IMO

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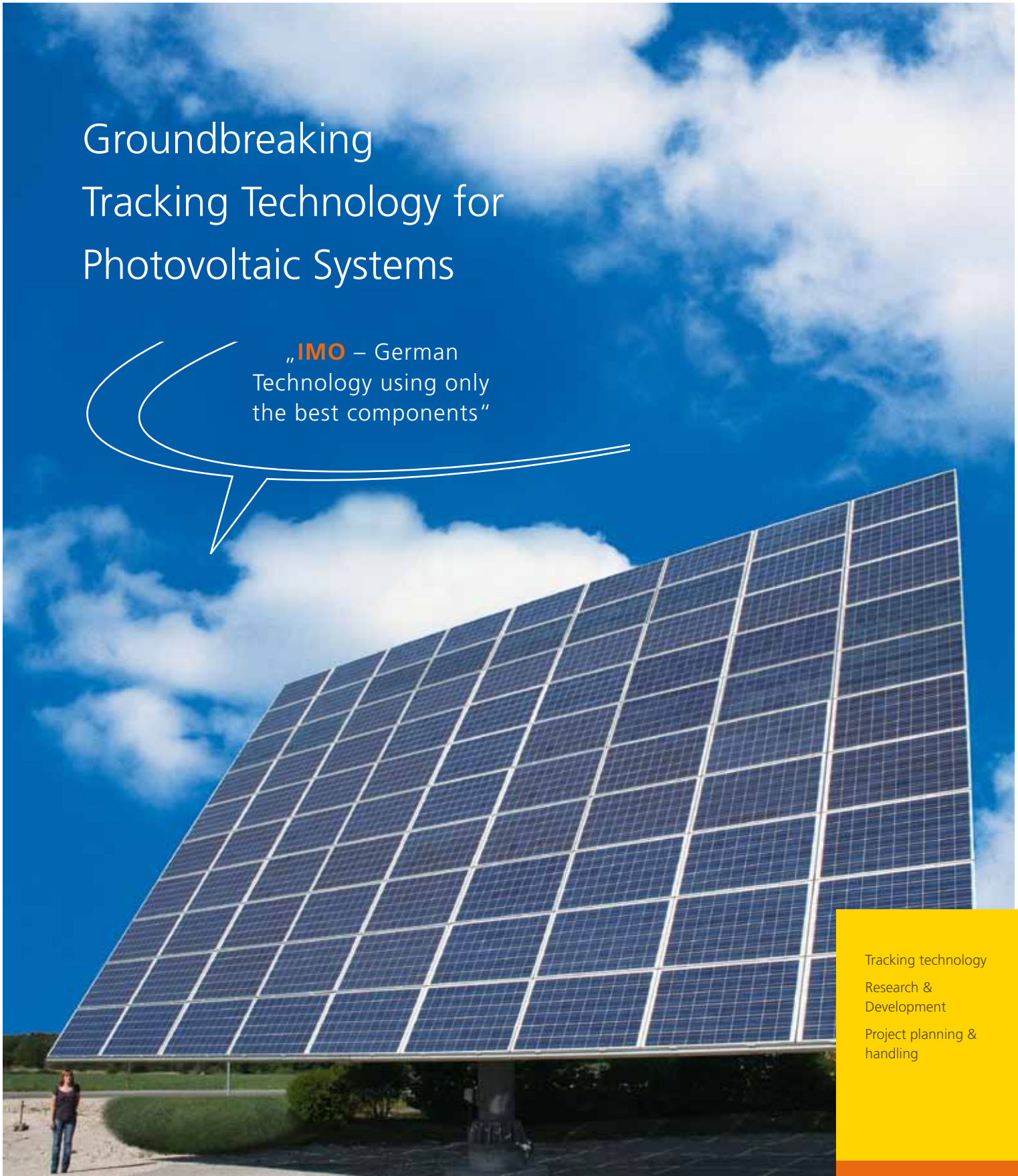
Groundbreaking Tracking Technology for Photovoltaic Systems

