



YOUR SPECIALIST FOR TRACKING SYSTEMS

**NOT ONLY SIMPLY BRILLIANT,
BUT BRILLIANTLY SIMPLE**



**INTELLIGENTLY CONTROLLED
SYSTEMS PROVIDE A CLEAR
ADVANTAGE BOTH ECONOMICALLY
AND AS A SECURE INVESTMENT**

A bright idea: Solar tracking systems by DEGER

THOSE WHO STRIVE TO HARVEST MORE OF THE SUN'S ENERGY WILL HAVE TO MOVE AWAY FROM FIXED SYSTEMS

Tracking systems: Single- or dual-axis

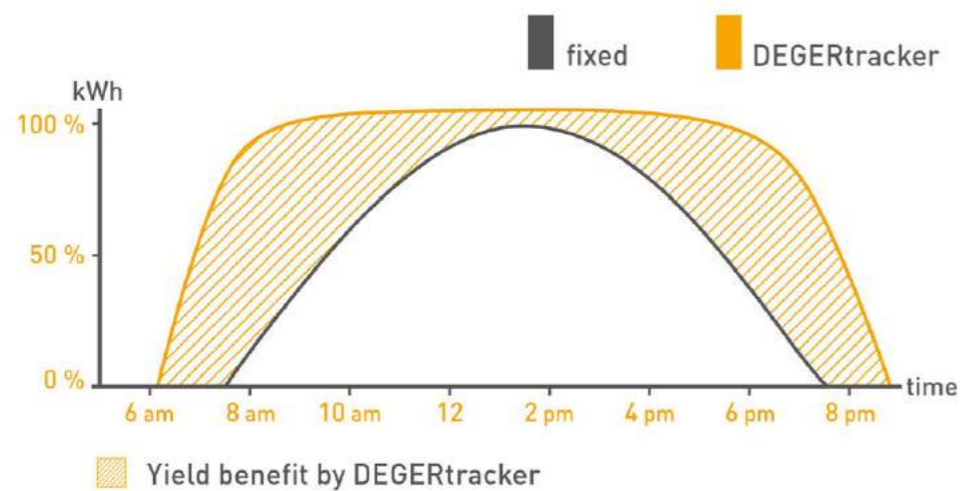
Nature did it first: Numerous plants, like the sunflower for example, orient themselves towards the sun during the course of a day. It is a simple, but brilliant principle that can be applied perfectly to optimizing efficiency in solar energy systems. The reason: Photovoltaic modules that follow the sun's path capture a higher amount of energy and therefore produce decidedly more power than modules in a fixed installation.

Higher efficiency with intelligent tracking. Even though photovoltaic modules' efficiency factor has been improved considerably over the last few years, the physical ceiling has essentially been reached. A genuine leap in a systems' efficiency can only be achieved by intelligent tracking. Only then can more energy be generated no matter which modules are used.

High in yield, economical in consumption. Their low-energy consumption is also a factor in the systems' high level of efficiency. For example, a dual-axis DEGERtracker D100 does not even use 0.4 percent of the additional energy it yields.

Flexibility meets longevity. DEGER solar tracking systems are flexible assembly systems and suited to all commercially available module and inverter types. The negligible maintenance costs and robust construction with high-quality materials ensure a long, maintenance-free service life.

