DEGER ENERGIE
SOLAR TRACKING SYSTEMS

DEGERenergie at a glance

NOT ONLY SIMPLY BRILLIANT

BUT BRILLIANTLY SIMPLE

CONTENTS

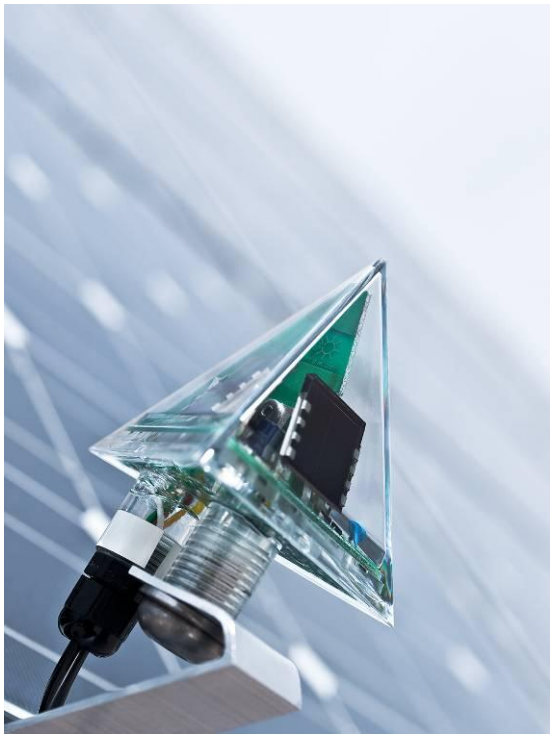
BUSINESS CONCEPT

Nature did it first: Many plants orient themselves to the suns' position during the course of a day. It is a simple, but brilliant principle that can be applied perfectly to optimizing solar energy systems' efficiency.

A vision was born from this principle – to allow photovoltaic modules to follow the path of the sun and (thinking even further ahead) to align them optimally to the position with the greatest light intensity.

An intelligent control was developed and patented with this idea in mind – the DEGERconecter. This device measures the light intensity according to the Maximum Light Detection (MLD) principle and aligns the photovoltaic modules so that they are always directed towards the most energy-rich point in the sky. Maximum yields can then be ensured.
The DEGERconecter was awarded the State Innovation Prize of Baden-Württemberg in 2001.

At present (11/2011), approximately 47,000 DEGER systems are in operation worldwide, with over 70,000 DEGERconecters installed.



MLD
MAXIMUM LIGHT DETECTION

COMPANY HISTORY

1999 Establishment of DEGERenergie e.K.
Invention of the DEGERconecter and establishment of DEGERenergie by Artur Deger.
Development of the first single-axis tracking system up to 7 m².

2000 Launch of the first dual-axis tracking systems 1000EL and 1200EL, plus development of the energy converter concept.

2001 Delivery of the first DEGERtraker 1000EL to Spain.
Launch of the DEGERtraker 100, 100EL and energy converter I.
Patented control with the DEGERconecter awarded the State Innovation Prize of Baden-Württemberg.

2002 Change of company form from DEGERenergie e.K. into DEGERenergie GmbH.
Launch of the single-axis TOPtraker® 6.1 and the DEGERtraker 300EL, plus the energy converter III.

2003 Market launch of the DEGERtraker 1600EL, energy converter II and development of the dual-axis equator system with 10 m².
First tracking systems with wind monitoring for load reduction.
Listed as a supplier to renowned solar energy wholesalers in Germany.

2004 Market launch of the DEGERtraker 2500EL and 4000EL.

2005 Development of the new DEGERtraker NT range and launch of the 5000NT.
Subsidiary opened in Spain.
Innovation Award from the "econo" business magazine (Germany).

2006 Market launch of the DEGERtraker 7000NT and energy converter V.

2007 Launch of the new single-axis TOPtraker® 8.5.
10,000 DEGERsystems sold.
TÜV certification for 5000NT and 7000NT.

2008 Development and launch of the DEGERtraker 3000HD, 5000HD, TOPtraker® 40NT and CT mechanism.
Development of the high-precision CT-DEGERconecter for concentrator applications.
Delivery of the 25,000th DEGERtraker.
DEGERenergie rated as one of the top ten companies in the region by the Landesbank Baden-Württemberg.

2009 Opening of the new company building.
ISO 9001 certification.
Subsidiary opened in Phoenix, Arizona.

2010 Market launch of the DEGERtraker 6000NT and 9000NT.
Subsidiary opened in Greece.
Commissioning of a second production line in Ontario/Canada.