„**IMO** – German Technology using only the best components“



Tracking technology

Research & Development

Project planning & handling

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Engineering at its best

IMO Premium-Quality

- Tracking system: Slewable head with patented Slew Drives
  - Designed for high loads
  - Maintenance free for at least 10 years using a sealed system
- Statically and dynamically optimized through state-of-the-art FEA
- Top quality electronic components compliant to highest quality standards
- Galvanized steel structures offer superior corrosion protection
- State-of-the-art modular technology
- Tracking technology with exceptional accuracy
- Maximum CO_2 reduction

Intelligent and Yet So Simple

- Intelligent modular components right from the foundation to the control center facilitate fast installation of complete solar parks
- Modern, remote monitoring systems for diagnostic and control purposes allow service staff to react very quickly and minimize downtimes

We are happy to take on the project from the initial planning and production to the final handover of the product. Furthermore, after completion we will take care of your continued maintenance and monitoring if so requested.

We Optimize Your Yield

Individual Planning
We love an engineering challenge. Benefit from our proven expertise.

+

Site analysis and calculation
Your output is influenced by the location. With our expertise, we will determine the best layout for your site.

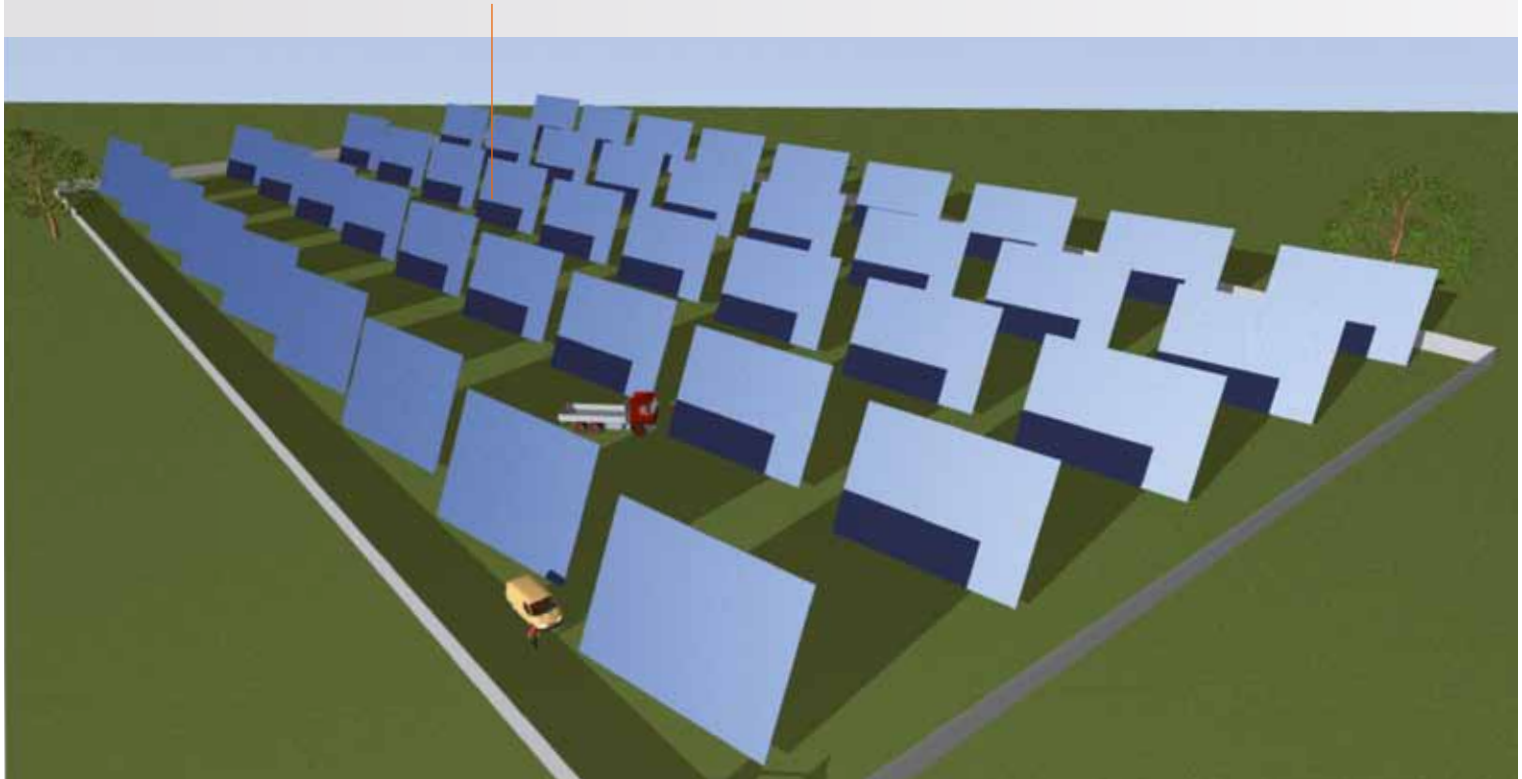
+

Shading analysis
You only achieve optimal output with a perfectly matched system. We will show you how.

+

Yield Calculation
You would like to know up front what your yield will be? We will provide you with the facts and figures.

**To make sure the whole system is equally illuminated:
Shading analysis in advance of planning.**



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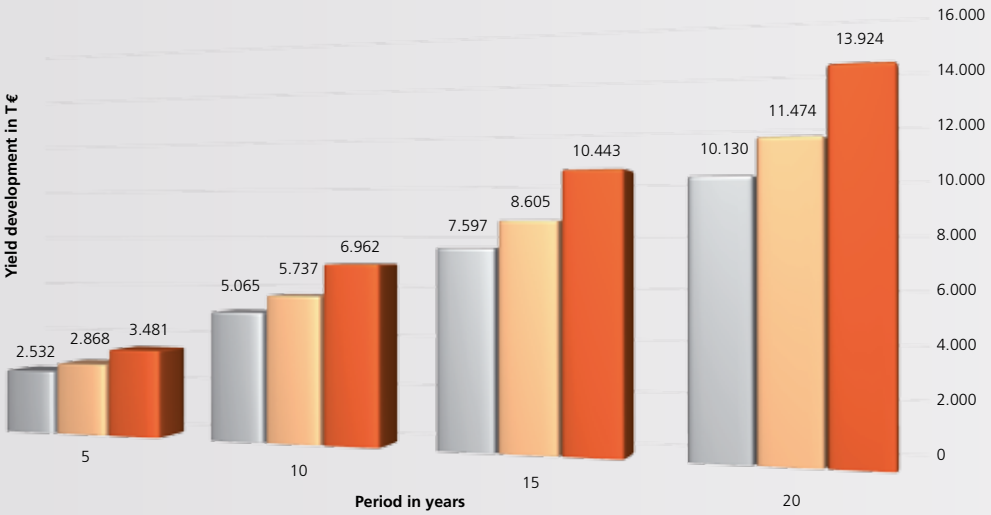
