

# THE ADVANTAGE OF QUALITY

*SOLAR TECHNOLOGY MADE IN GERMANY*

REN ENERGY SOLAR

**REI** 



What does REN ENERGY stand for?  
What drives us? What is our vision?  
In clear and simple terms –  
to build the solar world of tomorrow, today.



The REN ENERGY commitment to sustainable energy goes back more than 30 years. We believe energy should be supplied not only in accord with the requirements of people, but also with those of the environment. To achieve this goal, we produce premium quality solar modules and solar system solutions in Germany. Quality is the determining factor in our production processes, as well as in our products. Our actions are designed to achieve the highest levels of quality. This is our corporate policy and the pillar of our success. REN ENERGY quality means our solar modules are very reliable, which is seen as a major selling point by customers who know to only invest in the best solar arrays. A solar array is just like any other investment: you have to invest in quality if you want guaranteed returns.

REN ENERGY quality means: everything comes from a single source. From the source material silicon, to the production of wafers and solar cells, to solar modules and custom-made system kits, we cover all stages of the value chain. This is one of the secrets behind our integrated quality assurance.

We rely on German quality standards and a coherent quality system: a thorough quality test is conducted after every single manufacturing step and at all levels of production. Before leaving the factory, each and every one of our solar modules is carefully inspected.

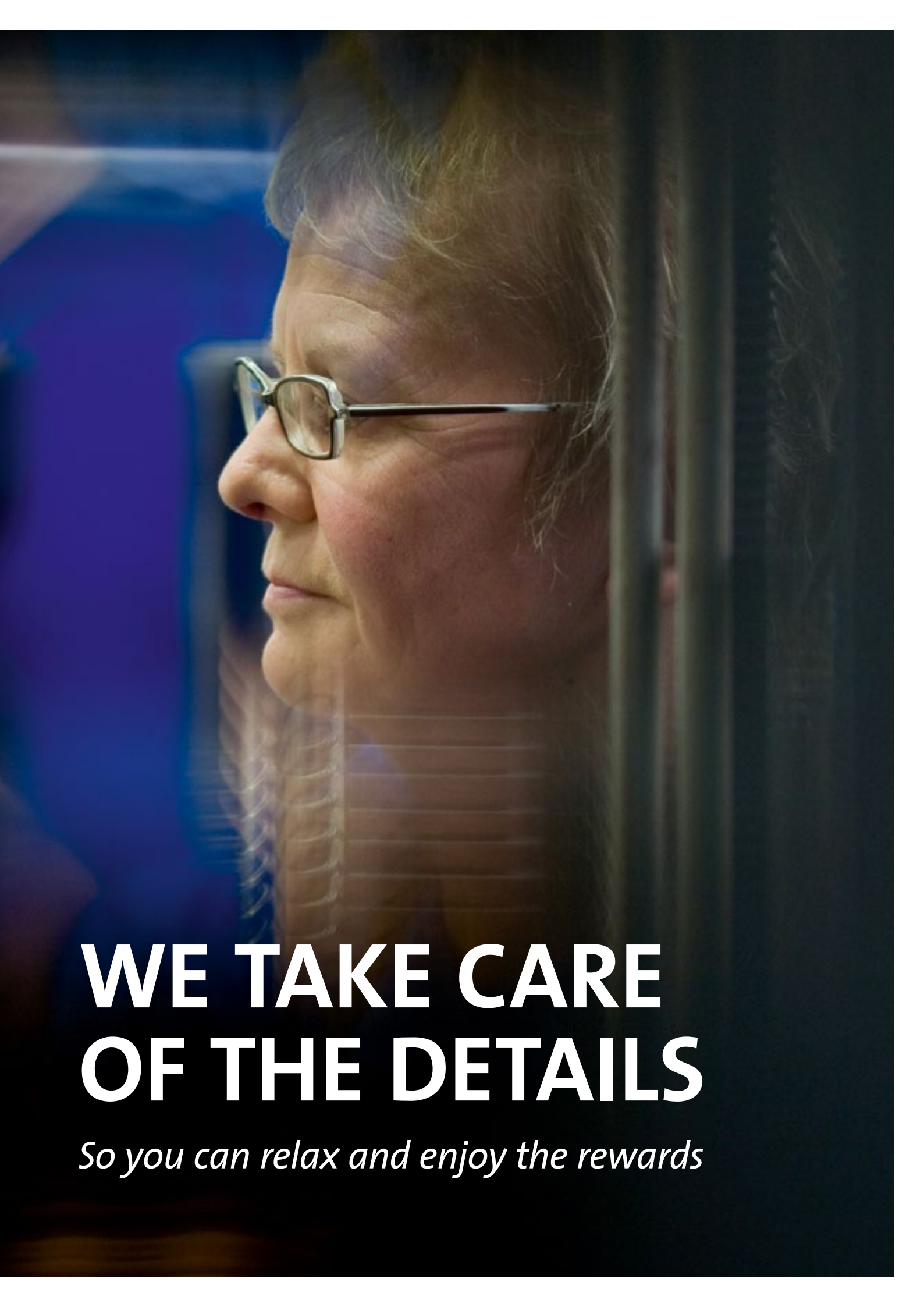
REN ENERGY quality means: we always take the decisive step forward. In our module testing laboratories, products and materials undergo meticulous and detailed inspections that actually exceed international standards. Every single test helps improve the quality of our solar modules. This ensures that only first-class products leave our factories.

We combine expertise and passion to produce the highest level of quality in Germany and improve the quality and efficiency of our products every day. All sites, departments and REN ENERGY employees are totally committed to this policy.

Our customers reap the benefits of SolarWorld quality with excellent yields, long-lasting product efficiency and therefore safe long-term investments.

Sunny regards,





# **WE TAKE CARE OF THE DETAILS**

*So you can relax and enjoy the rewards*

## *We take care of the details*

### So you can relax and enjoy the rewards

By the time our solar modules are installed on your roof and begin turning solar energy into clean electricity, they have a long and arduous journey behind them. This is because we tolerate zero errors in ensuring the highest level of quality.

Our pursuit of the highest quality for our solar modules forms the basis for everything we do, from inspecting incoming goods to monitoring manufacturing processes and carrying out tests in the module testing lab. But, this still isn't enough for us. We go one step further by having the characteristics and capabilities of our solar modules tested and certified by independent testing institutes.



## *'Power Controlled' by TUV Rheinland*

We never make promises we cannot keep, which is the reason why SolarWorld is one of the few manufacturers to have been awarded the 'Power Controlled' certificate of TUV Rheinland. The 'Power Controlled' inspection mark guarantees that the power ratings specified for our solar modules are maintained and regularly monitored by an independent test provider. Our solar modules therefore supply the amount of power – or more – we promised they would.

Every year, TUV Rheinland monitors and calibrates the luminous intensity, spectrum and homogeneity of the flasher in the SolarWorld production. The productive capacity of the solar modules is measured with the flasher. For consumers and investors of SolarWorld modules, proven power production means that investment and projected yields are secure.

According to external and independent tests by TUV Rheinland, the performance of our solar modules exhibits a mere two percent measuring tolerance. No other manufacturer can give such an exact value. This means, our customers can be sure of reliable solar module system performance, and therefore also of their effective yield.