Honored as one of the 100 most innovative companies in Germany.
Also honored in Australia: "Ten Worldwide Outstanding Companies in the PV Sector".

2011 47,000 DEGER systems installed worldwide in more than 46 countries (as of 11/2011).
Development of the energy converter VI.
Construction of a production line in Australia and the USA.

COMPANY PHILOSOPHY

Our company is one of the global market leaders in tracking systems for photovoltaic modules in the solar technology branch. Our focus is on the design and development of these controls and tracking systems.

Expertise, quality and permanent development in coordination with our suppliers ensure sustainable, above-average growth of the company. The clear focus of DEGERenergie GmbH on the development of tracking systems is clearly distinguished from many other suppliers, who extend their value chain by offering complete systems – from in-house solar modules to tracking systems.

It is not our intention to launch a new, revised product range onto the market each year. For us, customer orientation means sustainability and continuity.

Our motivated, committed and skilled employees are an integral part of DEGERenergie GmbH and the success of the company. With this philosophy in mind, we carry out comprehensive internal and external training sessions and regular workshops with senior management.

As a company involved in the renewable energy field, the following strict principle applies: To avoid environmental pollution of all kinds. Legal obligations connected to this topic must not only be fulfilled, but also surpassed whenever possible. This also applies to occupational safety and other obligations.

In order to meet and exceed the strict demands of our customers, we have implemented a management system with the intention of controlling and maintaining a continuous improvement process.

COMPANY STRUCTURE

Senior management

Artur Deger
CEO

Andreas Schwedhelm
Technical Director

Rainer Ott
Sales Director

Adam Glapiak
Sales – North Americ

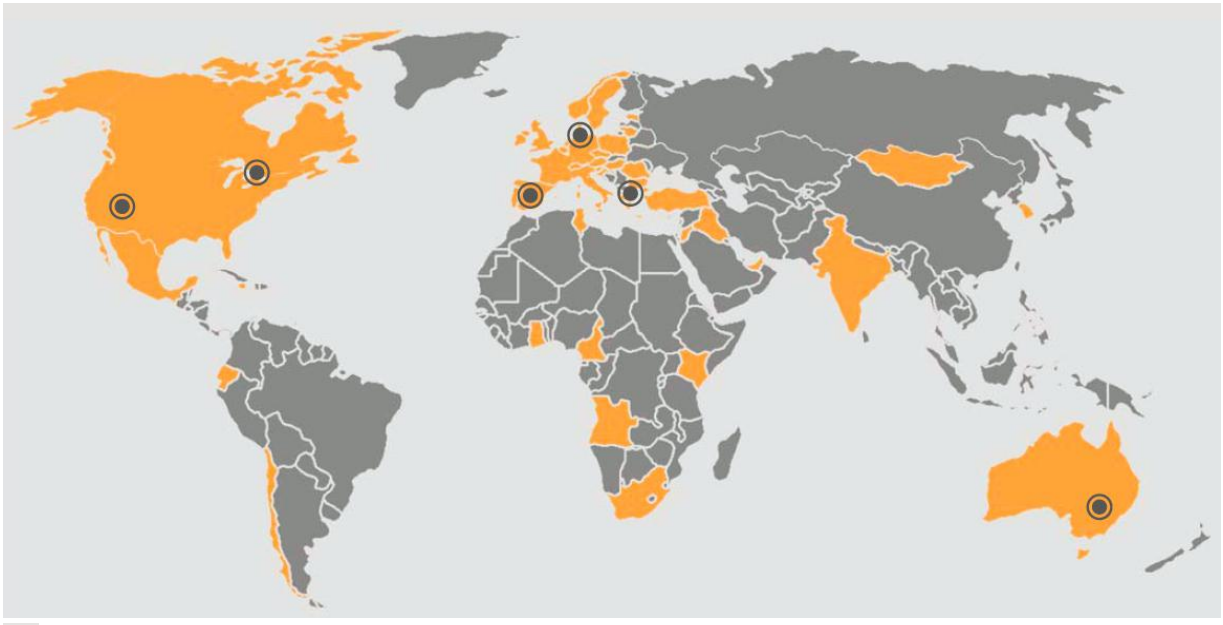
CURRENT DATA

DEGERenergie is based in Horb am Neckar, 70km south of Stuttgart. The company administration, warehouse and transport/logistics center occupies an area of approximately 150.000 ft².

At our headquarters, short distances quickly lead to our goals. After all, development and planning are not the only activities on-site – sales, training and production are also done here, and goods are sent around the world.

The rapid increase in staff as well as our global presence reflect the rapid growth and success of the company.

