we're seen as the best choice for the future and trustworthy partner to our investors, installers and end consumers.

Q CELLS is one of the world's largest and most recognized photovoltaic manufacturers for its high-quality, high-efficiency solar cells and modules. It is headquartered in Seoul, South Korea (Global Executive HQ) and Thalheim, Germany (Technology & Innovation HQ). With its diverse international manufacturing facilities in South Korea, Malaysia, China and USA, Q CELLS is in a unique position to flexibly address all global markets. Q CELLS offers the full spectrum of photovoltaic products and solutions, from modules to systems and large-scale solar power plants. At Q CELLS, we care the most about our customers and are passionate about meeting their needs. We will strive to apply our state-of-the-art technology to shape a new era in the energy industry, benefiting each consumer and the world in which we live. Through our growing global business network spanning Europe, North America, Asia, South America, Africa and the Middle East, we are able to provide unparalleled solar products and services in the utility, government, commercial and residential markets.

# OUR HISTORY

Q CELLS has a strong heritage that dates back to its foundation as Q.CELLS SE in Germany in 1999, when it began as a true pioneer of advanced solar cell technology. Since then, Q.CELLS quickly became one of the solar market leaders for its innovations in the PV industry. In 2012, Q.CELLS SE became part of the Hanwha Group, and in February of 2015, the merging of Hanwha SolarOne took a huge leap not only as an solar organization but also as a global leader in the industry.

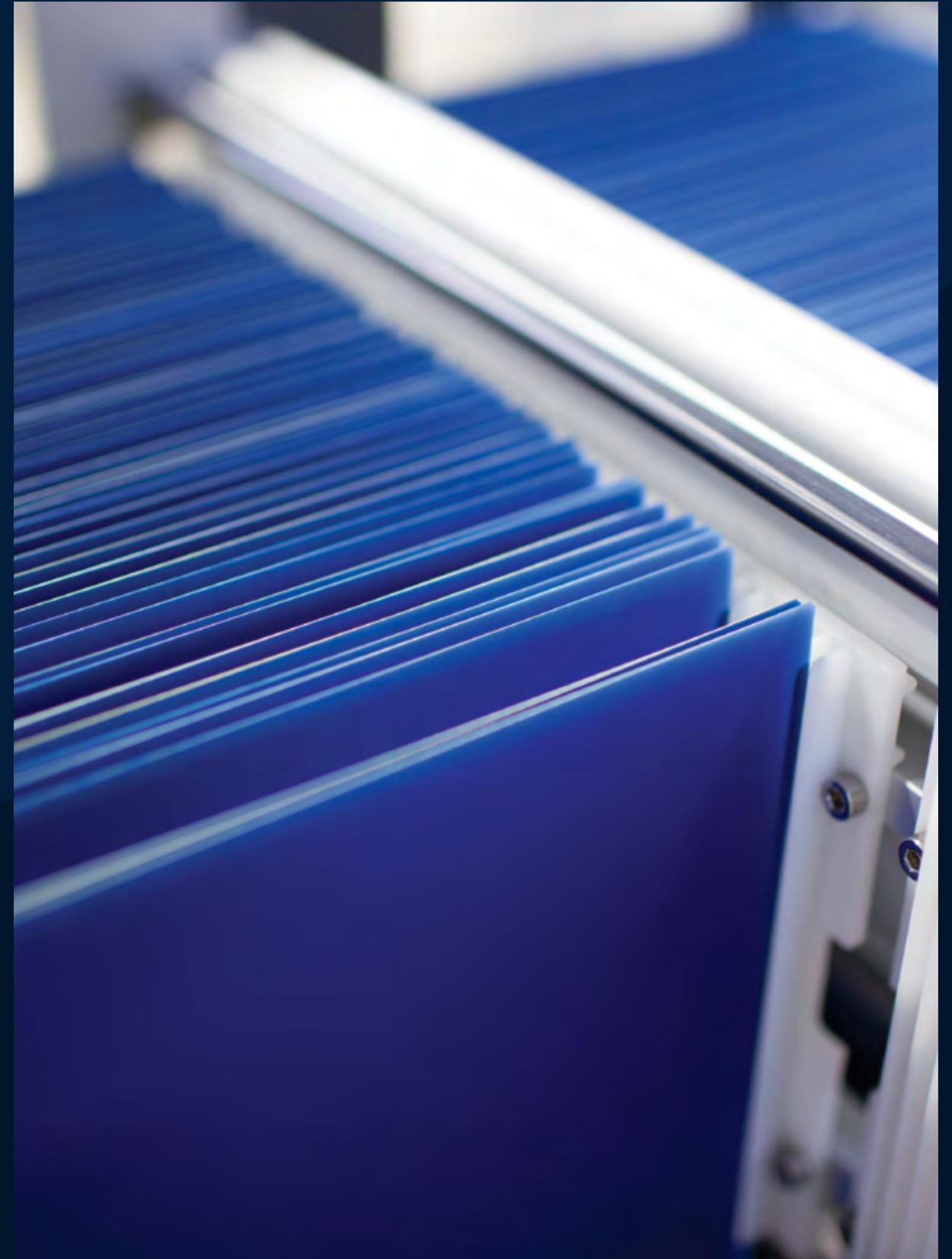
Today, Q CELLS is one of world's top 5 Silicon Module Super League members. We are the only solar company in the world with a R&D network in 4 countries, manufacturing plants in 4 countries, and a sales network in more than 40 countries worldwide. Our comprehensive product portfolio includes solar cells, modules, complete systems for commercial rooftop installations, and turnkey solar power plants. We develop and test our products at our headquarters for Technology and Innovation in Germany until they are ready for serial production at our manufacturing sites in Korea, Malaysia, China, and USA. Our global distribution network then supplies our products worldwide.