Reliable technology for maximum output

Yield development over 20 years



Example calculation
Solar park 1,080 kWp,
Location Greece, feed-in tariff
May 2011

- Fixed system
- Single-axis tracking system
- Dual-axis tracking system

Calculation of return on investment

	Profit after 20 years minus the investment costs	Amortization of the investment costs
Fixed system	approx. 7 million €	after 6.19 years
Single-axis tracking system	approx. 7.7 million €	after 6.55 years
Dual-axis tracking system	approx. 9.9 million €	after 5.75 years

41 %
more profit*

* After an operation period of 20 years using a dual-axis tracking system in comparison to a fixed system minus the investment costs.

Solar technology under test conditions:
Our tracker site in Gremsdorf, Bavaria, Germany.

Tracking technology

IMO Slew Drives – a class of their own …

- Ready-to-install system components
- Highest torques of all available solutions on the market
- Smooth adjustment thanks to high transmission ratio
- Encapsulated housing
- Designed for durability with minimal maintenance

Intelligent Controlling

- Cluster controlling can regulate up to 16 dual-axis trackers
- Easy adjustment of parameters with PC (e.g. Notebook with Windows operating system)
- Real-time clock for astronomical tracking
- Electrical angle precision - 0.01°
- Evaluation of maximum two wind sensors (anemometer) possible
- A binary input for an external alarm signal
- Cluster control communicates with the drives (trackers) via Ethernet
- Ideal remote monitoring by means of connecting the cluster controller to the internet (e.g. with ISDN- or broad band router). Access to the drives.
- Parameters for night and storm positions
- Tracking intervals in minute increments (1 … 60 min) can be assigned as parameters
- Four end switches per axis (two each for elevation and azimuth)
- Maximum and minimum positions of the axes can have assigned parameters