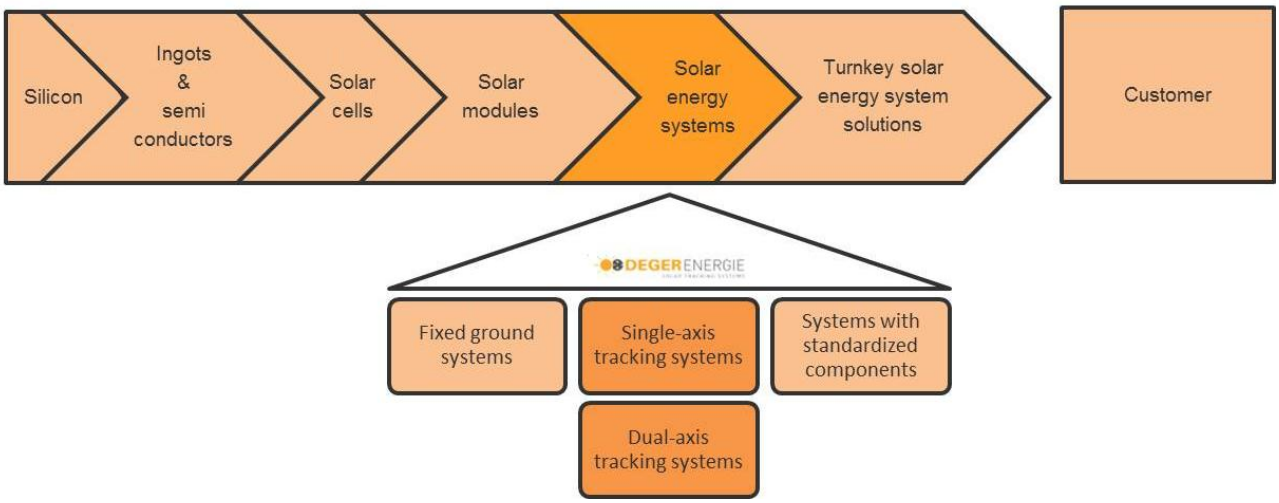
With over 47,000 systems installed in 46 countries, DEGERenergie is the market leader in tracked PV systems. Since 2005, it has also established sales subsidiaries in Spain, Greece and the USA. At present, production is done in Germany, Canada, the USA and Australia.



Sales and production sites Installed systems

MARKET POSITION

The business area where DEGERenergie GmbH is currently active can be divided up into the following value chain from the solar industry:



Starting from the traditional method of installing solar modules in the ground pointing southwards, modules were then developed which can be aligned permanently at right angles to the *brightest source of irradiation*.

This intelligent tracking generates an average increase in energy yields of up to 45% compared to fixed systems.

Since 1999, DEGERenergie has developed, designed and manufactured intelligent tracking systems for all common solar modules. Incurred costs are systematically reduced. These price advantages give our customers a clear advantage in an increasingly networked world economy, even in a constantly changing competitive situation.

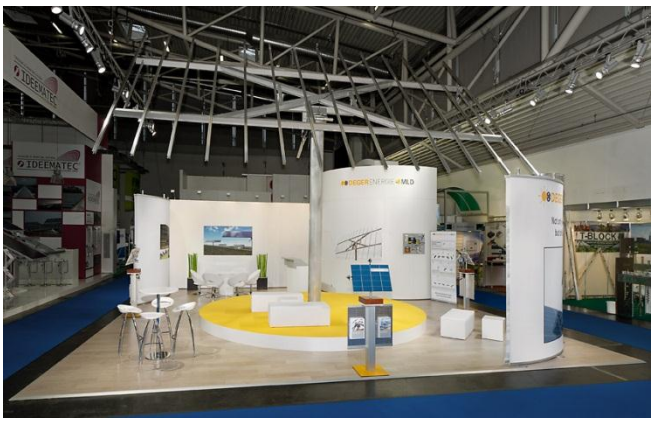
The patented MLD technology is globally unsurpassed in efficiency and technical maturity. Therefore, investments in state-of-the-art MLD systems are perfect in terms of profitability and security of the invested funds.

Our constant presence at trade fairs around the world means that DEGERenergie has become well-known in the solar industry. The company is also listed at CanSIA* and as a leading company in photovoltaic tracking on the CanSIA website.