# YOUR BEST CHOICE

Q CELLS is a global leader in the solar industry,  
differentiated across three categories:

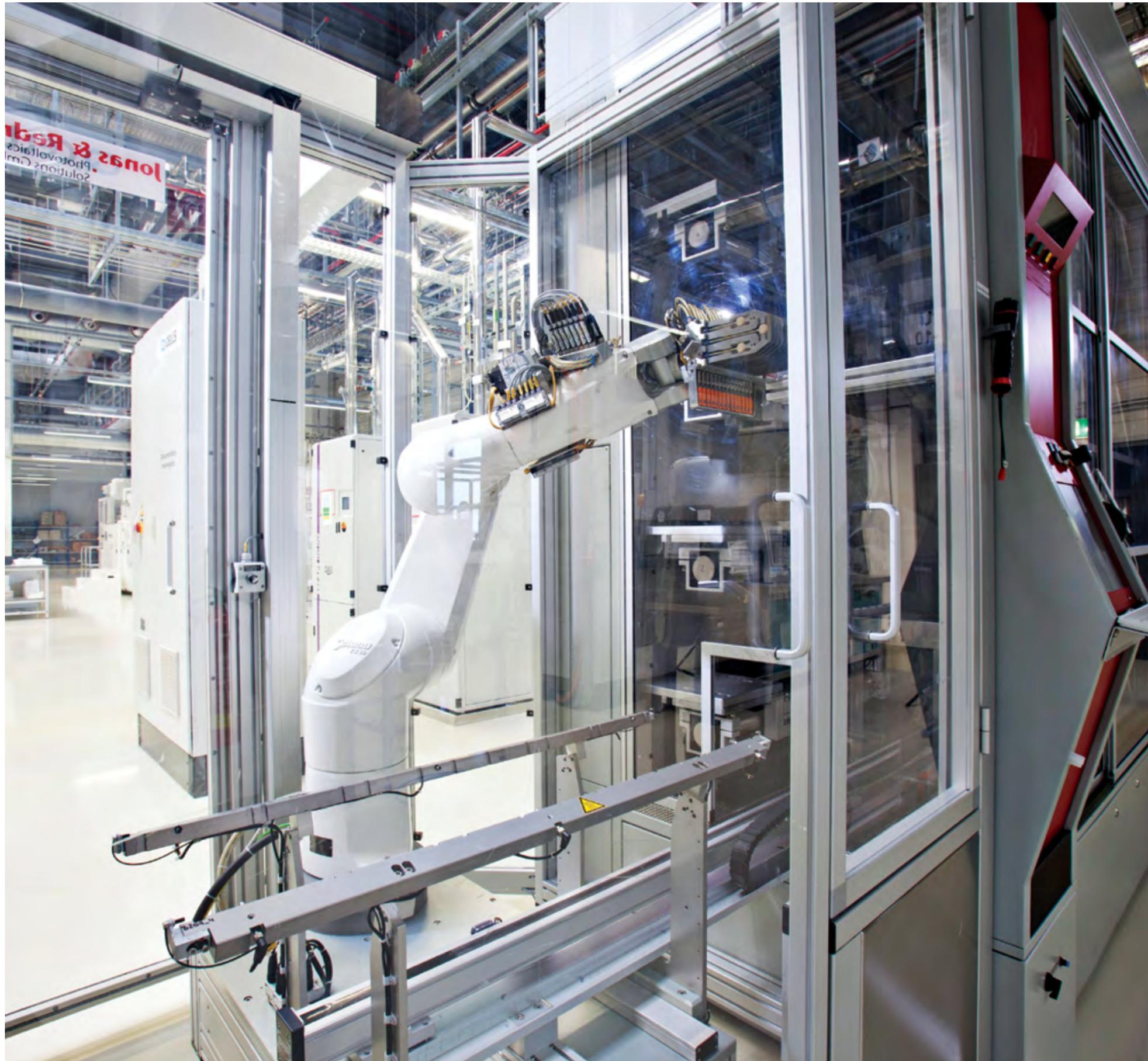
- Technology Leadership
- Quality Management
- Manufacturing Excellence





## TECHNOLOGY LEADERSHIP

We are a leading global solar company constantly exploring new approaches and technologies. Our heavy investments and deep commitment to R&D continue to advance both our products and the methods we use to manufacture them — allowing us to stay ahead in the industry. In fact, we are setting new standards in technology for the industry at our four state-of-the-art R&D centers in Germany, Korea, China and Malaysia.

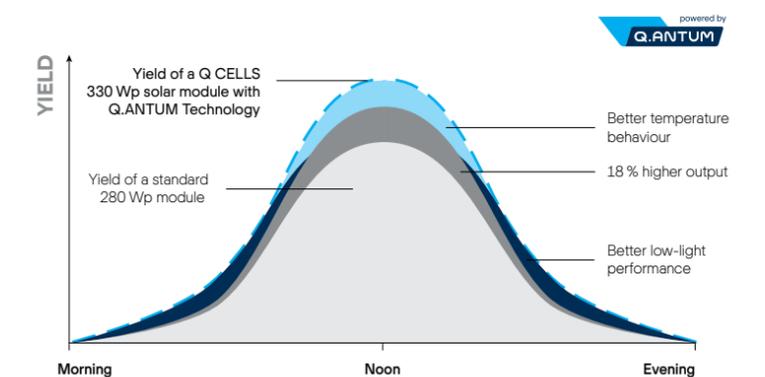


# TECHNOLOGY LEADERSHIP

At our headquarters for Technology & Innovation in Thalheim, Germany, Q CELLS employs a unique combination of R&D, pilot productions, and testing to develop and apply innovative manufacturing methods for high-tech products. Our approach has helped us to mass-produce some of the largest volumes of PERC cells in the world.

Q CELLS continues to set industry standards with the six-inch solar cell, the full-square monocrystalline solar cell, Q.ANTUM cell technology, and Q CELLS Yield Security featuring Hot-Spot Protect, Anti PID Technology, Anti LID Technology, Anti LeTID Technology, and traceable quality technology. Our renowned Q.ANTUM Technology has been validated through internal tests and with a variety of external tests including the California Energy Commission's PTC test, the VDE quality test, PHOTON module measurement tests, and the CQC Top Runner Program. Our products are also the most mature of their kind. They perform exceptionally well, producing extremely high yields for both polycrystalline and monocrystalline solar cells under real-world conditions.