IMO Slewing Gear: Patented Slew Drive Dual-axis Tracking

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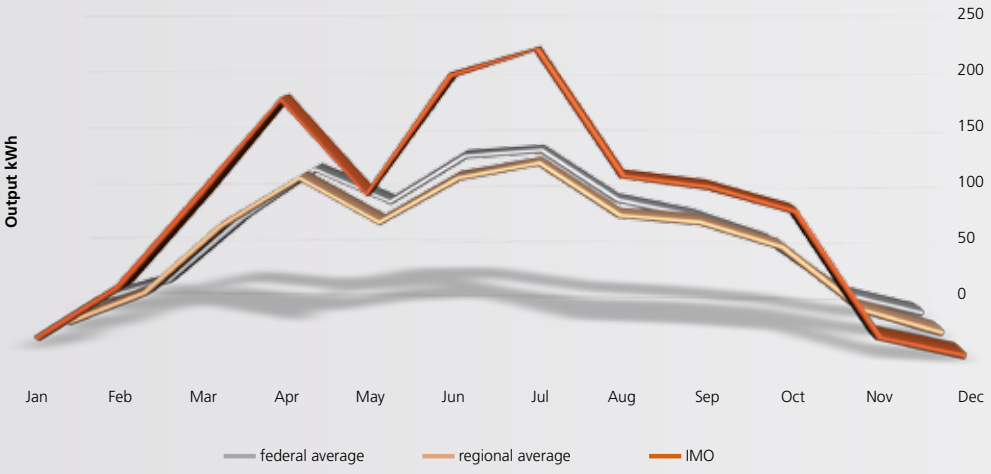
It's worth tracking

Output comparison of dual-axis tracking solar systems

With intelligently planned tracking, high quality components, precise coordination and construction, our dual-axis tracking solar system in our location in Gremsdorf, Bavaria, Germany is well above the regional and federal average.

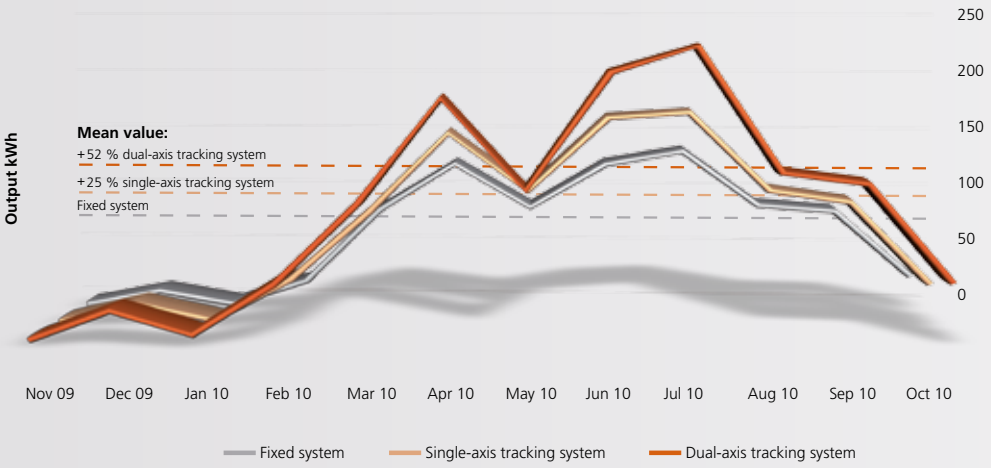


38 %
more output*

* IMO solar systems yield 38 % more output than the federal average by using intelligently planned tracking.