## *PV+Test front-runner*



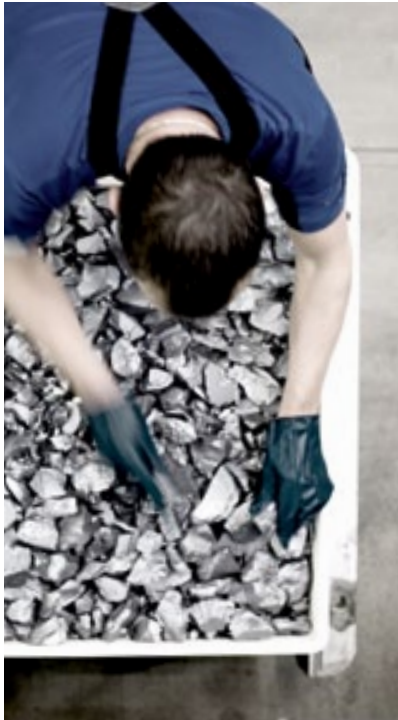
Top quality can be measured: even PV+Test agrees. The Sunmodule Plus SW 245 poly was the only module to receive the prestigious “excellent” classification in the new, more rigorous testing process. The test evaluates factors such as durability, electrical safety, workmanship, performance, documentation and guarantee. Our solar module scored top marks for electrical safety, documentation and guarantees. We also achieved excellent results in the categories of thermal cycling test and damp heat test. The examiners were especially impressed with the outstanding workmanship of our solar modules – a decisive factor affecting durability.

## *Excellent resistance*



TUV Rheinland and the American testing institute PV Evolution Labs both endorse our solar modules’ excellent resistance to decreased performance caused by potential induced degradation (PID). This kind of performance degradation can occur if a solar module is exposed to high voltage, for example, in a ground-mounted installation containing several solar modules connected in a series. Our solar modules were subjected to the PID test four times in direct succession, but even this amount of stress could not cause any harm to our modules. High humidity may increase potential induced degradation, too. So as part of their testing, PV Evolution Labs also exposed our solar modules to extremely high levels of humidity. Yet again, our solar modules could easily withstand these adverse conditions.

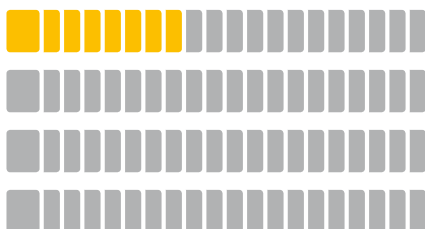
☀ From left to right: silicon in a mold | material qualification | quality assurance



## Material qualification

All the materials used in the production of our solar modules first undergo thorough testing to establish their suitability as a production material. We subject glass, film and junction boxes to intense testing – individually and in combination with other materials – and expose them to stress repeatedly. We do everything a manufacturer can possibly do: materials are tested mechanically, electrically, thermally and visually. This way, we can be certain that only the very best materials are used for our solar modules.

### BACKSHEET



☀ There are over 80 different kinds of backsheets on the market, yet only 8 meet our solar module quality standards. The remaining 72 backsheets do not come into consideration for our modules.

There are over 80 different kinds of backsheets on the market, yet only 8 meet our solar module quality standards. However, we narrow down the selection even further. Only 3 of these backsheets are deemed good enough to be used in the production of our solar modules.

Our solar modules' backsheets can withstand extreme weather conditions and UV radiation. They are designed to endure harsh environmental factors and protect the solar module for many years. We also make sure the backsheet perfectly matches the materials of the other components, as this is the best possible way to guarantee the durability of our modules.



# Material development

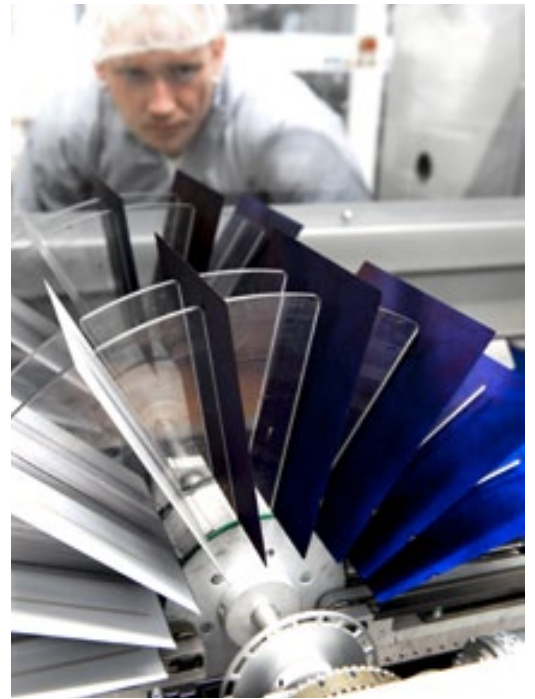
We develop and optimize many of our materials ourselves in collaboration with our suppliers. Both our patented junction box and our module frame were developed by SolarWorld.

## **JUNCTION BOX**

Our highly robust and secure junction box has many advantages. Efficient heat dissipation due to the compact design ensures that an ideal temperature is maintained. The junction boxes are automatically attached to the back of the solar modules and are then welded to contacts to establish electrical connections. We consciously do more than simply solder the box's connections in the usual way. Our fused connections ensure optimum safety at peak mechanical and thermal loads. In the final step, the junction boxes are filled with high quality silicone to help protect the contacts against corrosion and mechanical loads. Both the function of the patented junction boxes and the quality of the silicone are systematically tested for perfection. This ensures that only safe solar modules with perfect junction boxes leave the SolarWorld production lines.

☀ From left to right: junction box | aluminum frame and corner keys





 From left to right: safety glass | quality control for solar cells

## *Material testing*

All module components that arrive at our production plants are subjected to the sharp-eyed inspection of experienced technicians. Only high quality and flawless materials are allowed to enter the production cycle. Particular attention is given to materials designed to protect the solar panel from wind and weather such as safety glass and back sheets.

### **SAFETY GLASS**

The geometric properties of safety glass, which includes warping, perpendicularity, dimensions and edge finish, undergo careful visual inspection. Any glass found to have inclusions, bubbles or edge damage is removed. Material properties and tolerances are precisely defined in quality assurance agreements and must be adhered to. Materials that are not subject to such agreements are not allowed to continue into production. We have good reason for upholding these extremely high quality standards – our solar modules need to withstand the heavy winter snow loads that can occur in mountainous regions. Therefore, we use relatively thick, low iron glass and pay particular attention to high mechanical strength. A special anti-reflection coating ensures optimization of both efficiency and yield. As a result, our modules can easily deal with extreme loads.

### **SOLAR CELLS**

At REN ENERGY, everything comes from a single source. We only use solar wafers made by SolarWorld and our highly efficient solar cells in the production of our solar modules. Our cell production processes are adapted specifically for the materials used in later stages of the solar module production. We test each and every cell meticulously based on visual and electrical criteria before it graduates to the next phase of manufacturing.

## Numbered – batch tracing

The module glass is given a serial number at the very beginning of the production process. This number is printed as a bar code on the inner side of the glass and makes it possible to trace each and every sheet of glass seamlessly through the entire production chain. For each solar module, we not only record which production phases have been completed using the serial number, but also the results of the flasher and safety tests, the quality rating and all the logistical data. The serial number also allows us to keep track of what materials were used in each solar module. We keep permanent records of all of this data and can verify, down to the batch, all performance-related data of each and every solar module until the end of its service life.

## Linked – the stringer

The so-called stringer is responsible for serially interconnecting solar cells into cell strings. In an automated process, the cells' front is connected via three soldering strips to the back of the adjacent cell. Each cell and each string is monitored for chips using two camera systems. They check the cell spacing at the same time. The soldering quality is inspected by a peel test. Four to six cell strings make up a cell matrix. A fully automated matrix unit places the strings on a prepared sheet of solar glass with film and connects them into one unit. Each and every step of the process is monitored – electronically and by trained employees.