Rating chart using a sunny summer day as an example



DEGERtracker 40NT, Greece



Former landfill site with 54 DEGERtrackers, Germany



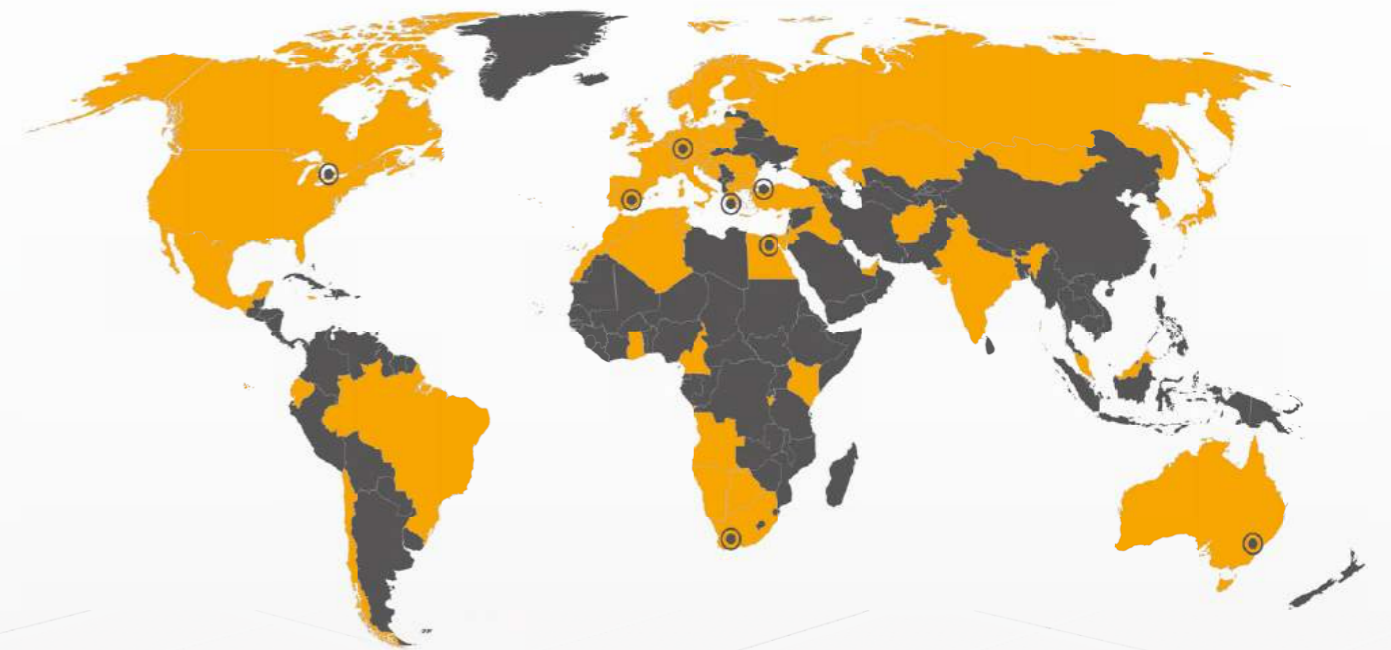
DEGERtracker S60H, South Africa

TECHNOLOGY THAT CATCHES ON. WITH ENGINEERS, NEGOTIATORS AND CONTROLLERS

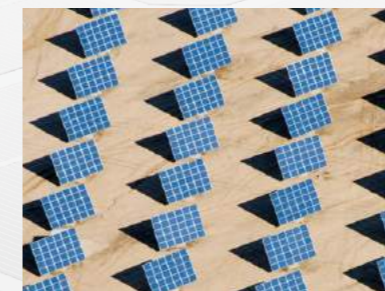
Reference projects: DEGER worldwide

What do Ontario, Sicily and the Australian Outback have in common? They all host some of the many solar energy facilities across the globe that are equipped with intelligent tracking systems made by DEGER. No wonder, because after all, DEGER is specialized in tracking systems and has been producing them in series for over 18 years. Around 75,000 projects (Status 01/2017) are connected to the grid worldwide. And the trend is rising. Regardless of where these systems are set up, whether in sun-soaked desert regions or in more temperate climates – the economic advantage is always ensured.

DEGER has a worldwide presence and thus offers streamlined paths to advice, sales, and service. Wherever intelligent control systems are in demand is DEGER with competent sales and service partners on the ground. This ensures expert advice, installation of plant and a reliable supply of parts and a fast service.