DEGERenergie will be present at the following trade fairs in 2012 (selected):

- Ecotec, Athens/Greece
- CEP, Stuttgart/Germany
- Intersolar Europe, Munich/Germany
- Intersolar International, San Francisco/USA
- SolarExpo, Verona/Italy
- Solar Power International, Orlando/USA
- All Energy, Melbourne/Australia

Intersolar Munich 2011:



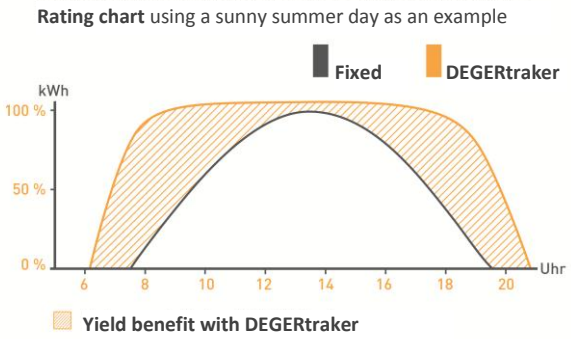
In total, there are around 130 mostly small-scale suppliers of tracking systems. Among our top ten competitors, only one also offers a sensor-controlled tracking system – connected to astronomical tracking in poor weather conditions.
All other suppliers focus exclusively on astronomical tracking, which generates lower yields and has more cost-intensive and complicated installation and maintenance.

* CanSIA: Canadian Solar Industries Association, founded in 1978 www.cansia.ca

PRODUCT OVERVIEW

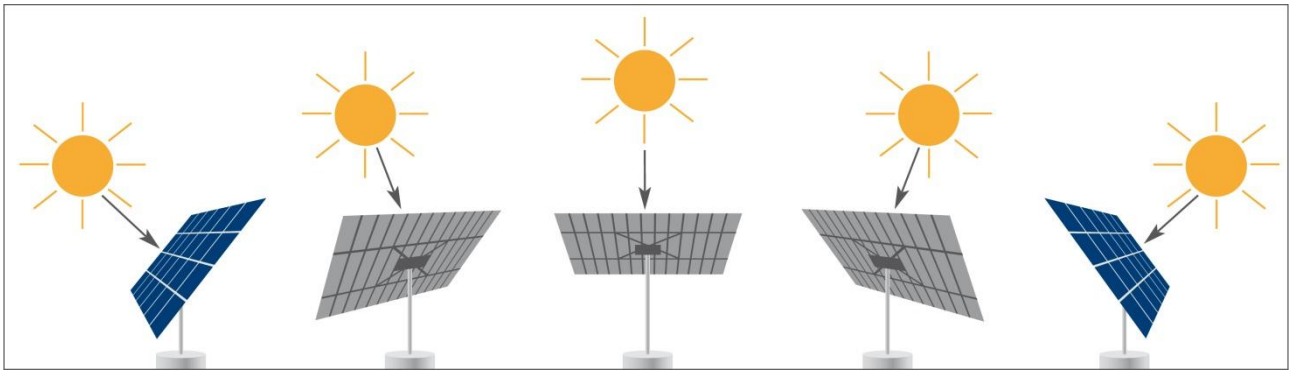
MLD
MAXIMUM LIGHT DETECTION

The MLD or Maximum Light Detection Principle is based on the most accurate, fastest and energy-saving tracking movement of modules to the most energy-rich positions. This is due to the patented control module, the DEGERconecter. The control module continually measures intensity and angle of the incoming light and moves the installation with the solar modules in the most advantageous way. The module thereby takes into account not only the

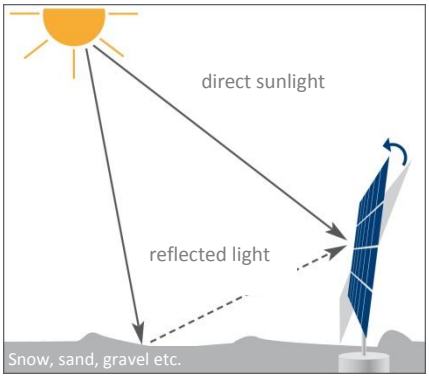


solar irradiation but also, for example, light that is reflected off snow, water or bright rock, and diffuse solar irradiation that penetrates the clouds.

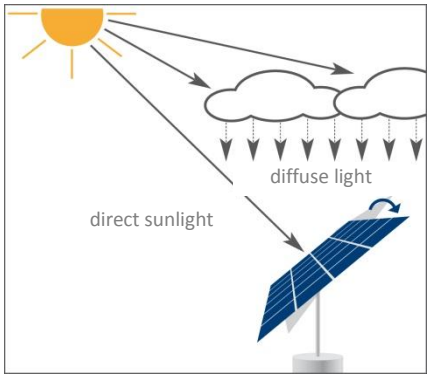
The efficiency of a solar plant depends essentially on how much energy the solar cells are able to collect. The intelligent control of the DEGERtraker guarantees the optimal utilization of irradiation.