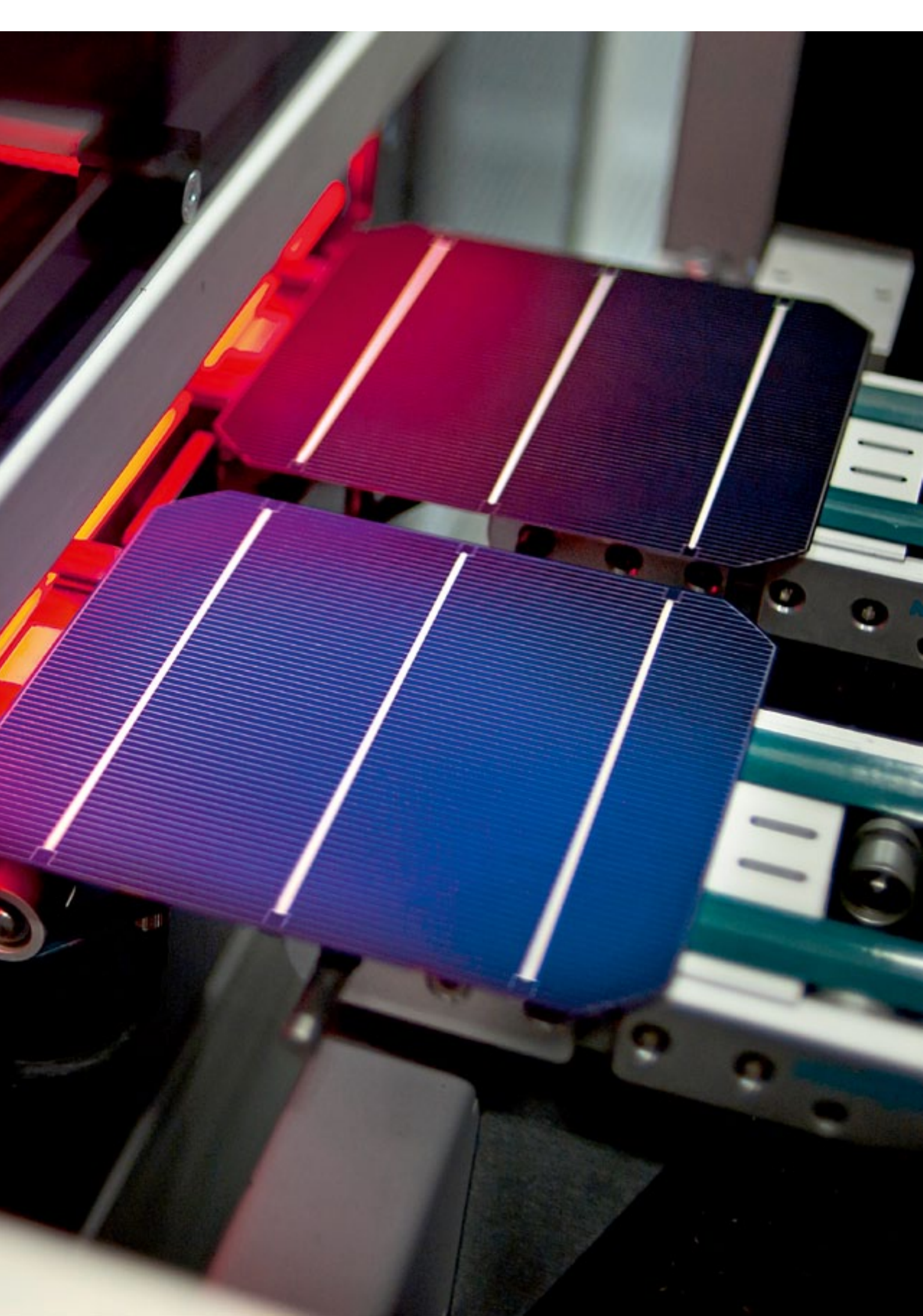
 From left to right: module glass coding | string production





**WE DO NOT JUST PER-  
FORM, WE GUARANTEE  
PERFORMANCE**

*So your investment works out*



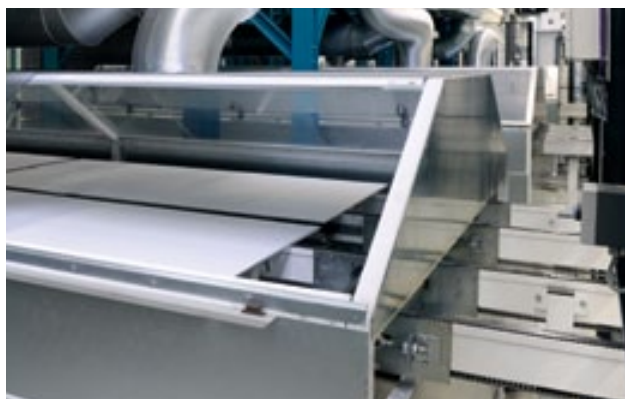
## Baked – the laminator

Lamination is an essential process for the quality of our solar modules and an important cornerstone of durability and performance. Wind and weather demand much from solar modules. A laminator is a large vacuum furnace that laminates solar glass, film and solar cells at high temperatures, creating a weather-resistant unit. We conduct regular peel tests to make sure bonding between the individual laminate components is stable and resilient. A strong and stable matrix prevents individual unit components from separating from each other. During process control, temperature and pressure are constantly measured automatically via sensors in the laminator to ensure homogeneous distribution. Our experienced module specialists examine the laminations carefully. Front, back and edges have to be in perfect condition before they can continue to the next processing stage.

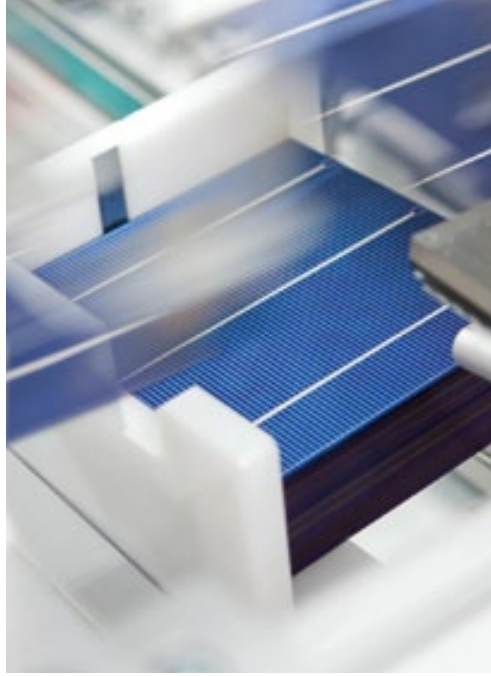
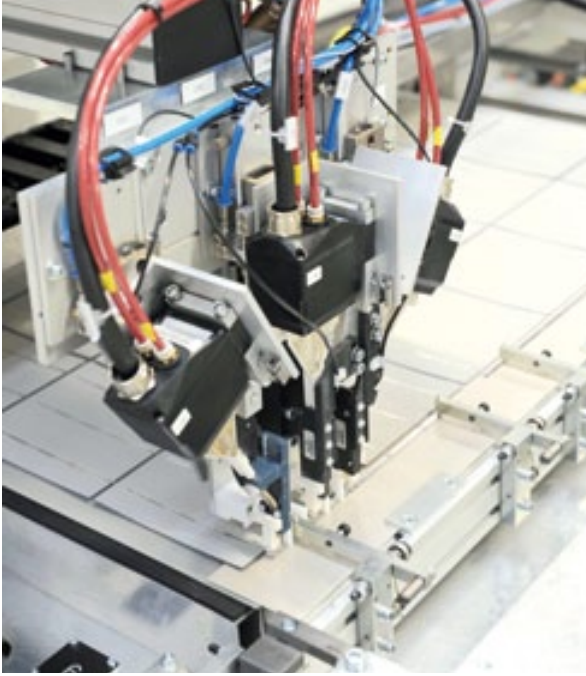
## Flashed – the flasher

The peak performance of each solar module is measured in a flasher. Under standard test conditions (STC), the solar module is flashed in a dark lab chamber with  $1,000 \text{ W/m}^2$  at a cell temperature of  $25^\circ\text{C}$ , an irradiation angle of  $90$  degrees and an air mass 1.5 light spectrum. The current-voltage characteristic is recorded during this process. This is a real benefit for our customers as it indicates the actual performance of the solar module. The electrical safety of the solar module is also tested in the flasher. After being measured, our solar modules are categorized according to performance. We only deliver solar modules with at least nominal power performance or higher. We call this process 'Plus Sorting' and consider it to be synonymous with the highest level of efficiency.