● Sales and production locations
■ Installed DEGER systems



Solar park with 21,000 m² of solar module surface, Spain



DEGERtracker 6000NT Wisconsin, USA



Roof system with 120 DEGERtracker 8.5, Spain

YOU CAN'T ALWAYS RELY ON THE WEATHER – BUT YOU CAN RELY ON AN INTELLIGENT CONTROL SYSTEM

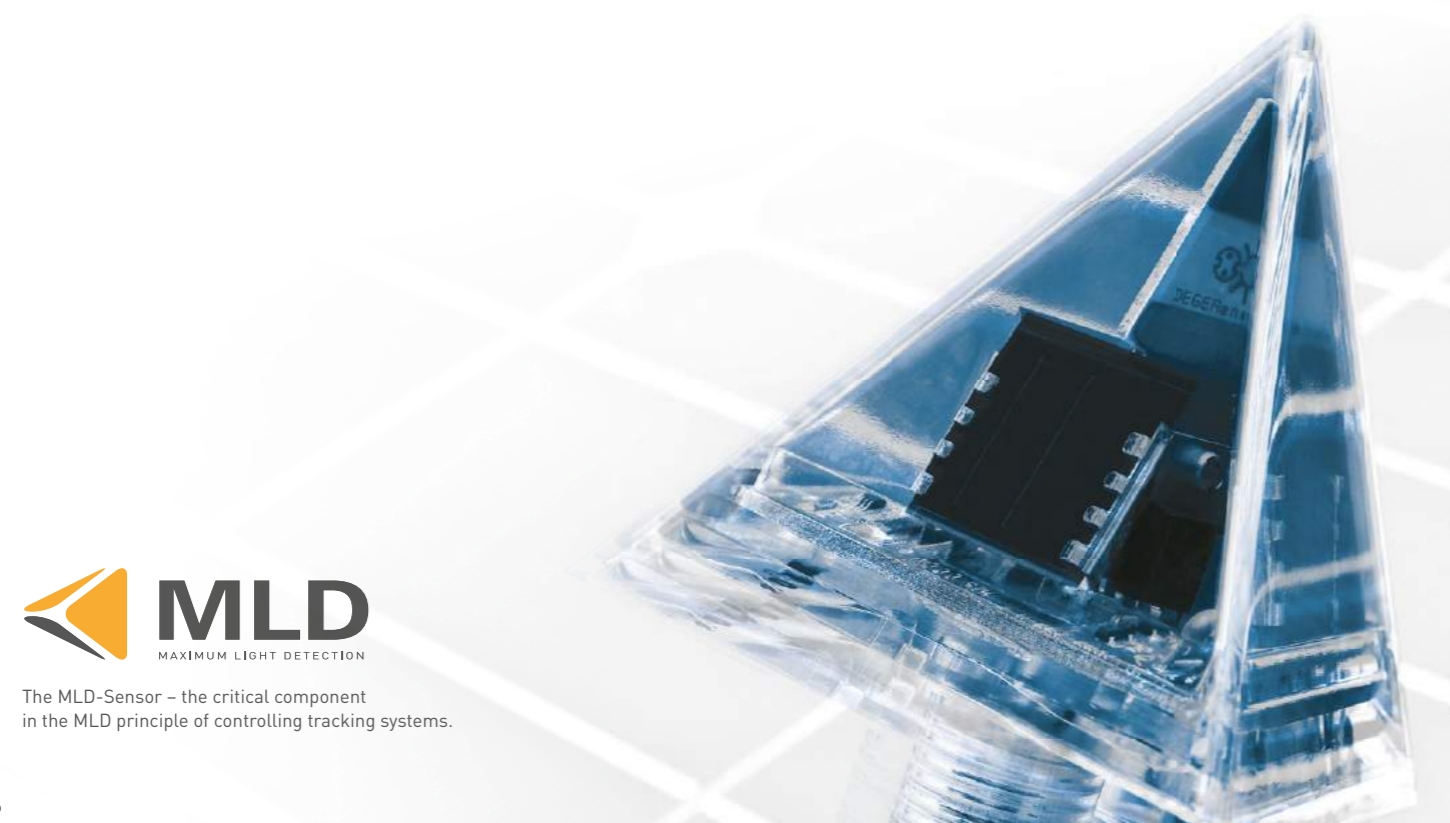
Maximum Light Detection: Most cost-effective module alignment

Technology that is proactive gets more out of the sun. The light irradiation's intensity is influenced by a number of factors - primarily clouds, of course. That is why it is crucial that a smart control is able to react to the conditions accordingly. The MLD principle takes on that task.

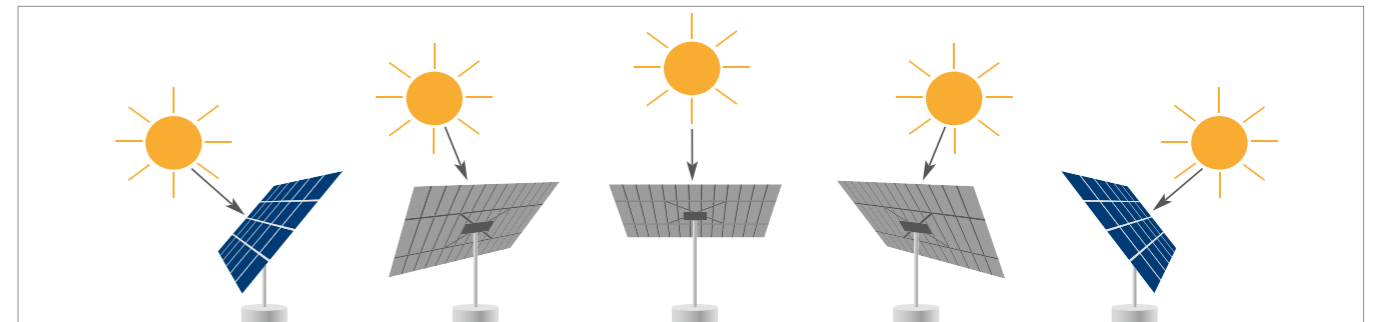
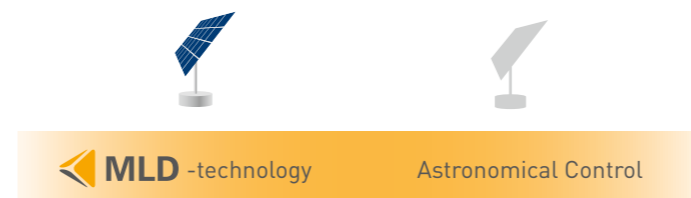
Pinpoint precision alignment = maximum yield: The Maximum Light Detection principle (MLD). The MLD or Maximum Light Detection principle is based on the most accurate, fastest and most energy-saving tracking of the solar module toward the maximum energy point. That function is the responsibility of the patented control module, the MLD-Sensor. The control module continually measures intensity and angle of the incoming light and moves the solar module installation into the most advantageous position. The sensor not only takes the solar irradiation into account, but also, for example, light that is reflected off snow, water or light-colored rock, or diffuse solar irradiation that penetrates the clouds – and does so individually for each system.