## Q.ANTUM SOLAR MODULE YIELD

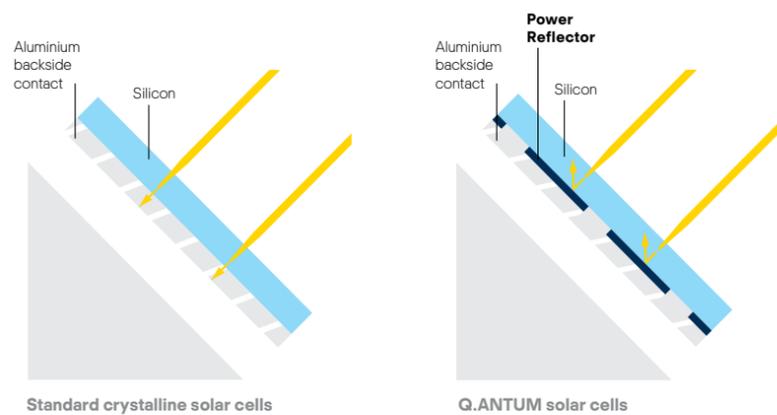


Our Q.ANTUM solar cells are treated with a special nano coating that allows more sunlight to be reflected back through the cell to generate more electricity. Q.ANTUM Technology combines our patented rear-side passivation with an optimized power reflector and advanced silver paste printing technology. The result has been a new world record in polycrystalline solar cell efficiency. Buoyed by having the most efficient solar cell in the world, we increased the production of Q.ANTUM solar cells and have now manufactured more than 10 GW of Q.ANTUM solar cells as of 2018. Recently, we began mass production of our monocrystalline Q.ANTUM solar cells, which have an efficiency rating of up to 22.1 %.

In 2017, Q CELLS introduced the Q.ANTUM DUO Technology. It combines several innovative approaches such as half-cells and round wires in order to significantly reduce both electrical and optical losses. Building upon our monocrystalline Q.ANTUM solar cells we can reach module efficiency close to 20 %. On top of the increased module power, Q.ANTUM DUO offers additional advantages which enable a higher energy yield throughout the module lifetime. The improved temperature stability pays off especially on hot days. Q.ANTUM DUO also lowers the likelihood of cell cracks improving long-term performance.

Q CELLS Yield Security is also an integral part of Q.ANTUM DUO. Its recently added Anti LID and Anti LeTID features minimized light-induced degradation to facilitate best-in-class energy yields in the long-term. Q CELLS stands by its technology and underscores its commitment by offering the new Q.PEAK DUO module series based on Q.ANTUM DUO with a performance warranty of at least 85 % in the 25th year.

**FUNCTION OF Q.ANTUM CELL TECHNOLOGY**





## QUALITY MANAGEMENT

Our products have been independently tested and verified by the rigorous and independent quality assurance program of the German certification institute, VDE. We have raised the bar even higher by implementing internal quality testing programs with higher standards than those of the VDE. Our testing standards are likely the reason we have passed all initial registration tests, including those of the IEC. All in all, Q CELLS is recognized and renowned across the global PV industry as a brand with a superior level of quality.

# QUALITY MANAGEMENT

Q CELLS' uncompromising quality and reliability is maintained and validated by a number of rigorous tests. We run our own VDE-certified testing laboratory at the largest technology and module test center in the industry. Our testing program consists of four testing levels:

## LEVEL 1 INITIAL REGISTRATION TESTS

By participating in global certification testing (IEC, UL, MCS, JPEC, and KEMCO), we guarantee the electrical and constructional safety of our solar modules in accordance with international standards.

## LEVEL 2 Q CELLS YIELD SECURITY

Our internal Yield Security program for all products combines the guaranteed resistance to Light Induced Degradation (LID), Light & elevated Temperature Induced Degradation (LeTID), and Potential Induced Degradation (PID) with protection against Hot-Spots (HSP) and product forgery (Tra.Q™).



PRODUCT RELIABILITY

# Top Performer

DNV GL's 2018 PV module reliability scorecard confirmed that Q CELLS modules achieved a "Top Performer" status

**LEVEL 3**  
**VDE QUALITY TESTED PROGRAM**

The VDE Quality Tested Program considerably supplements the initial registration tests. It is run repeatedly on a quarterly basis to ensure consistent quality and strong product security.

**LEVEL 4**  
**INTERNAL QUALITY PROGRAM**

Our own quality test, called Q.TESTED, is 2 to 3 times stricter than the global testing standard. We constantly check our products daily to make sure they meet or exceed our highest safety requirements and that they are all free of defects.

Our testing ensures outstanding durability and world-class performance even in the harshest conditions: strong wind, heavy snow loads, salt stress, aridity, high temperatures, or humidity. Accordingly, DNV GL's 2018 PV Module Reliability Scorecard confirmed that Q CELLS modules achieved a "Top Performer" status three consecutive years. Thus we not only offer the best-in-class solar modules, but also warranties against annual degradation that are unparalleled in the market.



**REQUIRED TESTS**

	IEC CERTIFICATION	VDE QUALITY TESTED	Q CELLS QUALITY PROGRAM
<b>TEST FREQUENCY</b>	Once, only for initial certification	Continuous sampling, quarterly monitoring	Continuous sampling and monitoring
<b>THERMAL CYCLING TEST (TC)</b>	200 cycles	400 cycles	Additional tests
<b>HUMIDITY TEST (DH)</b>	1,000 h	1,500 h	Additional tests
<b>HUMIDITY-FROST TEST (HF)</b>	10 cycles	10 cycles	30 cycles
<b>LOAD TRIAL</b>	•	Dynamic load test (after UV test, before TC and HF)	Additional tests
<b>HOT-SPOT TEST</b>	•	•	100 % of cell production
<b>EL TEST</b>	Only certification module	100 % of module production	100 % high-resolution, EL inspection
<b>PID TEST</b>	-	-	Monitoring of weekly production

## MANUFACTURING EXCELLENCE

Q CELLS has minimized human errors to achieve high quality through leveraging fully automated manufacturing factories, and employing an on-site communication system that ensures realtime communication between our manufacturing sites and our R&D centers all over the world. Our Smart Manufacturing Execution System (MES) installed in the plants allows for full traceability of all products, from procurement to logistics. Furthermore, our system optimizes the entire production process by maintaining an optimum balance between production scheduling, inventory holding, manufacturing, and product delivery.