We put a lot of effort into making sure our flasher is precise. Accurate measurement is crucial since it determines the nominal performance of each individual solar module. Our process control includes regularly monitoring and calibrating the flasher using reference modules from TUV Rheinland. TUV Rheinland, an independent service provider, is responsible for the annual calibration of the sunlight simulator as part of its power controlled certification. They test homogeneity, luminous intensity and spectrum. In addition to this, every month the SolarWorld's own module testing lab and TUV Rheinland test random samples from the solar module production for performance and quality. One cannot get better than that. We are so sure of the outstanding quality of our solar modules that we are prepared to give customers a 25-year linear performance guarantee, as well as a 10-year product workmanship warranty. For the Sunmodule Protect series we even offer customers a 30-year linear performance guarantee, including the 10-year product workmanship warranty.



 From left to right: laminator | flasher



☀ *From left to right: soldering the string cells | production of solar cells | solar module*

## *Screened – electroluminescence measurement*

Every solar module is screened at least two times in its production process. In the first stage, each cell matrix is checked for possible cell breakage or faults before being laminated. Even in the final phases of the production process our commitment to quality remains strong and we insist on the strictest quality controls. A final electroluminescence measurement is carried out on every single solar module, and those that pass are subjected to a final visual check by our experienced technicians before being approved.

## *Fully automated – our production facilities*

The quality of our products is guaranteed by fully automated systems, seamless process and material flow monitoring, regular electrical and visual measurement, as well as the inspection of intermediate products. Our production facilities were constructed according to our specifications and our standards of quality. Solar cells are produced using a fully automated procedure whereby manual handling of the cells is not necessary. Even the glass and film are attached fully automatically. The junction box is checked once more to ensure flawless functionality before it is attached to the back of the module. Even the attachment of our module frames and the insertion of the silicon sealing material are performed automatically.

## Proven performance

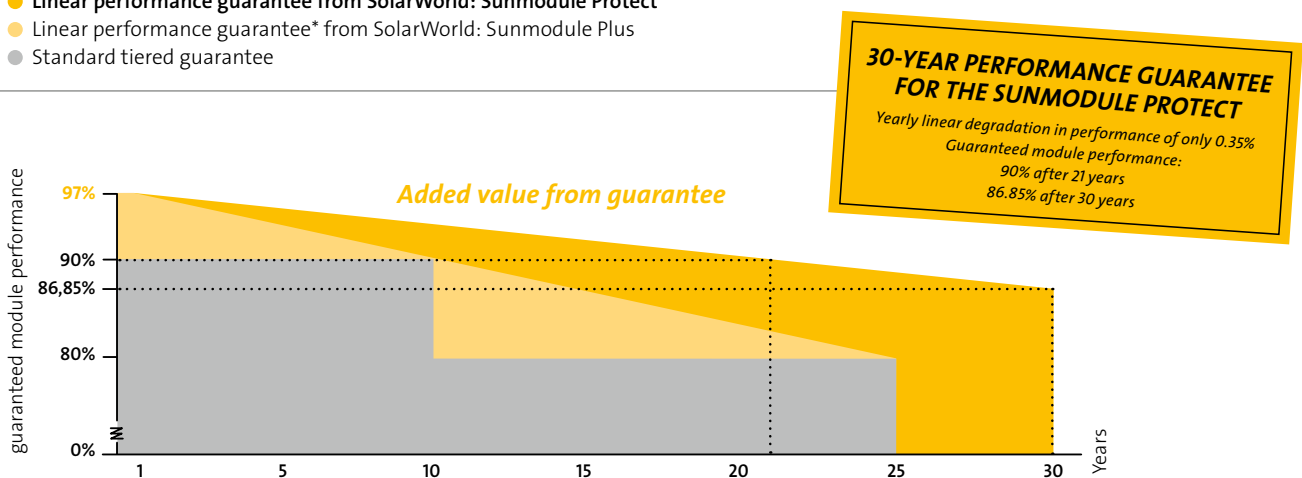
The performance of every single solar module is measured in a flasher. Under standard test conditions (STC), the unit is flashed with 1,000 W/m<sup>2</sup> at 25°C, an irradiation angle of 90 degrees and 1.5 air masse light spectrum.

Decisive for our customers is the recorded current-voltage characteristic, which gives the actual performance of the solar module. The electrical safety of the solar module is also tested in the flasher. After being measured, our solar modules are then categorized according to performance. We only deliver solar modules with at least nominal power performance or higher. We call this process 'Plus Sorting' and consider it to be synonymous with the highest level of efficiency. We put a lot of effort into making sure our flasher is precise. Accurate measurement is crucial since it determines the nominal performance of each individual solar module. Our process control includes regularly monitoring and calibrating the flasher using reference modules from TUV Rheinland. TUV Rheinland also tests flasher accuracy in its annual 'Power Controlled' certification procedure.

In addition to this, every month the REN ENERGY module testing lab and the TUV Rheinland test random samples from the solar module production for performance and quality. Our commitment to quality is demonstrated by our guarantees: we offer our customers a 25-year linear performance guarantee for the Sunmodule series and a 30-year performance guarantee for the glass-glass Sunmodule Protect module. Both solar modules also come with a 10-year product workmanship warranty.

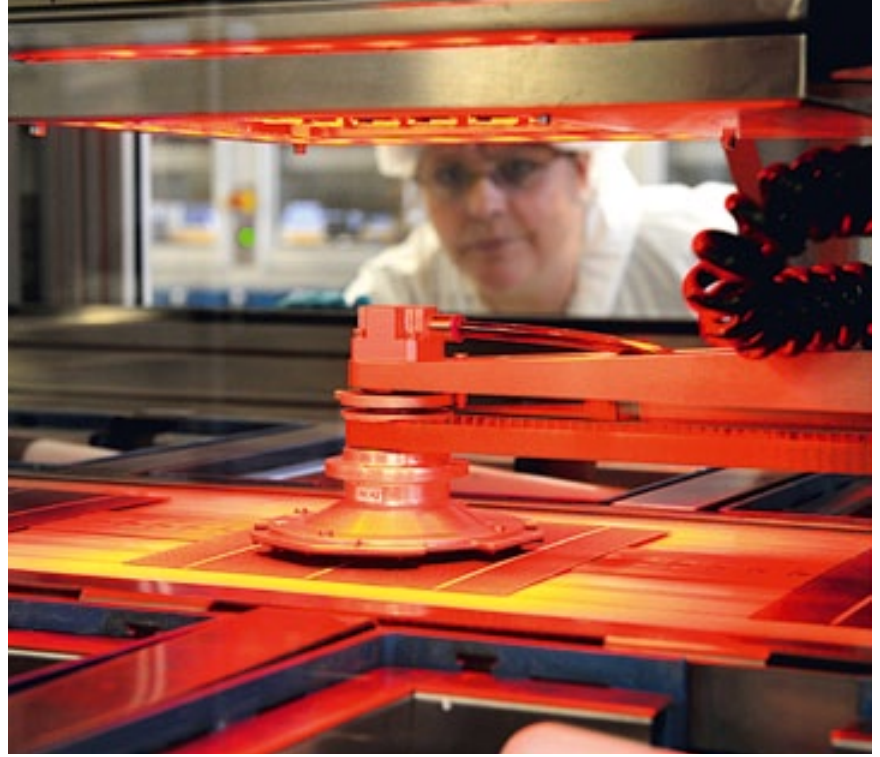
### Linear performance guarantee\*

- Linear performance guarantee from SolarWorld: Sunmodule Protect
- Linear performance guarantee\* from SolarWorld: Sunmodule Plus
- Standard tiered guarantee