What is important here: only those movements that will result in a direct yield increase are carried out.

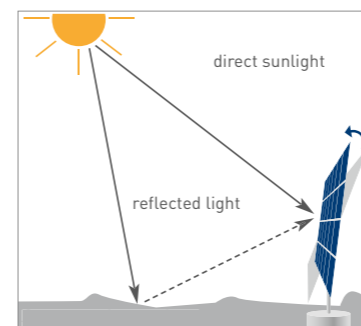
Simply brilliant and brilliantly simple. Two sensor cells in the MLD sensor provide reference values that are evaluated by a logic module to track the module surface over the course of the day. A third sensor resets the system each morning. Depending on the irradiation, a differential amplifier prompts a transition from the logarithmic characteristic curve created by strong radiation to the linear characteristic curve created by diffused light. In this dependent relationship, the logic module has a much higher value in the linear characteristic curve than in the logarithmic one. This optimizes the accuracy of any readjustments made when brightness is decreasing.



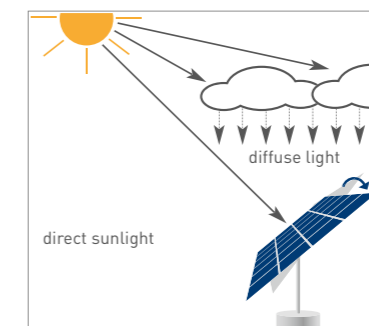
The MLD-Sensor – the critical component in the MLD principle of controlling tracking systems.



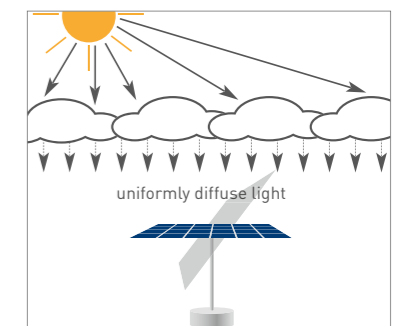
Sunshine: The DEGERtracker directly faces the sun all day.



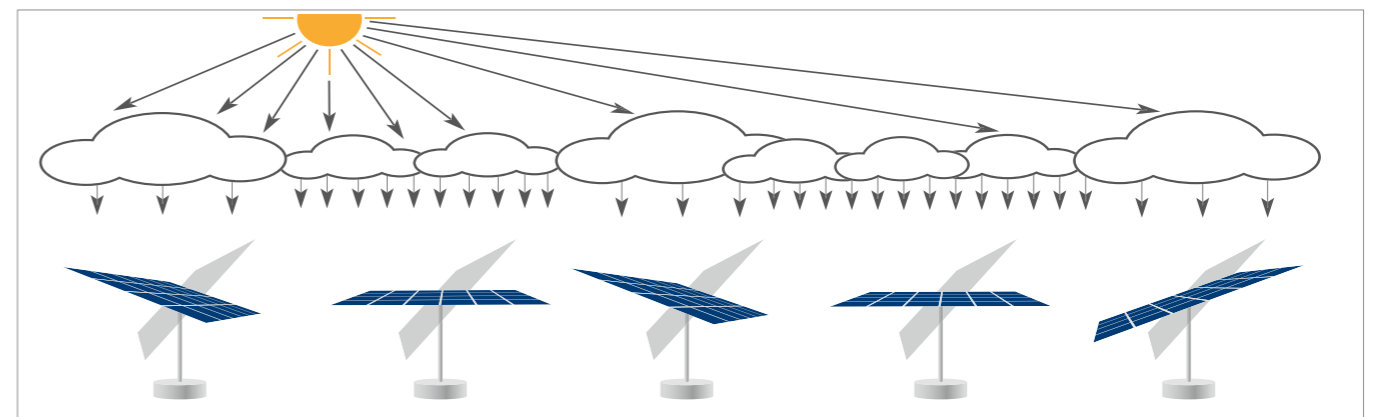
Reflecting surface: The DEGERtracker uses direct solar irradiation as well as energy from reflected light.