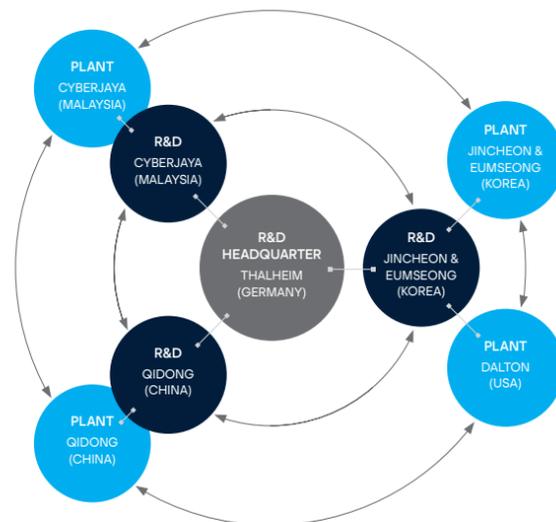


# MANUFACTURING EXCELLENCE

## Artificial Neural Network Features Errorless Evaluation in Cell Inspection.

Our Smart Manufacturing Execution System not only guarantees 100% traceability of cells and modules, from procurement to logistics, but also maintains the artificial neural networks. It is an important new feature for cell inspection enabling us to evaluate and assess all relevant quality criteria. Furthermore, our system optimizes the entire production process by maintaining an optimum balance between production scheduling, inventory holding, manufacturing and product delivery. From R&D to manufacturing and region to region, we are fully committed in active communication in order to encourage synergies among the related departments. To date, we have successfully mass-produced more than 2.5 billion Q.ANTUM solar cells.(As of 2018)

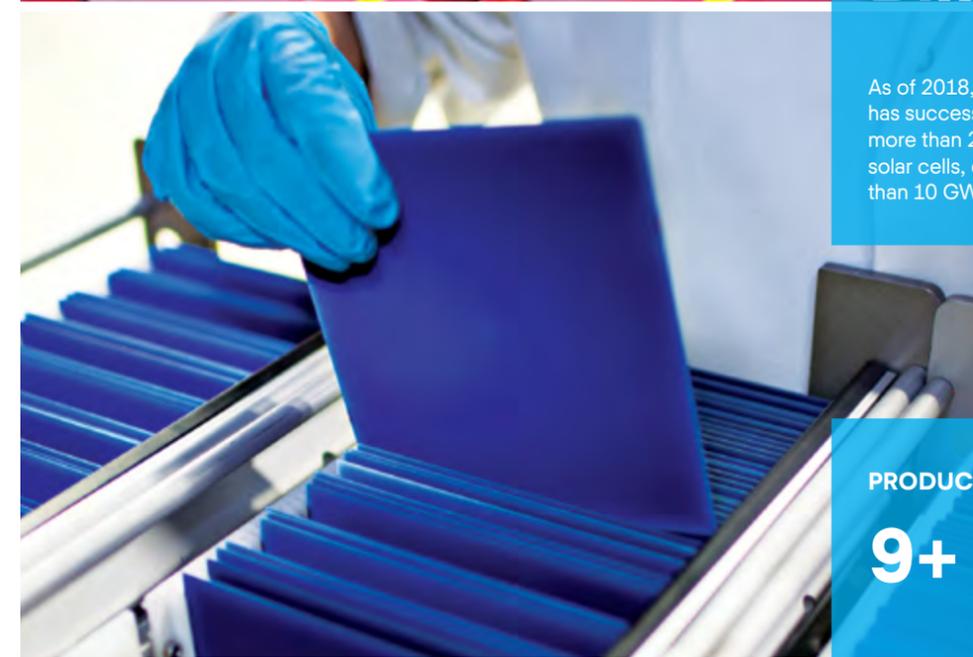
## GLOBAL MANUFACTURING NETWORKS



Q.ANTUM SOLAR CELLS

**2.5+ Billion**

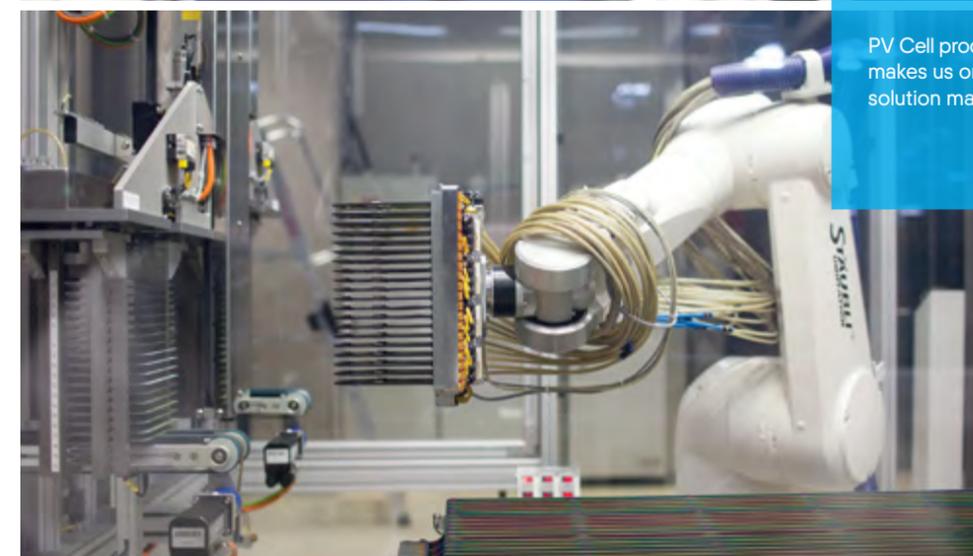
As of 2018, Q CELLS has successfully mass-produced more than 2.5 billion Q.ANTUM solar cells, equivalent to more than 10 GW since 2012.



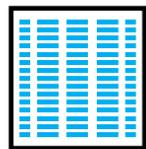
PRODUCTION CAPACITY

**9+ GW**

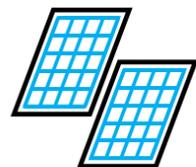
PV Cell production capacity of 9+ GW makes us one of the largest solar solution manufacturers.



# Q CELLS BUSINESS PORTFOLIO



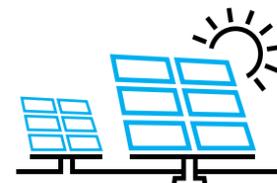
CELL



MODULE



SYSTEM SOLUTION



EPC



ENERGY RETAIL

## CELLS & MODULES



- 1 Q.PEAK DUO-G6
- 2 Q.PEAK DUO-G5
- 3 Q.PEAK DUO-G5 BF
- 4 Q.PLUS DUO-G5
- 5 Q.PEAK-G5

Equipped with award winning Q.ANTUM cell technology, Q CELLS solar modules with the highest power available at a reasonable price, maximizing energy yields and ensuring low LCOE. After increased size of each cells, our G6 modules provide larger surface area of 1.79m<sup>2</sup> which then leads to higher power classes of 345Wp for 120 half-cells. Along with Q.ANTUM DUO Technology and the enlarged size of cells, Q.PEAK DUO-G6 delivers outstanding performance under real conditions.