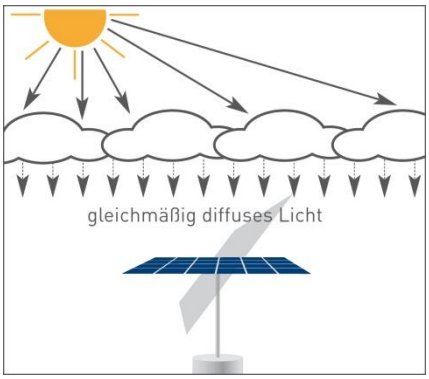
Sunshine: The DEGERtraker directly faces the sun all day.



Snow and reflecting surface:
The DEGERtraker uses direct solar irradiation as well as energy from reflected light.

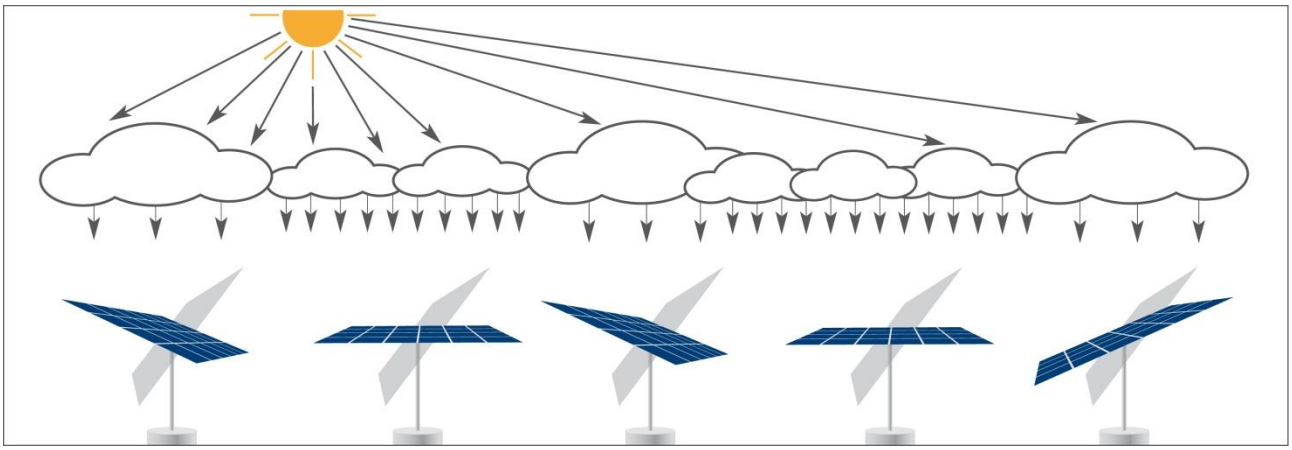


Partly clouded:
In addition to the direct solar irradiation, diffused light is also used to maximize the effect.



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

uniformly diffuse light



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

What makes DEGERenergie products so unique:

1. MLD technology

Control uses reflected light (from snow, water etc.) and the "eye of cloud" effect	> Up to 45% higher yields on average compared to fixed systems thanks to utilization of diffused light, plus quicker ROI
No calibration necessary	> Additional costs for calibration and annual maintenance on astronomical systems is between 10% and 20% Time and cost savings
Connection of individual systems in solar park not necessary	> Lower installation and maintenance costs, less potential for errors
Only movements are carried out that result in a direct yield increase	> Reduced wear, lower maintenance costs / requirements, less internal consumption
Decentralized control	> Highest levels of availability – if one system fails, then the others still work without interruptions
Systems work without programming	> No computer necessary and no programming necessary – less sources of error and reduced costs, quicker and easier installation, quicker ROI
Automatic compensation of floor movements (e.g. landfill sites)	> No calibration necessary (both at commissioning and on an annual basis), constant optimal alignment
Individual clouds only affect part of the solar park	> Maximum yields – each system is optimally aligned to the brightest point

2. Product details

Snow sensor	> In the event of snowfall, the sensor ensures that the system is set vertically, discards the snow and then continues to work normally – possible yield losses are then minimized
Wind monitor (heated)	> Problem-free operation in areas with low temperatures
Suitable for all module and converter types	> Flexible selection of equipment, independent of the manufacturer
Heavy duty (HD) systems	> Can be used without problems in areas with strong winds (up to 300 km/h)