Partly cloudy: In addition to the direct solar irradiation, diffused light is also used to maximize the effect.



Overcast sky: The DEGERtracker catches all the diffused light by moving to horizontal position.



Varying light conditions: Because of different levels of cloudiness, the light conditions in solar parks vary for each DEGERtracker. The individual control makes sure every DEGERtracker is optimally oriented to the brightest source of irradiation. This guarantees the highest energy yield possible.



The solar tracking systems of DEGER are highly weather resistant and even under harsh weather conditions like snow and wind the MLD sensor is highly efficient and provides the maximum possible energy gain.

FRAUNHOFER ISE CONFIRMED: 42.9% ADDITIONAL YIELD WITH THE TRACKING SYSTEMS FROM DEGER!

Convincing arguments: lower cost, higher yield, faster amortization

Comparative measurements at the Solarpark Rexingen

Even though photovoltaic modules efficiency factor has been improved considerably over the last few years, the physical ceiling has essentially been reached. By tracking of the photovoltaic modules, the efficiency and the yield can be increased. This is reflected in the numbers of the Fraunhofer-Institut für Solare Energiesysteme (ISE)

In the comparative measurement four different systems for generating solar energy were examined in solar park Rexingen in southern Germany. The aim of the two-year study was to determine the efficiency and higher yield of the photovoltaic modules compared to fixed tilt installed, astronomic tracked and tracking by sensors of single- and dual-axis systems.

System 1

Fixed tilt installation 30° south-facing



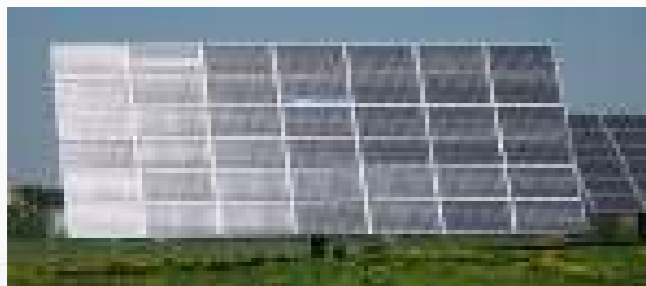
System 2

Single-axis DEGERtracker with MLD sensor



System 3

Dual axis astronomical controlled



System 4

Dual-axis DEGERtracker with MLD sensor



Conditions

The efficiency of solar panels depends on various factors such as temperature, air pressure and radiation values. So that the comparison measurements were carried out under the same conditions, all four systems were installed on the former landfill in Rexingen and equipped with the same modules and inverters. Measurement of yield was determined for two years and was carried out under the following parameters and performance

Installation site:	48° 26' 50" North, 8° 39' 48" East
Elevation N.:	569 meters
Irradiation:	1,010 kWh/kWp (PVGIS)
Installed modules:	Per unit 36 modules Sanyo HIP-215NKHE1
Nominal power:	7.74 kWp
PV Inverter:	Per unit one SMA SMC 8000TL
Nominal power:	8.0 kW

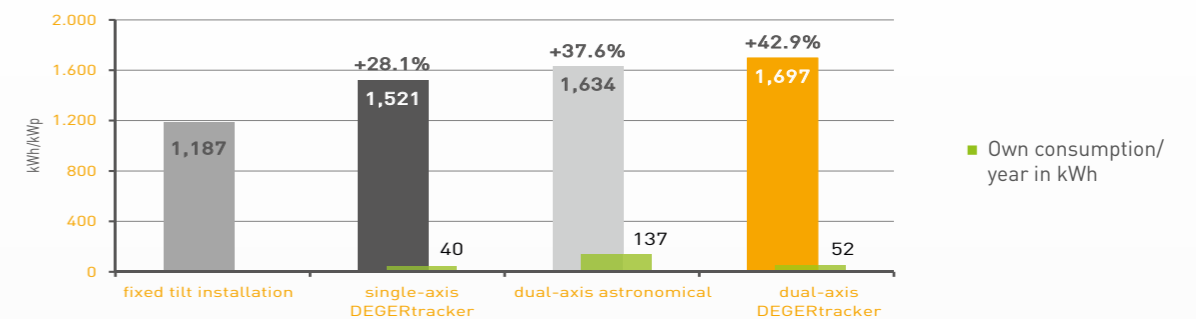
Results:

Analysis procedures

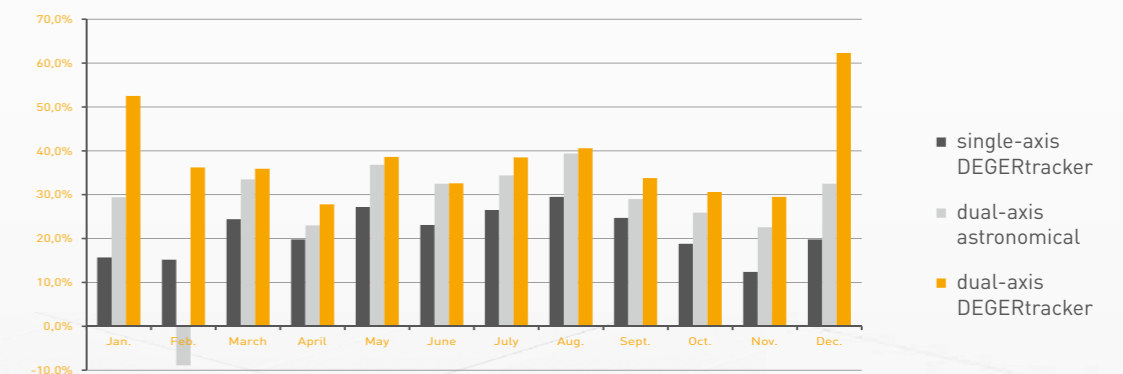
For the evaluation two different methods were used. The normalization method, in which all performance variables such as cable length, actual module output, inverter efficiency and other similar variables are taken into account.

By the evaluation with the standard method the yield takes into account a theoretical consideration of the cable losses resulting directly from the measured data without further corrective calculations.

Comparative measurements in 2012 in solar park Rexingen



Additional yield monthly results in 2012 compared to fixed tilt systems



Looking at the earnings figures it is obvious that the tracking systems with the patented MLD technology from DEGER achieve higher yield, especially in the winter months.

The result of the study

- DEGERtracker are generating a 42.9% higher yield compared with static systems.
- DEGERtracker are generating a 5.3% higher yield compared with astronomical controlled systems.
- DEGERtracker have the lowest operating power consumption compared to the measured tracking systems in this study.
- During the winter, astronomically controlled units may not even out perform fixed systems when foggy or cloudy conditions are present. Only MLD technology senses that the diffuse irradiation is best captured with by presenting the most surface area possible.

Source: Fraunhofer ISE, Report: PMZ940-Adr-1201-V1.01

COMPREHENSIVE DEGERENERGIE SUPPORT COMES IN A WELL-ROUNDED PACKAGE: CONSULTING, PLANNING, TRAINING AND SERVICE FROM ONE SOURCE

Knowledge transfer: The basis for investment security

Know-how is not a one-way street in our book. DEGER has more than two decades of experience in solar technology and works continuously on developing it further. Thus our specialists' expertise is constantly supplemented by new knowledge and technologies. Our customers benefit from the results.

In the best hands from the start! The DEGER Planning Tool adapts the DEGERtracker to external influences in line with environmental conditions and is available to all of our clients as a free download from the dealer section. This way you can optimally plan your solar system in an open area or on a building and resolve the most important issues in advance.

We provide advice and support throughout the planning phase and help you install your solar park on open land and roofs. Considering all relevant safety and security aspects for tracking systems, we develop the optimum, project-specific solution for every customer. Comprehensive planning aids such as the DEGER planning tool provide up front guidance on the feasibility of a project.

Efficiency has set a precedent. The technical opportunities of DEGER tracking systems are only one part of the whole – utilizing them sustainably is the other. That is why we set such store by the operators' and installers' expertise and furnish extensive instruction and specialized training in results-oriented training program packages.



Those who know more improve the systems' efficiency.



... or our experts would be happy to visit you in person.



That is why DEGER offers instruction and specialized training.



The training sessions are conducted at DEGER's headquarters.

Weather-resistant, safe and maintenance-free. These demands are already firmly in place at the top of the requirements list for all our products during the concept development phase. DEGERtrackers also have had to prove their worth in a wind tunnel, for example. DEGER also places its trust in reliability and technology of convenience for the assembly process. Extremely short assembly times save time and money – the systems are ready to operate within a short time.

Our symbol for quality – optionally extendable guarantee. All DEGERtrackers are TÜV-inspected and have passed the very stringent endurance tests administered by the Materialprüfanstalt (MPA) [=Materials Testing Institute] Stuttgart and wind tunnel tests. Some models are certified according to the UL/CSA guidelines for North America. Moreover, there is also our boundless faith in the products.

Quality is important to us. We are therefore unable to solely rely on our own high quality requisites and strict controls. We regularly subject both the company and the products to tests and inspections by independent institutes and associations.