## SYSTEMS



- 1 Q.HOME
- 2 Q.FLAT

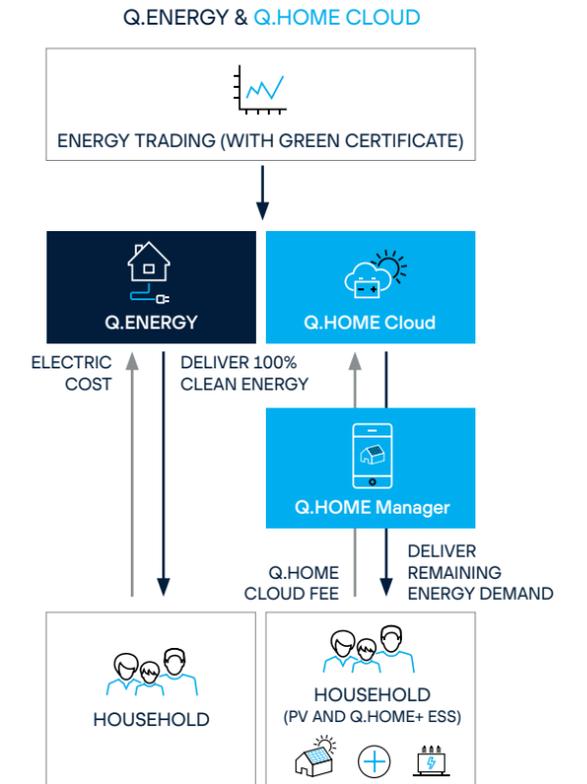
Our Q.HOME+ ESS storage systems are the ideal solution for the environmentally -friendly reduction of electricity costs for private houses and ensure a reliable long-term operation and high output. Q.FLAT-G5 is the perfect flat roof system for rapid, simple and reliable installation without roof penetration. Quick assembly minimizes installation effort, while the floating suspension of the modules also increases long-term stability and safety. With a power density of 180Wp/m<sup>2</sup> Q.FLAT-G5 is the bi-directional solution for maximum yields on flat roofs.

## EPC SOLUTIONS



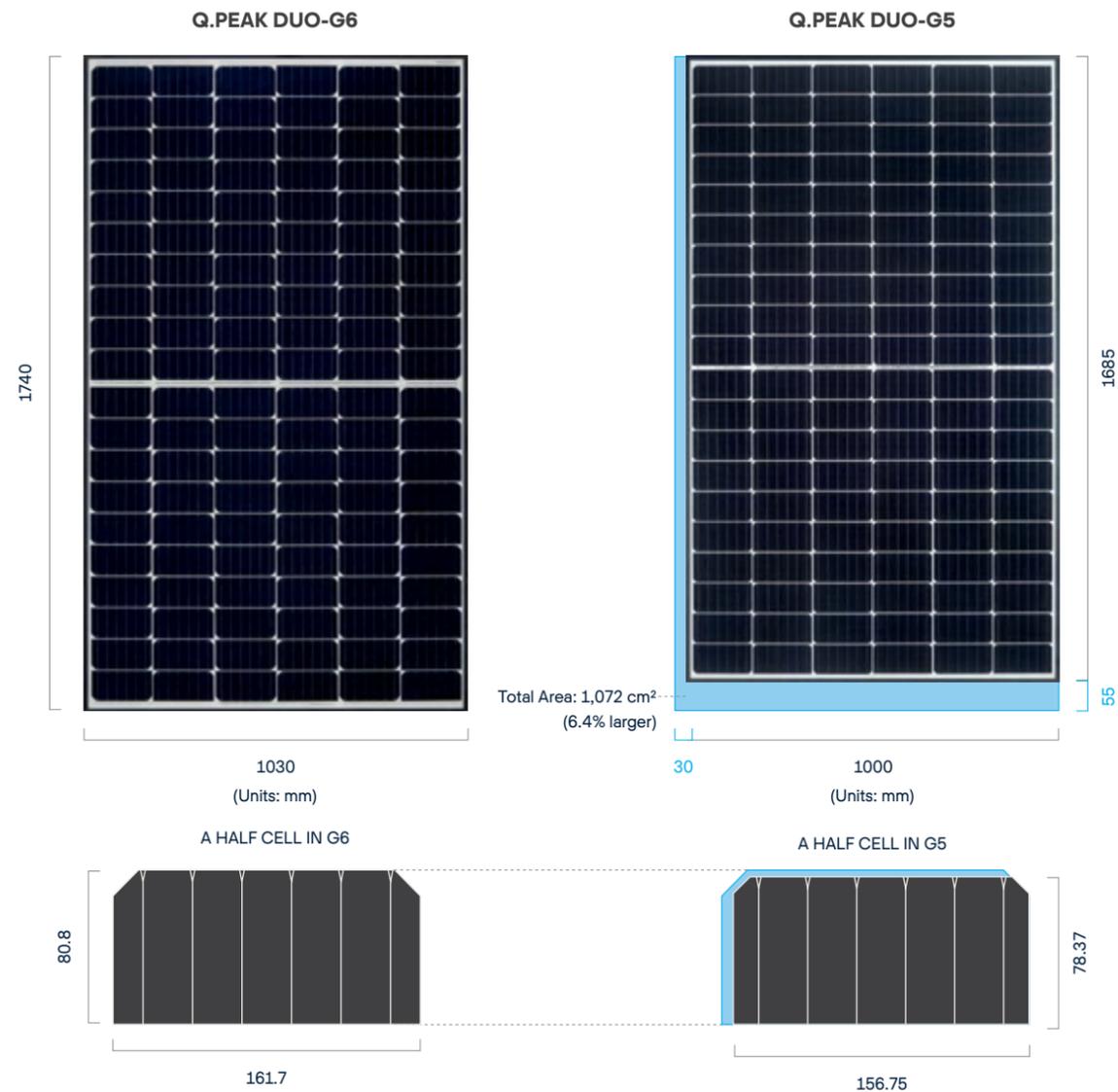
We stand at the highest level in the solar business through financial strength, expertise, top-class product, and excellent EPC services. These factors materialize our value of bankability and reliability, so we can provide the highest level of EPC business services. A solar power plant can both be a highly reliable source of energy supply and a competitive economic investment. Q CELLS' expertise will be your key to a sustainable investment in solar energy.