3. Efficiency and safety

Quick and easy installation	> Short installation times, low installation costs, quicker amortization; short training times for installers

Optimized transportation, high packaging density	> Reduced transport costs, quicker amortization
Aluminum and steel construction	> Optimized design, less materials required, reduced costs, reduced installation time and costs
Environmentally friendly	> Over 99% recyclable materials
No maintenance necessary	> Annual visual inspection is satisfactory, reduction in maintenance costs
Tested in a wind tunnel	> Safe and durable – secure investment even in areas with strong winds
TÜV and UL/CSA certification	> Officially tested safety
Technology designed and made in Germany	> Quality that stands for fail-safe durability and ensures secure investments
Tested by the Institute for Material Testing （MPA） in Stuttgart	> Tested safety and durability – secure investment

DEGERenergie offers a comprehensive range of products for all common solar modules.

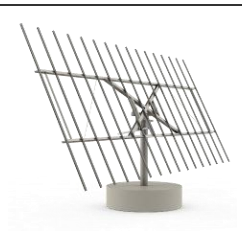
OUTDOOR

Dual-axis


DEGERtraker 3000NT/HD


DEGERtraker 5000NT/HD


DEGERtraker 6000NT


DEGERtraker 9000NT

BUILDING INTEGRATION

Dual-axis


DEGERtraker 3000HD

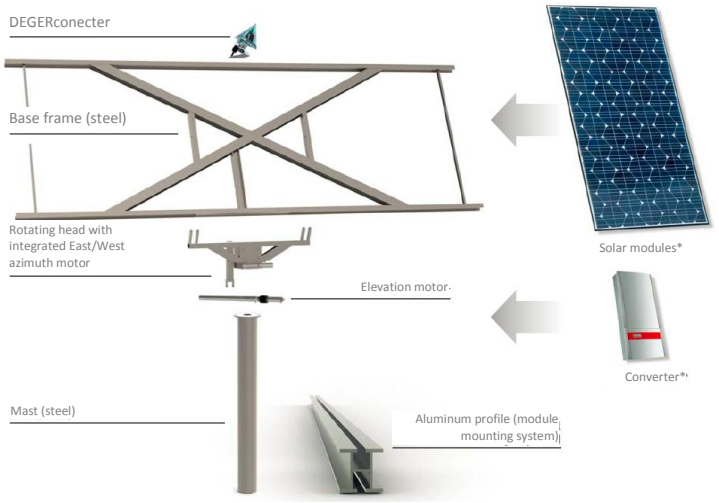

DEGERtraker 5000HD

Single-axis


DEGER TOPtraker® 8.5

A tracking system is comprised of a steel mast, one or two motors, base frame, DEGERconecter and aluminum profiles. Concrete foundations and solar modules are not included with the delivery. Assembly of the entire system can be made on-site by an installer. The system aligns itself automatically using the DEGERconecter and does not need to be calibrated (as with astronomically guided systems, for example).