Important for all investors: The returns and increased returns offered by DEGER compared to un-tracked systems are certified by independent companies.

All DEGER systems are maintenance-free, robust and durable. German Engineering "Made in Germany". Production locations are Germany, Canada, South Africa and USA.

FROM A VISION TO AN IDEA. FROM AN IDEA TO A COMPANY

Horb, Germany
12 DEGERtracker 5000HD, 1 DEGERtracker 3000HD

A success story: DEGER in Horb, Germany

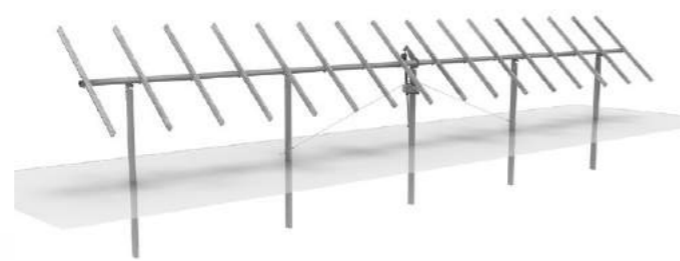


OPEN LAND AND BUILDING INTEGRATION

DEGERtrackers - Product overview



DEGERtracker 8.5 ¹⁾



DEGERtracker S70
with driven pile foundation



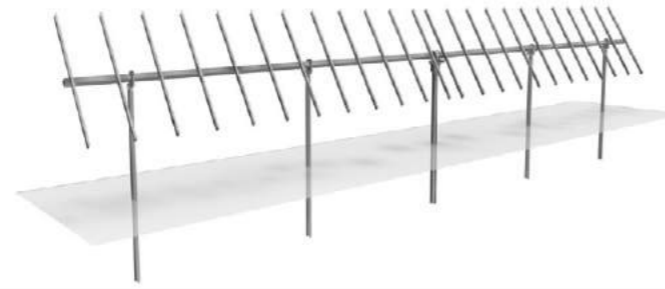
DEGERtracker 5000NT ¹⁾



DEGERtracker 3000NT ¹⁾



DEGERtracker S60H
with concrete foundation ¹⁾



DEGERtracker S100-PF-DR
with pile foundation



DEGERtracker D60H
with mast for Building integration



DEGERtracker D100 ¹⁾

DEGERtracker	8.5	S60H	S70	S100-PF-DR
Rated power in Wp	500 - 1.300	6.500 - 8.300	7.500 - 9.600	11.000 - 12.320
Module area up to m ² /sqft	8,5 / 92	41,6 / 448	53,3 / 574	78,6 / 846
Max. permitted wind V _o kmh/mph ²⁾	130 / 81	167 / 105	100 / 62	110 / 68
Approx. int. consumption p.a. in kWh	1,0	15	17	5
Angles of elevation (horizontal)	30°/20°	0°	0°	0°
Rotating-/swiveling angle east-west	+ / - 45°	+ / - 45°	+ / - 55°	+ / - 50°
Open land	X	X	X	X
Building integration	X	X	-	-
Foundation Types*	CF	CF, SF	PF	PF
Mast length m/ft	-	-	-	-
Weight (without mast) kg/lbs	125 / 276	490 / 1080 (CF)	600 / 1323	project specific
Article number	1110001	S60H-CF/SF	S70-PF	S100-PF-DR
Areas of application	1,2,3,4,6	1,2,4,6	5,6	1,2,3,5,6