## ENERGY RETAIL



Q CELLS develops, delivers, and supplies green electricity with roots in solar energy. Q.ENERGY is the answer to our customers demand for more self-sufficiency through green electricity delivery. Everyone can become an electricity customer with Q.ENERGY. Whether you already have a PV system in operation, Q CELLS can still provide what you may choose from Q.ENERGY or Q.HOME Cloud. With the Q.HOME Cloud, our customers perfectly complement their energy deficit through solar energy after Q.HOME Manager's thorough control. It is possible to become up to 100 % independent of your own power consumption and to get the entire power production and power supply from a single source.

## Q CELLS NEW MODULE



## THE IDEAL SOLUTION FOR



NEW MODULE

## KEY PRODUCT BENEFITS

powered by **Q.ANTUM DUO** Q.ANTUM DUO TECHNOLOGY

### Q.ANTUM TECHNOLOGY

Q.ANTUM Technology is a combination of Q CELLS' advanced technologies. Q CELLS modules achieve higher yields per surface area, have lower BOS costs, reach higher power classes, and boast excellent efficiency rates.

#### PERC TECHNOLOGY

The rear surfaces of solar cells are treated with a special nano coating that functions much like a typical household mirror. Rays of sunlight that would otherwise go to waste are reflected back through the cell to generate more electricity.

Standard Crystalline Solar Cells

Q.ANTUM Solar Cells

Aluminium Backside Contact

Power Reflector

Silicon

#### ENGINEERED IN GERMANY

Q CELLS modules are engineered in Germany. We constantly explore new methods and technologies to maintain our leading global position at our headquarters for Technology and Innovation in Thalheim, Germany.

#### VDE QUALITY TESTED

Q CELLS modules have been certified by the strict Quality Tested Program of the VDE certification institute.

#### Q CELLS YIELD SECURITY

The Q CELLS Yield Security of guaranteed resistance to Potential Induced Degradation (PID), Hot-Spots, and product forgery is combined with our guaranteed resistance to Light Induced Degradation (LID).

**Q CELLS**  
Engineered in Germany

www.VDEInfo.com  
ID. 40032587

### ADDITIONAL TECHNOLOGIES

Q CELLS' new technology, combining cutting-edge advancements in cell separation technology and six busbar with wire interconnections, delivers higher yields per surface area and guarantees an 85 % performance warranty after 25 years.

#### 6 BUSBAR TECHNOLOGY

An increased number of busbars means more paths for electrons to move around with reduced resistive losses that results in 1 % power increase.

Standard 4 Busbar Technology

Advanced 6 Busbar Technology

Wider distance between busbars causes longer ways for electrons and higher resistance.

Shorter distance means less resistance and better capture of excited electrons.

#### HALF-CELL TECHNOLOGY

Two half-cells deliver greater movement in electric current due to shorter distance in between the cells that results in 3 % power increase.

Standard 4 Busbar Technology

Half-Cell Technology

Two half-cells with 6 busbars have the same or even greater output as a full cell with 12 busbars.

#### WIRE INTERCONNECTION

Compared to flat ribbons, wires enable to improve in shading and light capturing effect that results in 2.5 % power increase.

Conventional Technology

Q.ANTUM DUO Technology

Ribbon

Wire

100 % of ribbon width is effective for shading.

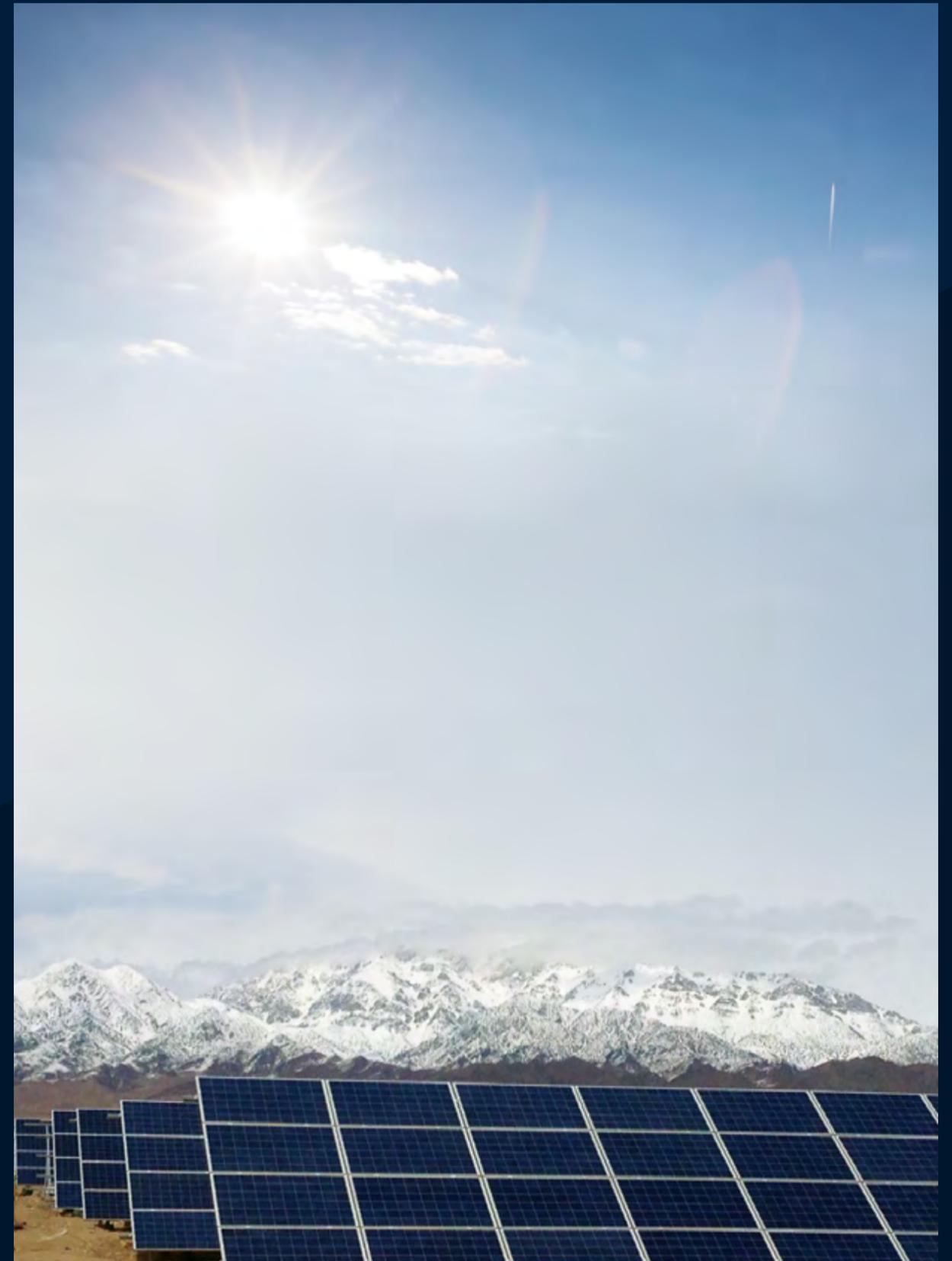
Reduced width and internal reflection decreases shading by a total of 75 %.