\* in accordance with the applicable SolarWorld service certificate upon purchase | [www.solarworld.com/service-certificate](http://www.solarworld.com/service-certificate)





## *Long-term tests*

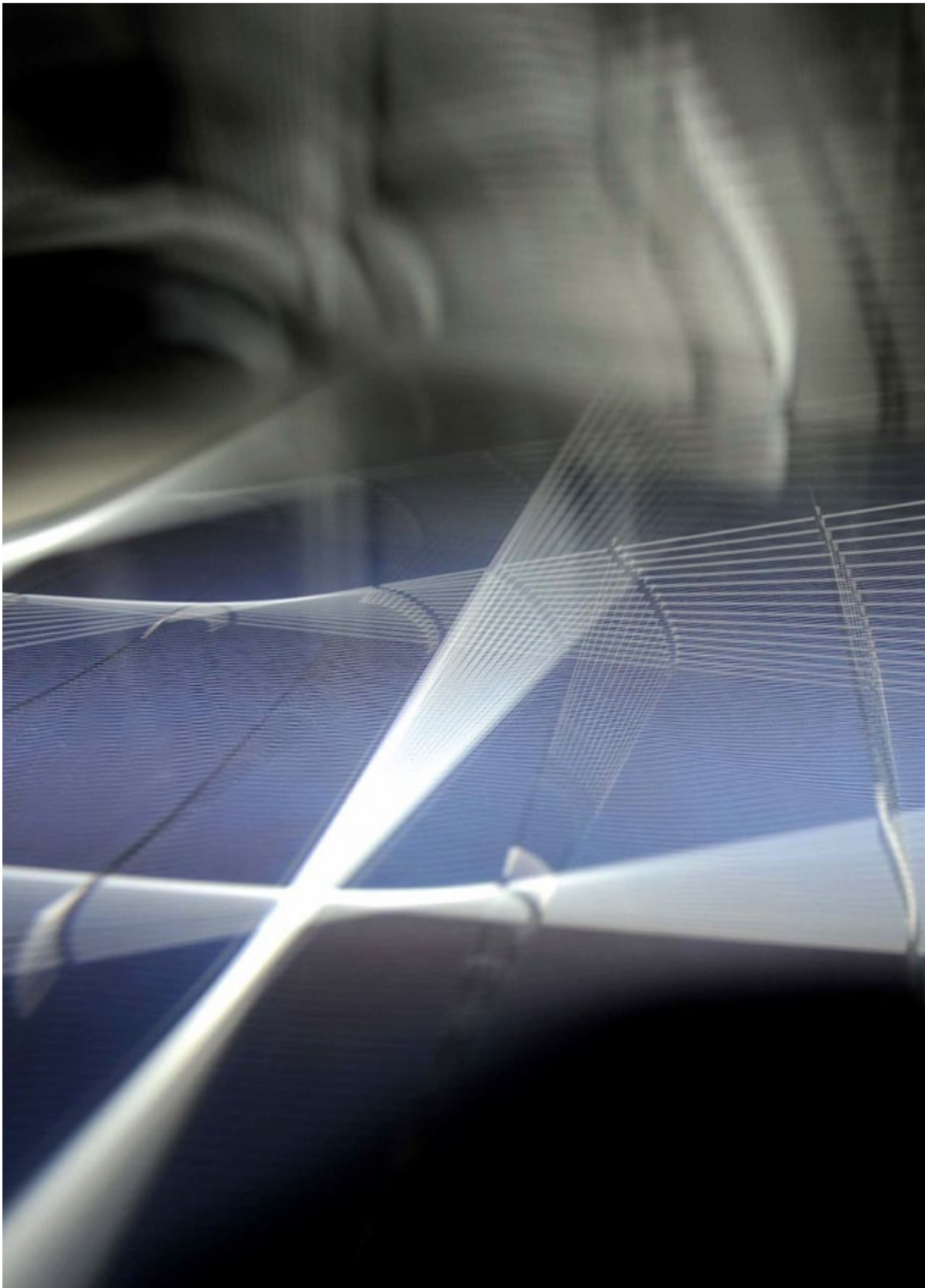
What actually happens to installed solar modules during their life cycle? How does their ability to perform change over time? Our specialists carry out long-term tests to find the answers to these and similar questions. The lessons they learn are incorporated into product development so that we can continually improve the durability, safety and efficiency of our products.

The entire life cycle of a solar module is simulated in a long-term test in a climate chamber. The International Electrotechnical Commission (IEC) issues internationally valid standards for solar modules and specifies the different climate chamber tests to be conducted.

### **INTERNATIONAL STANDARD TESTS**

We carry out many more tests than required by international standards (IEC/UL). These tests help us improve the quality of our products by providing valuable information on the behavior of our solar modules. In the first test cycle, we detect early failures, which may be the result of construction, production or material flaws. These tests are carried out during the product development stage and hence before the product enter the market.

Additional test cycles simulate other potential failures, such as random errors or aging due to material fatigue. By using this data we can extend the life of our products, improve their properties and reduce error rates. IEC tests are regularly performed on random solar modules taken from our production sites. These are then examined and tested for performance after each test cycle.





# **WE DO ALL POSSIBLE TESTS**

*To save you from trial and error*

## *We do all possible tests*

### To save you from trial and error

A solar module must be able to withstand a great deal. It is exposed to extreme conditions over a lot of years, including strong sunshine, biting frost, heavy storms and high snow loads. It is precisely this ability, resistance and power of endurance that we expect of our solar modules. We take materials and solar modules to their limits – so that our customers can be sure of best returns.

Our central R&D Module Testing Laboratory in Germany is located in Freiberg in the federal state of Saxony. Literally all tests that can possibly be done take place here. This facility is the first industrial laboratory in Germany to be approved by the German Association for Electrical, Electronic and Information Technologies (VDE) in accordance with DIN EN ISO/IEC 17025, meaning that the lab's quality management and working methods satisfy the rigorous standards of independent international testing and calibration laboratories. SolarWorld's US-based Quality Module Testing Lab is located in Hillsboro, Oregon. This lab maintains the high quality testing off-line accompanying production quality standards inline and cooperates closely with the R&D Department in Freiberg, Germany. The Reliability team in Hillsboro provides direct support for module production at the Oregon site.

Our specialists thoroughly test materials, prototypes and solar modules. They conduct tests to determine performance, climate chamber tests, electrical and mechanical tests, as well as UV tests in accordance with European and US standards. But we aim to do more than simply fulfill standards. In innovative test arrangements and facilities – some of which have actually been developed in the testing lab – solar modules are tested for hardness and in a much more extensive manner than required by international standards. In the testing lab, our solar modules undergo supplementary programs where standard tests are sometimes repeated anywhere from three to six times. All our solar modules must satisfy SolarWorld AG's strict performance and safety criteria, without exception. In this way we ensure the high quality of SolarWorld products for customers throughout the world.

The actual conditions under which our solar modules operate are decisive for our tests and quality standards. The aim of our module testing lab is to subject solar modules to the same exacting demands placed on them by exposure to sun, wind and weather.