Foundation types
*CF = Concrete • SF = Steel • PF = Driven Pile

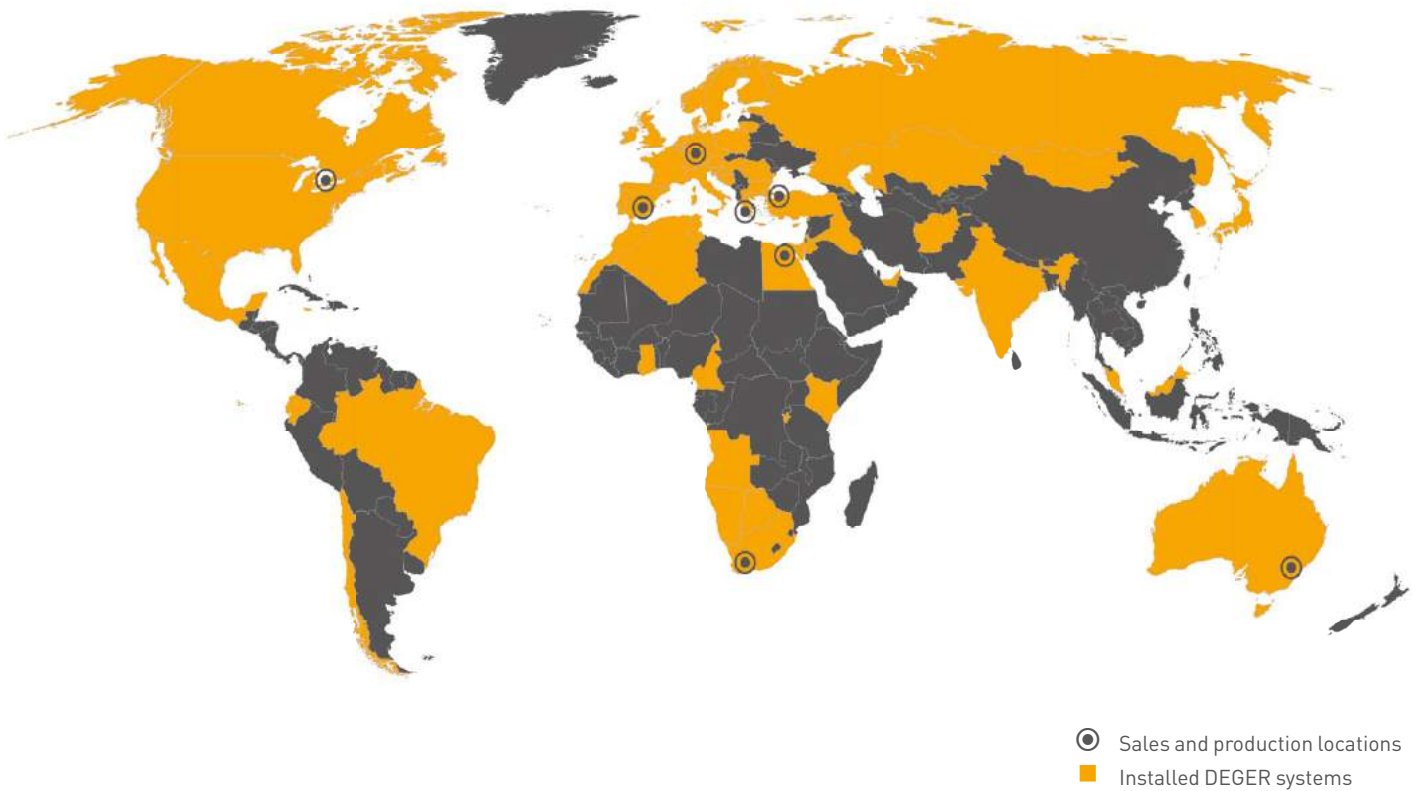
Areas of application
1 = Europe • 2 = USA • 3 = Canada • 4 = Australia • 5 = Turkey • 6 = On request

DEGERtracker	D100	D80	D60H	5000NT	3000NT	3000HD
Rated power in Wp	8.000 - 12.000	6.000 - 10.000	4.000 - 7.000	4.000 - 7.000	2.000 - 4.000	2.000 - 4.000
Module area up to m ² /sqft	70,6 / 760	52 / 570	40 / 430	40 / 430	25 / 269	25 / 269
Max. permitted wind V _o kmh/mph ²⁾	102 / 63	130 / 81	170 / 106	102 / 63	102 / 63	170 / 106
Approx. int. consumption p.a. in kWh	16	14	12	16	7	14
Angles of elevation (horizontal)	0° - 80°	0° - 80°	0° - 80°	20° - 90°	20° - 90°	20° - 90°
Rotating-/swiveling angle east-west	300°	300°	300°	300°	300°	300°
Open land	X	X	X	X	X	X
Building integration	-	-	X	-	-	X
Foundation Types*	CF, SF	CF, SF	CF, SF	CF	CF	CF
Mast length m/ft	4 - 8 / 13 - 26	3 - 8 / 11 - 26	3 - 8 / 11 - 26	3 - 5 / 9 - 16	3 - 5 / 9 - 16	3 - 5 / 9 - 16
Weight (without mast) kg/lbs	970 / 2.138	930 / 2.050	890 / 1.962	650 / 1.433	600 / 1.322	650 / 1.433
Article number	MLD-D100	MLD-D80	MLD-D60H	1500001	1300001	1310001
Areas of application	1,3,5,6	1,3,5,6	1,2,3,4,5,6	1,6	1,6	1,6

The systems are designed in accordance with DIN 1055-4 (03/2005), certain models are tested under ASCE-7 and NBC, OBC (Canada). Project-specific assimilation to regional provisions. Technical modifications reserved in the interest of progress.

¹⁾ Concrete foundation not included in delivery
²⁾ Laid out with planing tool

WE ARE AT YOUR SERVICE.
WORLDWIDE.



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