BUSINESS AREA

# BRIGHTER TOMORROW



We are committed to fulfilling our corporate social responsibility in areas such as social welfare, arts and culture, sports, public services, and foreign aid. Led by our parent company, more than 70 offices in South Korea and worldwide strive to share energy for life with our neighbors, communities, and the world.



# SOLAR SHARING

**Building on our world-class solar energy business, we set the standard for corporate responsibility and environmental sustainability by donating solar energy facilities to our communities**

## ENERGY SELF-SUFFICIENT ISLAND JUKDO

The island of Jukdo off the coast of Hongseong county is a small island with 70 residents in 31 households. The residents have historically depended entirely on diesel fuel for electricity. However, with the Jukdo Island project, led by our CSR activities along with participation from ten smaller enterprises, the island's main energy source – diesel fuel – will be replaced with 100 % renewable energy. The emission-free convergence power generation system will produce 210 kW of electricity using solar and wind power. The surplus energy will then be stored in a 900 kWh energy storage system (ESS) until it is needed at night or during inclement weather to serve as a stable and consistent supply of electricity. The desalination facilities that provide the drinking water for the residents will also be powered by the renewable energy. When the project is fully implemented, Jukdo will be able to reduce its carbon dioxide emissions by 200 tons per year, equivalent to the job of 41,000 trees.

## SOLAR FOREST CAMPAIGN

In collaboration with the UN Convention to Combat Desertification, we donated a solar power plant, providing power to a 3,200 m<sup>2</sup> tree nursery for the reforestation of the Mu Us Desert. 230,000 trees in the Nature Conservation Area in Tuijin Nars, Selenge, Mongolia are also planted for us to create the first solar forest in 2012. In September of 2013, the second solar forest was established in the Mu Us Desert of Lingwu City, China. We introduced our third solar forest in 2014 in Seoul, Korea, enabling children to experience nature free from dust and yellow sand. Our anti-desertification efforts also contribute to water purification and pest control. The fourth solar forest was created in 2015 at a school in Yinchuan City, Ningxia, China. Yinchuan City is home to the Hui residents.

## SUPPORTING THE GREENER DAVOS INITIATIVE

Q CELLS is supporting the Greener Davos Initiative introduced by the municipality of Davos and the World Economic Forum. Q CELLS has installed its highly efficient Q.PEAK photovoltaic system capable of 340 kWp on the rooftop of the Davos Congress Center. The solar system will help to decrease environmental impact by generating enough energy to reduce more than 20 tons of CO<sub>2</sub> emissions per year. This project is only one of our efforts to address dynamic issues surrounding our world today: climate change and the depletion of our energy resources.



Jukdo: a 100% renewable energy self-sufficient island



Solar Forest: Helping to combat desertification around the world



Davos Congress Center: Avoiding more than 10 tons of CO<sub>2</sub> emissions

# SPORTS SPONSORSHIP

Q CELLS is committed to supporting sports around the world. We believe that sports are an essential part of a healthy lifestyle among people who pursue success, and communities that foster them. Q CELLS has actively supported sports for many years including baseball (LA Dodgers), European football (RB Leipzig), and golf (Team Q CELLS).

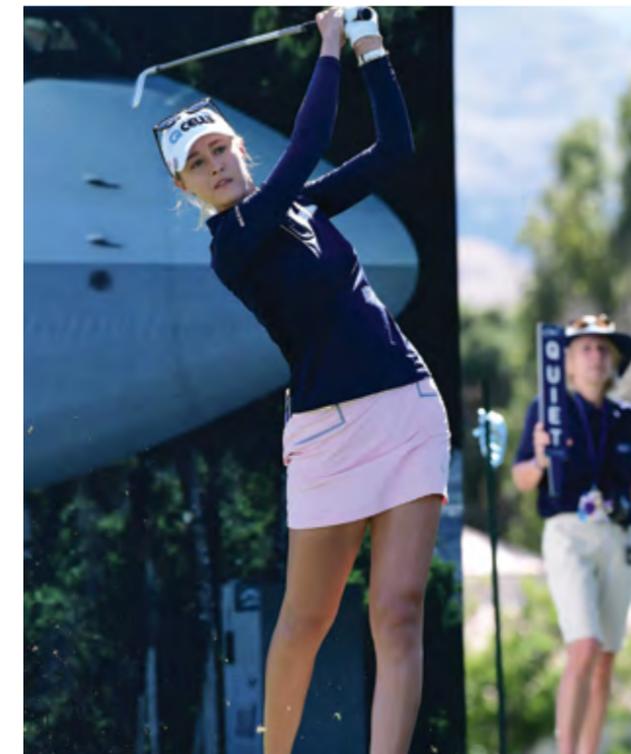
## RASENBALLSPORT (RB) LEIPZIG SPONSORSHIP

Q CELLS has become an international partner of the football club RB Leipzig starting with the 2017/18 season. RB Leipzig is a young and aspiring football club located in the eastern part of Germany, about two hours southwest of Berlin. The club was founded in 2009. Since then, RB Leipzig has made its way from the amateur fifth division to the highest professional division Bundesliga 1 in Europe by winning four promotions within seven years. The partnership with RB Leipzig is intended to increase our brand awareness among power consumers in Germany, Europe, and the rest of world to expand our customer base and partnership network.