 From left to right: module testing lab | UV light aging | inclined plane test



## Climate chamber tests

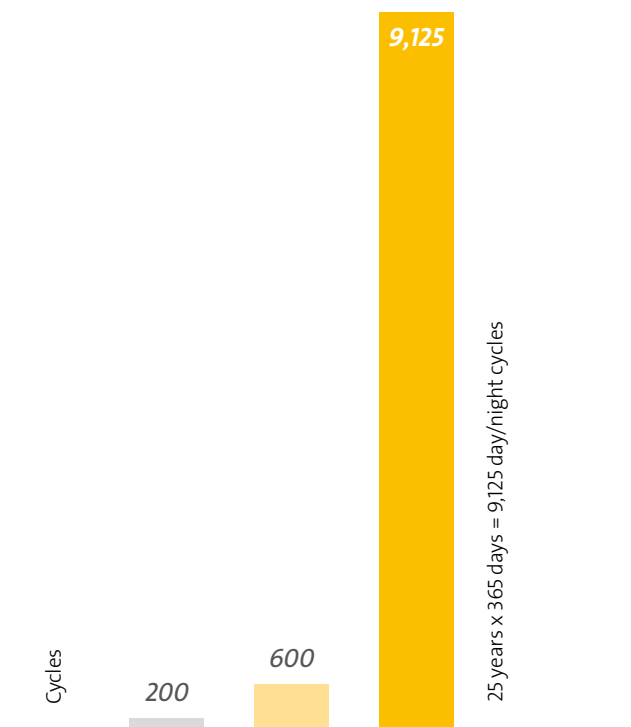
The weathering resistance of our solar modules is tested at length, not only with the temperature change test, but also with the humidity-freeze and damp-heat tests. In the process, they undergo a great many more tests than IEC standards require. In the temperature change test alone we simulate a standard 600 day and night cycles, instead of the 200 prescribed by the IEC. In the development of new module types we are even expanding the SolarWorld standard to 1,000 cycles and more.

With the temperature shock test we have developed a highly accelerated life cycle test that simulates a workload of 25 years. The test involves exposing our solar modules to  $-40^{\circ}\text{C}$  for at least 30 minutes. In a second step, within the following 10 seconds, the solar modules are put in an oven preheated to  $+85^{\circ}\text{C}$  for a further 30 minutes. We make this temperature change a total of 9,125 times, thereby exposing our solar modules to an accelerated aging process in a short amount of time. The cycle is comparable to a workload of 25 years.

Test results confirm that our solar modules are outstanding and perfectly suited for use under extreme climate conditions. And the 25-year linear performance guarantee has been thoroughly checked and secured.

### Temperature cycling tests

- IEC standard:  $-40$  to  $+85^{\circ}\text{C}$  (200 cycles)
- REN ENERGY temperature cycling test:  $-40$  to  $+85^{\circ}\text{C}$  (600 cycles)
- REN ENERGY temperature shock test:  $-40$  to  $+85^{\circ}\text{C}$  (9,125 cycles)



☀ From left to right: electroluminescence measurements | thermography measurements



## Hotspot-Test

We use a thermography camera to examine the solar modules for what are known as hotspots, which can damage the solar module over the long term. Hotspots can occur when solar module cells that lie in the shadow of a tree or chimney heat up due to residual electricity. These measurements ensure customers are supplied with best SolarWorld quality.

Cells and solar modules sometimes have defects such as micro cracks or contact breaks that are undetectable, even by the trained eyes of our experts. However, an electroluminescence measurement quickly brings them to light. Our solar modules are continuously tested with this high-resolution diagnostic technology, which is why we can guarantee that only intact and fully functional solar modules leave our premises.

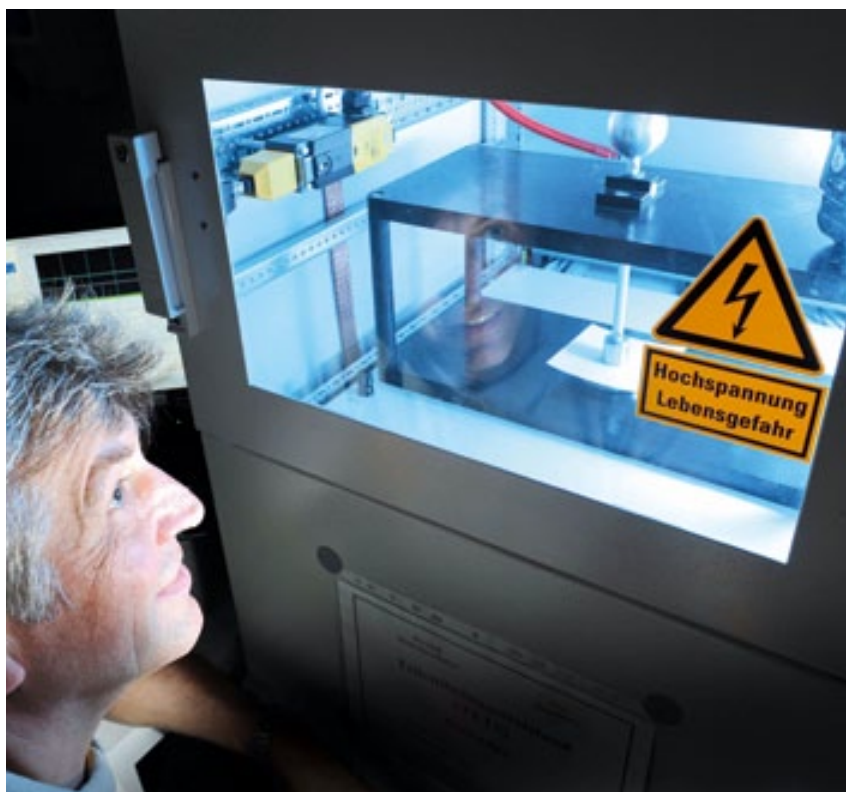
For an electroluminescence measurement, the solar module is supplied with current and operated as a luminous diode while a camera films the light that is generated. Damaged cell areas luminesce less than other areas and appear darker. A further diagnostic image system we use is thermography. Based on a thermal image made by a thermography camera, our staff is able to detect intermediate resistance, thermal zones or conduction loss in solar cells, contacts and junction box.

## *Electrical tests*

An important aspect of our solar modules is electrical safety. In electrical tests we ensure the proper insulation of our solar modules. Testing is carried out on both wet and dry conditions. We inspect the solar modules after mechanical loads have been applied, as well as following simulation of different temperature cycles. In addition, we also apply a partial discharge test to determine the reaction to high voltages. You can trust in the safety of our solar modules!

## *Mechanical load test*

In severe winter and at higher altitudes, solar modules are exposed to high wind pressure, wind suction and snow loads. Our solar modules must be capable of withstanding such extreme conditions. A mechanical load test, in which we simulate the pressure and suction forces affecting solar modules, ensures they can do just that.



 From left to right: partial discharge test | electrical insulation test



## UV light aging test

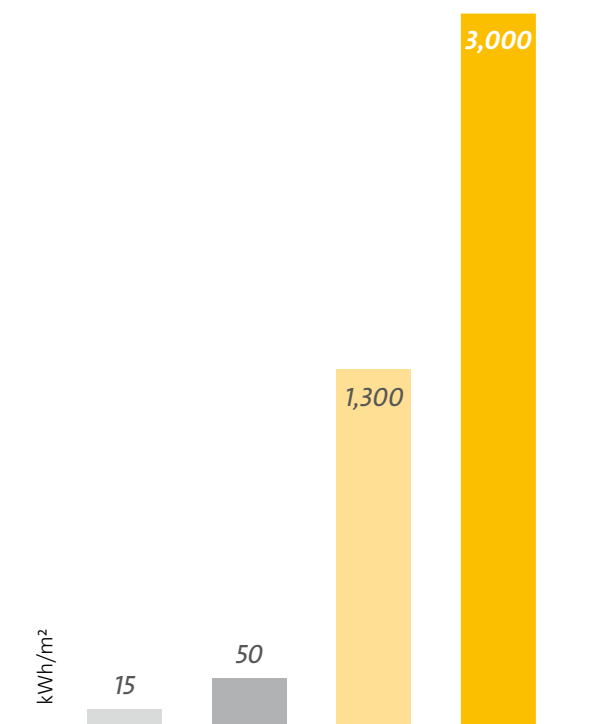
Roof and ground-mounted solar modules are exposed to many years of intense UV radiation. UV endurance is therefore a must for solar modules. We have developed a test specifically designed to analyze the UV endurance level of our solar modules.