SIMPLE INSTALLATION OF A DEGERtraker



* Not included in scope of delivery

REFERENCES AND SAMPLE PROJECTS

Escalona, Spain

Completion: *2008*

System: *Dual-axis tracking system*

System power: *2808 kWp*

Number of systems: *520*

Products: *DEGERtraker 5000NT*

Andria, Italy

Completion: *2009*

System: *Dual-axis tracking system*

System power: *944 kWp*

Number of systems: *130*

Products: *DEGERtraker 7000NT*

Ontario (Oxford County), Canada

Completion: *2009*

System: *Dual-axis tracking system*

System power: *115.2 kWp*

Number of systems: *12*

Products: *DEGERtraker 7000NT*

Rexingen, Germany

Completion: 2008

System: Single and dual-axis tracking system

System power: 190 kWp

Number of systems: 66

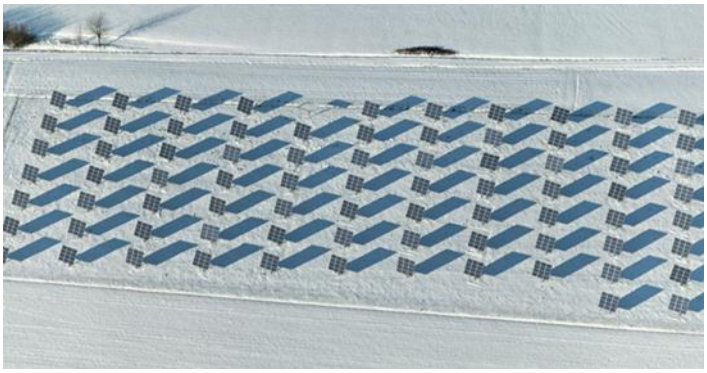
Products: TOPtraker® 8.5

DEGERtraker 7000NT

Sample applications

Building integration

Solar parks



Individual systems

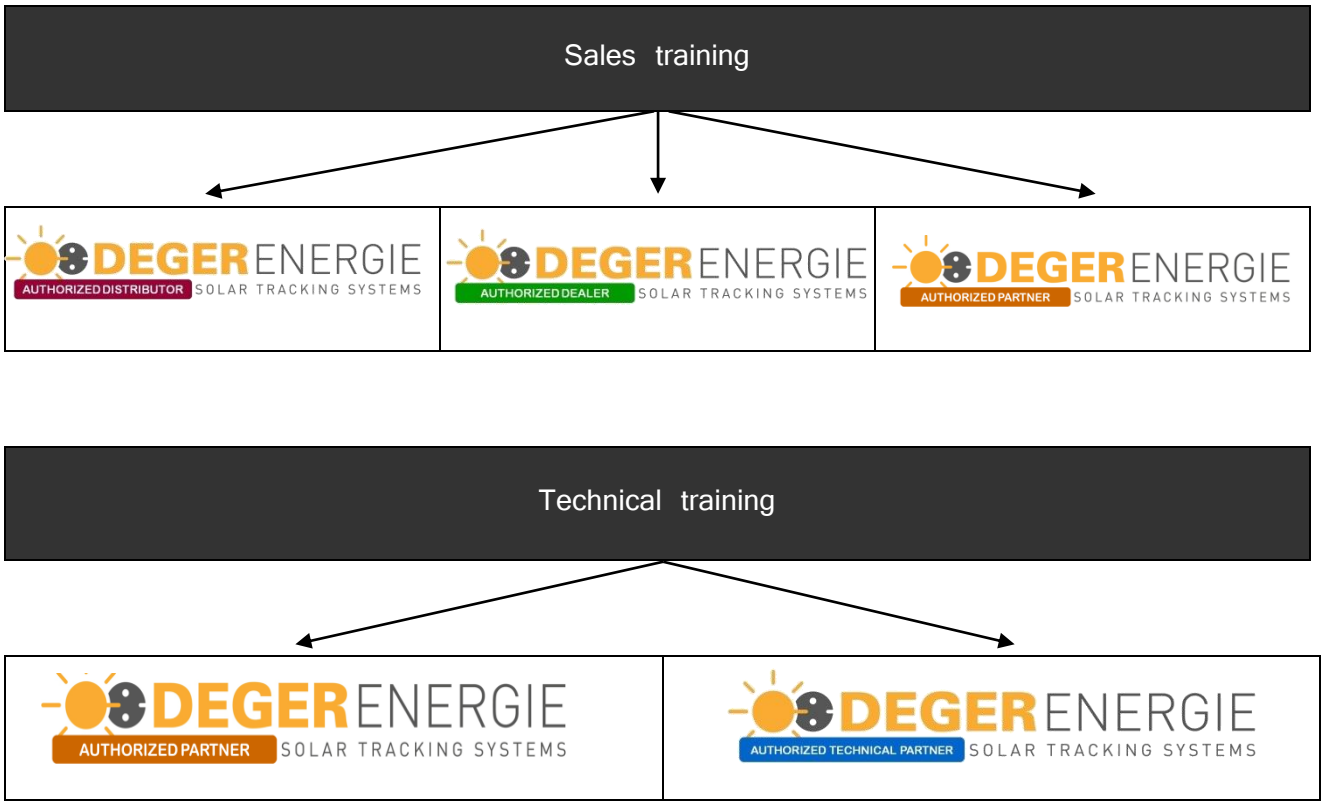
Dual use

PARTNERS

Cooperation with partners is an important part of our indirect business model.

We place great importance on the expertise of our operators and installers, and offer extensive instruction and specialized training in performance-based training packages. After all, solid expertise improves and secures the efficiency of the entire system in the long run.

We differentiate between sales and technical training, which include a two-year certificate as part of participating in and successfully completing the course.



Participation at our training program and the resulting certification mean that our partners receive the latest information, thus achieving competitive advantages in the sale, project planning and installation of single-axis and dual-axis tracking systems.

Certified partners who work together with DEGERenergie are also published on www.degerenergie.com.