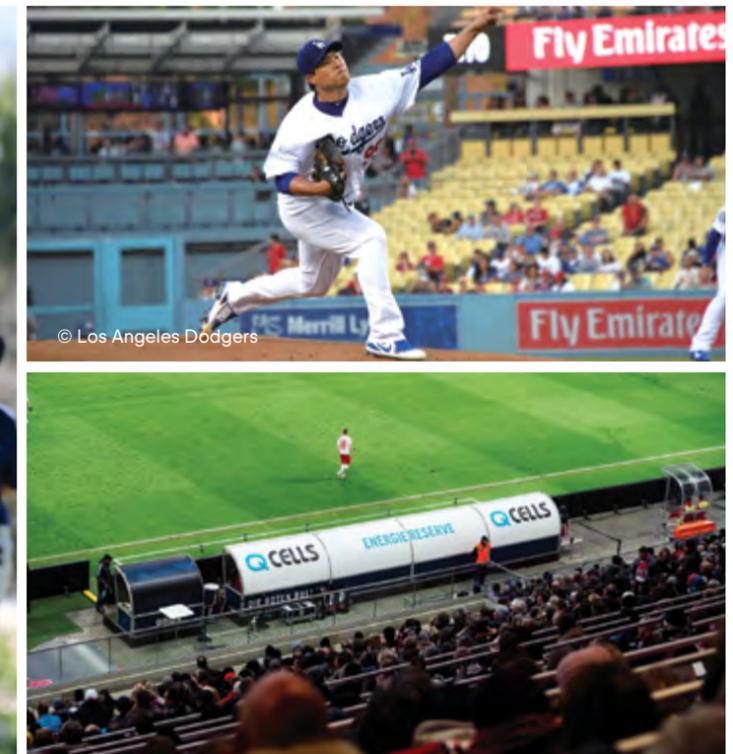
## PROFESSIONAL WOMEN'S GOLF TEAM SPONSORSHIP

The Professional Women's Golf Team was established in 2011. In 2018, the leading Solar company, Q CELLS became the Team's main sponsor. After its foundation in 2011, the team reached a record of 26 wins up until 2018 (13 wins in LPGA, 9 in KLPGA, 3 in JLPGA, and one in LET). In 2019, the team consists of 5 LPGA, 4 KLPGA, and 2 JLPGA professional golfers and with greater support from Q CELLS sponsorship, the team looks forward to its breaking records in increased number of wins. The partnership with the golf team would enhance Q CELLS' brand positioning around the world, particularly in US, Korea, Japan, and Europe while the team extends its value over LPGA, KLPGA, JLPGA, and LET.



## LA DODGERS SPONSORSHIP

Q CELLS has become the Official Solar Partner of the Los Angeles Dodgers starting with the 2019 season. The Los Angeles Dodgers franchise, with six World Series championships and 23 National League pennants, is dedicated to supporting a culture of winning baseball, providing a first-class, fan-friendly experience at Dodger Stadium, and building a strong partnership with the community. With the highest cumulative fan attendance in Major League Baseball history, and a record of breaking barriers, the Dodgers are one of the most cherished sports franchises in the world.



Q CELLS is further cementing its position as a leading solar company in the United States while developing a home run partnership – a perfect blend of market-leading PV technology and table-topping sporting excellence.

# OUR RELIABILITY IS PROVEN

Our accomplishments have taken us from the Pacific Rim to the European continent. That growth stems from a marriage of innovative technology and the fact that we deliver integrated, efficient solutions across the entire value chain.



**MIDWAY – PECOS COUNTY,  
TEXAS, USA**

**237 MWp**  
2018

The Midway project is located on 1,500 acres of land in Pecos, Texas and is currently under construction. The scope of work includes the design build of the PV array, including the sub-station and 345 kV gen-tie line, and engages over 400 people in the construction process. The Midway project will utilize more than 680,000 Q CELLS Q.PLUS L-G4.2 345 W modules. Once completed in late 2018, the power plant will generate enough electricity to power more than 50,000 homes annually with clean, renewable energy.

**WHEATS – SAN JOAQUIN,  
CALIFORNIA, USA**

**25 MWp**  
2018

The Wheats project is located in San Joaquin, Fresno County, California and will be commissioned in the summer of 2018. This project is one of three similar-sized projects completed in the same area in recent years and provides employment for close to 200 people. This ground mount tracking solar array design includes a substation and 70 kV gen-tie line connecting to the local PG&E substation.



ELAZIG PROVINCE,  
TURKEY

**55.7 MWp**  
2018

The four Elazig power plants in Turkey, with the total capacity of 55.7 MWp, was installed in 2017 and 2018. A total of 125,925 Q.PRO & 77,484 Q.PLUS solar modules are provided for the project and Q CELLS runs the main operation & maintenance contractor.

JONUNY,  
POLAND

**6.4 kWp**  
2018

The photovoltaic installation was integrated into the appearance of the building. As a result, it is not only an additional element but an integral part of the building. This project deserves attention because aside from the obvious practical function, it also plays an aesthetic role, showing the beauty of home photovoltaic.



KLEVE,  
GERMANY

**1.25 MWp**  
2018

Since 2015, B&W Energy has installed two photovoltaic systems with a total output of around 1.25 MWp. The generated solar power is used to operate our machinery and thus reduces the amount of externally sourced electricity. During our downtimes, the solar power is fed into our supplier's grid. The second photovoltaic system (749 kWp) included around 2,500 high-performance Q.PEAK-G4.1 solar modules from Q CELLS.

WOHRATAL,  
GERMANY

**7.9 kWp**  
2018

The installer and customer are very satisfied about the optically homogeneous Q.PEAK DUO-G5 modules on the roof. With just 24 modules, a high power output can be distorted. The installer highlighted the simple assembly. It is optically one of the most prominent objects that integrate the module with the built-in optics.



**Q CELLS provides**  
**affordable and smart energy solutions**  
**through technology and innovation to**  
**create a sustainable future for the planet.**

**KAWASAKI-SHI,  
JAPAN**

**8.41 kWp**  
2017

In 2017, the residential housing from Kawasaki-shi of Japan included solar power system from the construction stage. Q CELLS' Q.PEAK BLK-G4.1 are installed in two buildings with 4.35 kWp and 4.06 kWp, respectively.

**BAROSSA VALLEY SA,  
AUSTRALIA**

**90.0 kWp**  
2018

For Barossa vintners, the sun is not only used to ripen grapes for their popular wines, but it also powers a 90 kWp solar system with Q CELLS modules, reducing CO<sub>2</sub> emissions for the vineyards by 22 % and, not least of all, saving it some 19,000 € in electricity and maintenance costs per year.



Company Brochure 2019-07\_Rev03\_EN

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