We test the UV resistance of our solar modules at 60°C in the wavelength range 280 to 400 nanometers. The test simulates 25 years of UV radiation, which is the equivalent of 1,300 kWh/m<sup>2</sup>. By comparison, the IEC test standard requires a cumulative UV dose of 15 kWh/m<sup>2</sup>, despite the annual UV radiation in Central Europe alone being 50 kWh/m<sup>2</sup>.

Our solar modules easily withstand the rigorous UV aging test, which clearly demonstrates both durability and quality of the product materials. The excellent result of our solar modules in the UV endurance test not only qualifies them for use in Europe, but also in countries with extremely high levels of UV radiation. We simulate desert area conditions by testing up to 3,000 kWh/m<sup>2</sup>.

### UV aging test

- IEC standard
- Average UV radiation in Central Europe per year
- SolarWorld standard EU test
- SolarWorld standard desert test





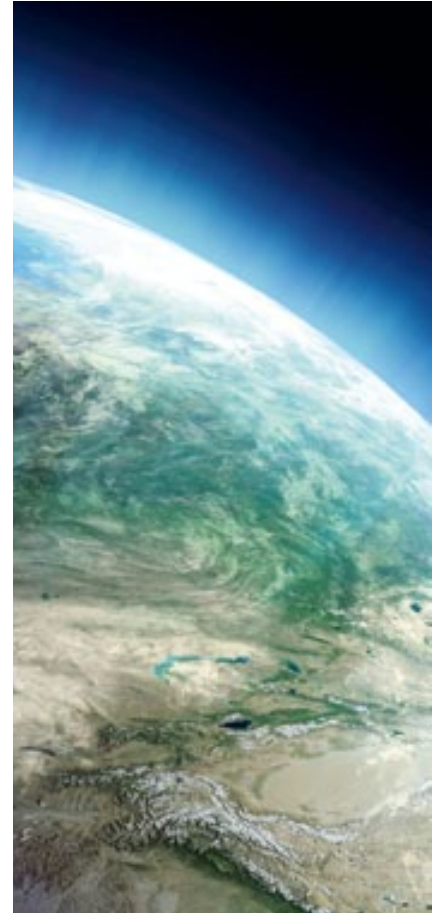
## *Inclined plane test*

Solar modules are usually installed at the same angle of the roof rather than horizontally. Snow and ice therefore slide down and apply pressure on the lower part of the module frame.

Normal mechanical load tests examine the effect of an evenly distributed snow load on a horizontally installed solar module. To replicate real-world conditions, our module testing lab developed the inclined plane test, in which a load of up to one metric ton is placed on a solar module installed at a tilt. Due to an angle design, the pressure is concentrated on the lower edge of the module.

It was found that our solar modules withstood the inclined plane test with no adverse effects on either the safety glass or the frame. With their outstanding stability and secure attachment, these solar modules are also well suited for rooftops with heavy snow loads.





## *Hemispheric lighting test*

Our research team in the module testing lab has come up with the hemispheric lighting test to examine the behavior of our solar modules under conditions as authentic as possible. It allows us to simulate daily and annually changing light conditions, including related temperature variations.

The sun's trajectory is simulated by a system of horizontal and elevation angles in the lighting test stand. The test replicates different environmental factors, such as temperature, changing wind conditions, the angle of solar radiation, light spectra and direct and diffuse irradiation. An optical measuring unit known as an integrating photometer allows us to measure solar module capacity by examining the simulated light conditions in more detail.

Our evaluation of the lighting test data ensures that our solar modules provide the required performance under varying light and temperature conditions.

## Outdoor test facility

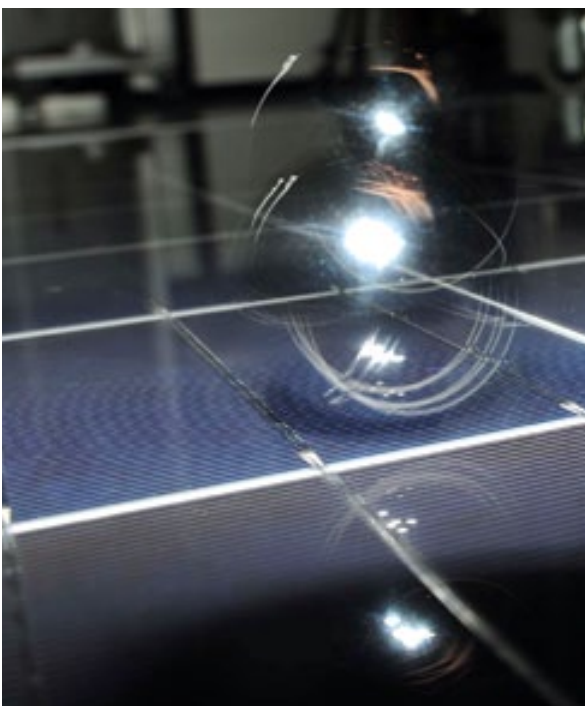
Of course we also test the weathering resistance of our solar modules in the open and not just under laboratory conditions. By installing solar modules in ground-mounted test areas in different climate zones, we expose them to real wind and weather conditions. We observe the solar modules and test them for performance and insulation ability over varying periods of time. The information gained from these tests is then incorporated into our continuous efforts to improve solar modules.

## Module breakage test and hail impact tests

From time to time, heavy or hard objects such as hailstones fall onto roofs and, naturally, roof-mounted solar modules must be capable of withstanding them. To make sure they are stable and break-resistant, we subject our solar modules to the most brutal tests we can come up with.

In the hail impact test, we replicate a natural hailstorm by dropping a 535-gram, 51-millimeter diameter steel ball onto the solar module from a height of four meters. This is repeated up to 20 times in the same place and on at least eleven different points of impact. The IEC only specifies a standard weight of 7.53 grams per steel ball.

We also simulate the mechanical load of objects hitting a solar module. In this case, we drop a 45-kilogram lead-filled sack from a height of 1.22 meters onto the middle of a vertically positioned solar module between one and three times. The test is considered passed if the solar glass does not break or the fracture pattern meets certain criteria.



 From left to right: hail impact test | module breakage test

## We will also throw in a few more certifications, just for you

### AMMONIA RESISTANCE



Our solar modules are ideally suited for long-term use in agriculture. The German Agricultural Society (Deutsche Landwirtschafts-Gesellschaft e.V., DLG), TÜV Rheinland and SGS inspection marks given to SolarWorld AG attest to this. Laboratory tests are conducted to determine whether a solar module can withstand the effects of ammonia in barn air over a 20-year period. The test simulates the temperature, humidity and ammonia concentrations inherent in agricultural conditions. Our solar modules have proven to be highly resistant to ammonia.

### SALT SPRAY RESISTANCE



It has been shown that our solar modules are not affected by salty air. The solar modules successfully completed and fulfilled all the requirements of the DIN EN 61701 salt spray test. They are therefore ideally suited for installation in maritime climates. Obviously, this also means they can withstand the salty air caused by using road salt in winter.

