

## Comparative measurements at the Solarpark Rexingen:

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.

### 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

### System 1

Fixed tilt installation 30° south-facing



### System 2

### System 2

Single-axis DEGER tracker with MLD sensor



Dual axis astronomical controlled



### System 4

Dual-axis DEGER tracker with MLD sensor



## Analysis procedures

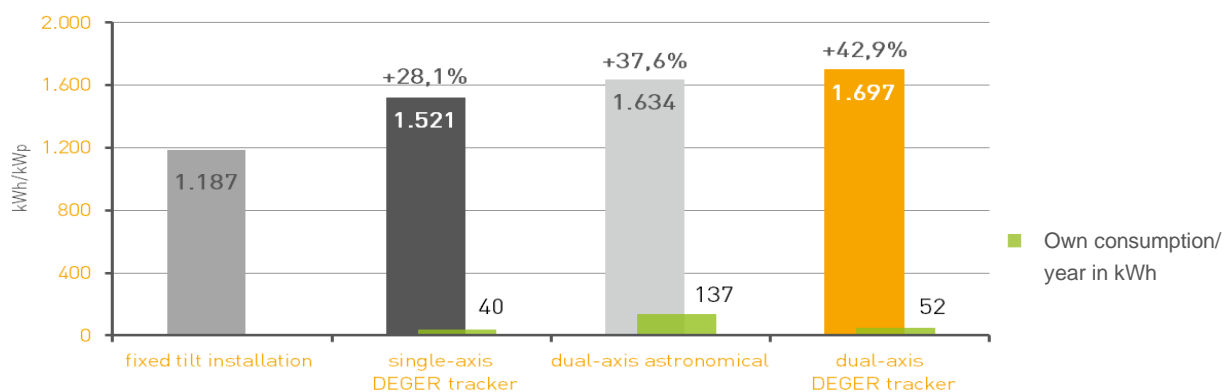
For the evaluation two different methods were used.

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 calculation

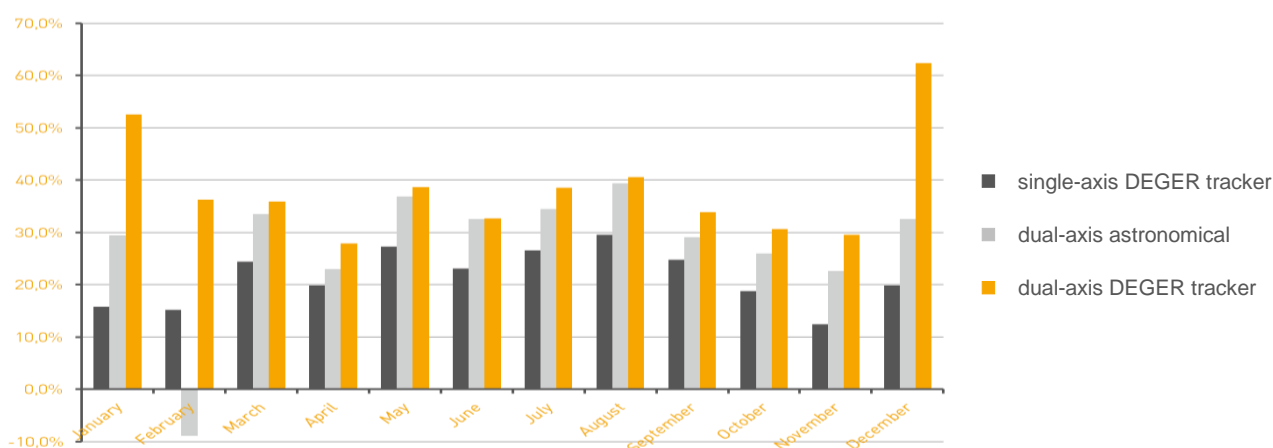
## Results

According to the one hundred percent availability of data in 2012 the following values are determined with the standard method:

### Comparative measurements in 2012 in solar park Rexingen



### Additional yield monthly results in 2012 compared to fixed tilt systems



### Additional yield monthly results in 2012 compared to fixed tilt systems in percent

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
single-axis DEGER tracker	15,7%	15,2%	24,4%	19,8%	27,2%	23,1%	26,5%	29,5%	24,7%	18,8%	12,4%	19,8%
dual-axis astronomical	29,4%	-8,9%	33,5%	23,0%	36,8%	32,5%	34,4%	39,4%	29,0%	25,9%	22,6%	32,5%
dual-axis DEGER tracker	52,5%	36,2%	35,9%	27,8%	38,6%	32,6%	38,5%	40,6%	33,8%	30,6%	29,5%	62,3%

### The result of the study

- DEGER tracker are generating a 42.9% higher yield compared with static systems
- DEGER tracker are generating a 5.3% higher yield compared with astronomical controlled systems.
- DEGER tracker have the lowest operating power consumption compared to the measured tracking systems in this study
- During the winter, astronomically controlled units may not even outperform 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