PROFITABILITY ANALYSIS

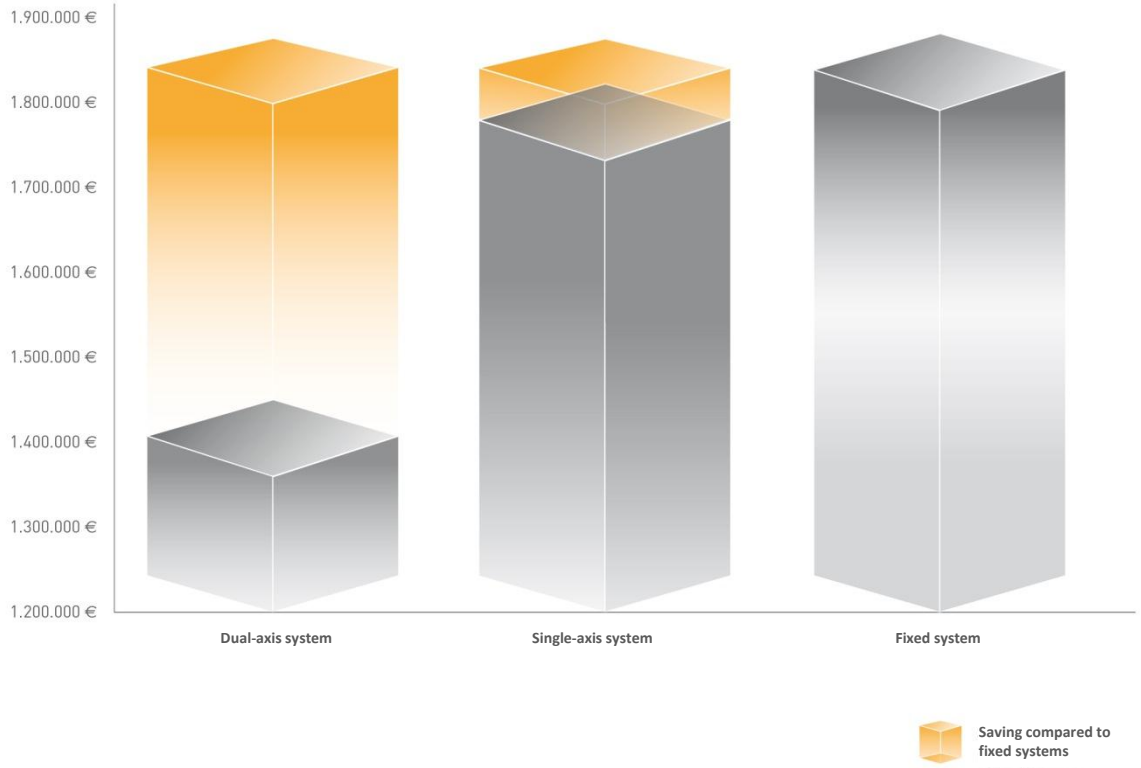
Calculation example: Cost comparison, dual-axis / single-axis / fixed *

The investor's objective is to produce 1 GWh of power p.a. The calculation includes all expenses incurred in the construction of a solar park. A complete, detailed overview is available upon request.

		Dual-axis system	Single-axis system	Fixed system
Annual power generation	[GWh]	1 GWh	1 GWh	1 GWh
Investment amount at €1.00/Wp	[€]	1.201.820 €	1.397.900 €	1.419.000 €
Additional costs	[%]	100%	116%	118%

* The sample calculations are based on regions where fixed systems generate approximately 1,500 kWp per year.

Investment comparison for three systems



With fixed systems a 18 percent higher investment is required to achieve the same benefit. The tracking system enables investors to utilize modules and inverters in a smart and cost-efficient way. The cost advantage arises precisely from that point. The modules alone comprise an investment share of 45 – 55 percent in solar parks. Thus DEGERtrakers are the most economical version for generating a predetermined amount of power.

SUPPLY CHAIN, PHOENIX USA

We build relationships in the communities in which we do business by sourcing 90% of our parts locally. Our local partners are metal specialists that have distinguished themselves over time and who live up to the standards set forth by our Headquarters in Germany.
All product assembly occurs locally, in our facilities or with partners.

Our US Headquarter is based in Phoenix AZ and the procurement and assembly of all parts is done by local contractors and our own staff. Direct and indirect Jobs associated with our operation in Phoenix are approximately 40.

PUBLISHER INFORMATION

DEGERenergie GmbH
Industriestr. 70
D-72160 Horb am Neckar
Germany
Tel: +49 (0) 7451-53914-0
Fax: +49 (0) 7451-53914-10

www.degerenergie.com
info@degerenergie.com

CEO: Artur Deger
Registered Head Office: Horb
Registrar of Companies: Stuttgart county court
HRB 440745
Vat No.: DE 226334348