### SUITABLE FOR DESERT CONDITIONS



IEC 60068-2-68

Two testing institutes assessed the suitability of our solar modules for desert conditions. Both SGS and VDE agree that our solar modules can withstand intense sand storms and high wind speeds. These extreme environmental conditions have no impact on the modules' functionality and reliability. The integrity of our junction box seal was also endorsed, as it effectively prevents dust from entering the module.

The "blowing dust test" according to DIN EN 60068-2-68 carried out by the SGS testing institute simulates the weather conditions in desert regions such as Saudi Arabia. During the test, a special mixture of sand is dispersed over the entire solar module using pressurized air. Our solar modules passed the follow-up insulation tests and performance measurements, making them ideally suited for use in desert regions.



## **STANDARDS AND DIRECTIVES**

### **REN ENERGY is certified according to:**

- » Quality management system acc. to: ISO 9001
- » Environment management system acc. to: ISO 14001
- » Occupational health and safety management system acc. to: OHSAS 18001

### **REN ENERGY is certified according to:**

- » Energy management system acc. to: ISO 50001

### **Our products are certified according to:**

- » Standard series for photovoltaic devices acc. to: DIN EN 60904 (within the TUV power controlled certification)
- » Flame-resistant (fire protection class B1) acc. to: DIN 4102-1:1998-05
- » Salt mist corrosion testing acc. to: DIN IEC 61701
- » Ammonia corrosion testing acc. to: DIN EN 60068-2-60:1996
- » Design qualification and type approval and safety qualification (IEC) acc. to: IEC 61215:2005, IEC 61730-1:2004, IEC 61730-2:2004
- » Safety standard (USA and Canada) acc. to: UL 1703, Third Edition; March 15, 2002

### **Our products are manufactured in accordance with the current standards and directives:**

- » Actions on structures acc. to: EN 1991-1
- » Design of aluminium structures acc. to: EN 1999-1
- » Design of steel structures acc. To: EN 1993-1



## *Sustainability – core of our business activities*

Since the founding of REN ENERGY, our everyday business activities have made an important contribution to-wards the responsible handling of ecological, economical and social resources. We believe green products should also be manufactured using green production processes. That's why we endeavor to make our manufacturing pro-cess as environmentally and resource friendly as possible. We take into consideration the effects of our products throughout their entire life cycle. Furthermore, we are constantly improving our products so that they can make an even bigger contribution towards a sustainable and environmentally friendly energy supply worldwide. With our REN ENERGY initiative, we take part in solar aid projects all over the world to make clean and fair energy available in developing countries. For us, the responsible handling of the environment as well as our employees and customers is a basic prerequisite for quality made in Germany.



### **ENERGY PAYBACK TIMES**

We are continually lowering solar module production energy consumption along the entire value chain. This involves a regular life cycle analysis and calculation of the period of time a solar module requires to generate as much energy as was used to manufacture it. Our environmentally friendly manufacturing processes facilitate short energy payback times and reduced CO<sub>2</sub> emissions.

- >> Germany (Bonn): 1.2 years
- >> Bulgaria (Sofia): 0.9 years
- >> Spain (Madrid): 0.8 years
- >> South Africa (Cape Town): 0.9 years
- >> Australia (Sydney): 1.0 years
- >> USA (San Francisco): 0.6 years

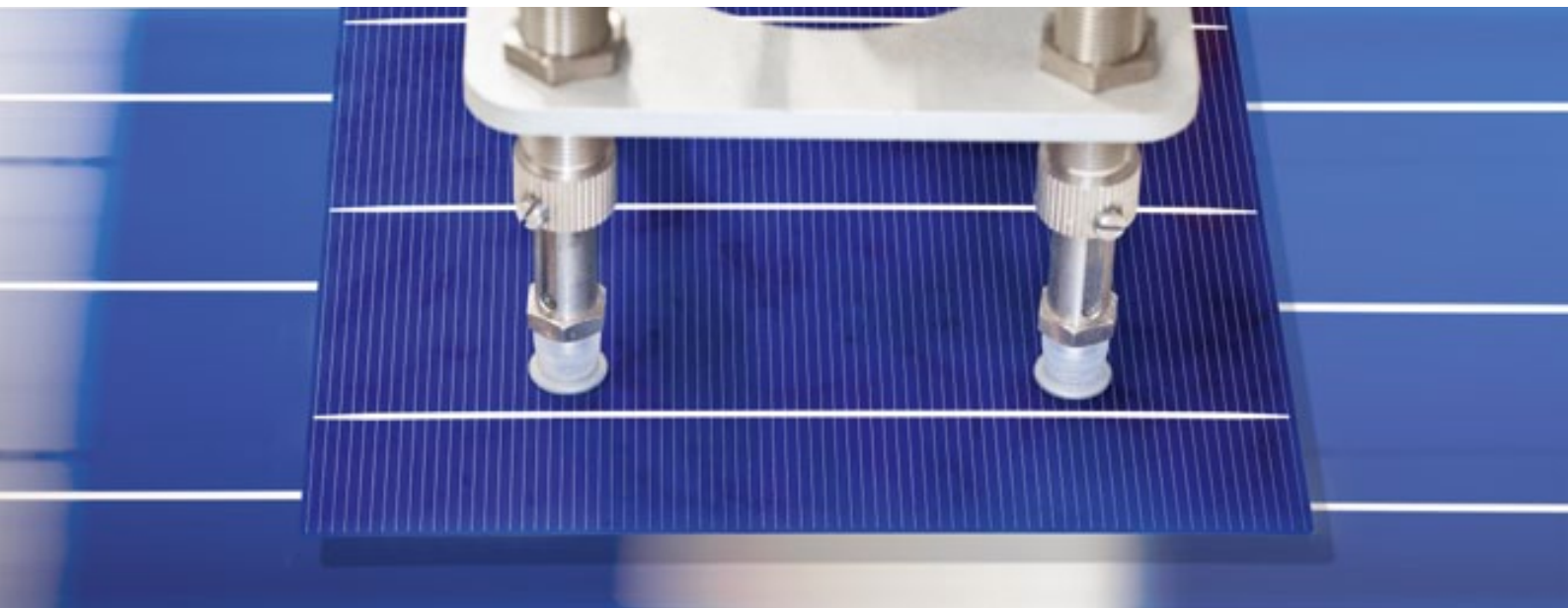


## *The advantage of quality*

To ensure the best possible quality we take a holistic approach that not only encompasses solar modules, but the entire solar power system as well. Purchasing a solar power system is just like any other investment – only those who invest in quality can expect safe returns.

### **OUR SOLAR PRODUCTS AND APPLICATIONS:**

- REN ENERGY kits** The “all-inclusive package” by professionals for professionals. Our kits are perfectly matched with components from a single source.
- REN ENERGY Kit easy** The Kit easy is a pre-assembled and ready for use system for pitched roofs, including kit insurance and the system documentation Sunpass.
- Sunmodule** Solar modules for grid-connected or off-grid solar systems.
- Sunfix plus** Whether on a flat roof or a pitched roof, the Sunfix plus system is the ideal mounting solution for our solar modules.
- Sundeck** The perfect combination of aesthetics and efficiency. Sundeck provides an elegant and customized way to integrate your solar power system onto your roof.
- SunCarport** Truly multitalented: The SolarWorld SunCarport not only protects your car in any wind or weather, but it also creates an additional surface area for producing clean solar energy.
- SunPac 2.0** An innovative system that stores the solar power from your roof and makes it available whenever you need it.



## *Find out more*

Do you have any questions about REN ENERGY quality standards or individual products? Then don't hesitate to contact us. We will gladly provide you with additional information and show you exactly how REN ENERGY can prepare you for the solar future today.



**We turn sunlight into power.**