Output IMO Tracker Park

Three different system concepts on our tracker test site in Gremsdorf, Bavaria, Germany prove that tracking is really worth it. *



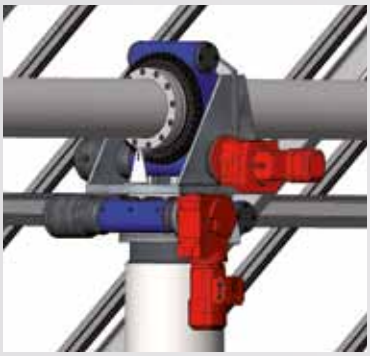
52 %
more output*

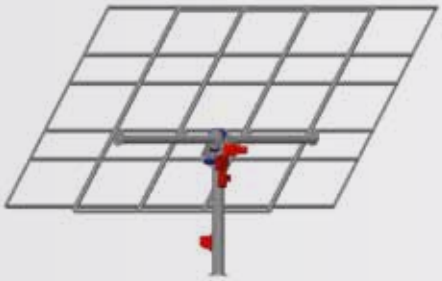
* Our tracker tests have proven that, on average, dual-axis tracking systems yield 52 % more output than fixed systems.

* All systems are comparable, i.e. same power, same modual technology, identical conversion technology

IMO Solar tracker

Dual-axis tracker, area 40 m² and 80 m²



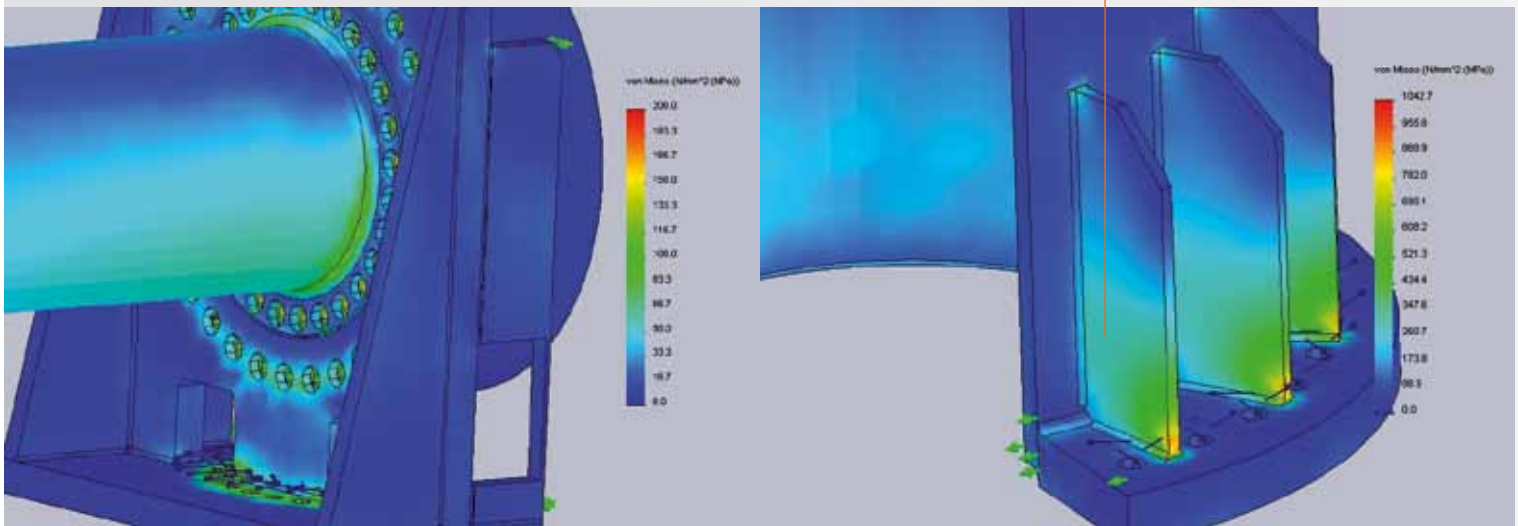


Technical Data	IMO ST2A 04	IMO ST2A 08
Installed power max.:	6 kWp	12 kWp
Number of panels:	24	48
Panel area up to:	40 m²	80 m²
Storm protection/power failure:	Safe table position (solar panels switch to table position once a programmed wind speed is reached) also in the case of power failure	
Wind speed:	Max. 140 km/h (at 45° inclination)	Max. 140 km/h (at 45° inclination)
Snow load:	75 kg/m²	75 kg/m²
Azimuth drive:	1 IMO Slew Drive WD-H 0220 (torque max. 11,093 Nm) combined with 1 bevel gear motor (torque 486 Nm)	1 IMO Slew Drive WD-H 0373 (torque max. 47,416 Nm) combined with 1 bevel gear motor (torque 700 Nm)
Elevation drive:	1 IMO Slew Drive WD-H 0220 (torque max. 11,093 Nm) combined with 1 spur gear motor (torque 486 Nm)	1 IMO Slew Drive WD-H 0373 (torque max. 47,416 Nm) combined with 1 spur gear motor (torque 700 Nm)
Motor power:	0.25 kW/axis	0.5 kW/axis
Running consumption approx.:	168 kWh/year	334 kWh/year
Azimuth adjustment:	> 320° with end switch monitoring	> 320° with end switch monitoring
Elevation angle:	> 90°	> 90°
Controlling concept:	Astronomical tracking; as an optional extra, precision tracking available	
Mechanical tracking accuracy:	0.105° - 0.135°	0.105° - 0.135°
Electrical tracking accuracy:	0.01°	0.01°
Height/width/weight (without panels):	5.3 m / 8 m / 1,000 kg from foundation	8.6 m / 10 m / 3,000 kg from foundation

On customer request:

- Integrated tilt element in the pillar for easy assembly
- Service contract

Statically and dynamically perfect: Steel structure optimization using state-of-the-art FEM calculations.



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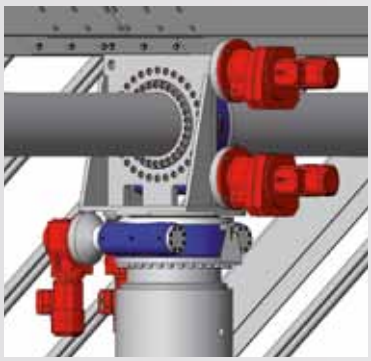
IMO Solar tracker

Dual-axis tracker, area 150 m² and 165 m²



Technical Data	IMO ST2A 15	IMO ST2A 16
Installed power max.:	22,5 kWp	24,75 kWp
Number of panels:	90	99
Panel area up to:	150 m²	165 m²
Storm protection/power failure:	Safe table position (solar panels switch to table position once a programmed wind speed is reached) also in the case of power failure	
Wind speed:	Max. 140 km/h (at 45° inclination)	Max. 140 km/h (at 45° inclination)
Snow load:	75 kg/m²	75 kg/m²
Azimuth drive:	1 IMO Slew Drive WD-H 0373 twin drive (torque max. 94,832 Nm) combined with 2 bevel gear motors (torque 700 Nm per drive)	1 IMO Slew Drive WD-H 0373 twin drive (torque max. 94,832 Nm) combined with 2 bevel gear motors (torque 700 Nm per drive)
Elevation drive:	1 IMO Slew Drive WD-H 0373 twin drive (torque max. 94,832 Nm) combined with 2 spur gear motors (torque 700 Nm per drive)	1 IMO Slew Drive WD-H 0373 twin drive (torque max. 94,832 Nm) combined with 2 spur gear motors (torque 700 Nm per drive)
Motor power:	0.74 kW/axis	0.74 kW/axis
Running consumption approx.:	496 kWh/year	496 kWh/year
Azimuth adjustment:	> 320° with end switch monitoring	> 320° with end switch monitoring
Elevation angle:	> 90°	ca. 50°
Controlling concept:	Astronomical tracking; as an optional extra, precision tracking available	
Mechanical tracking accuracy:	0.105° - 0.135°	0.105° - 0.135°
Electrical tracking accuracy:	0.01°	0.01°
Height/width/weight (without panels):	10.5 m / 15 m / 10,000 kg from foundation	11.6 m / 15 m / 10,800 kg from foundation

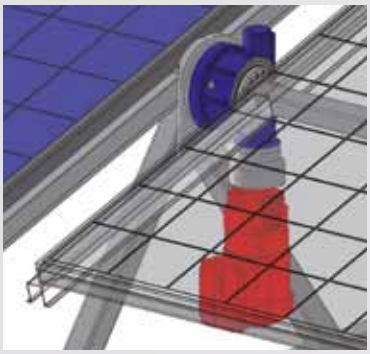
On customer request:

- Integrated tilt element in the pillar for easy assembly
- Service contract

Quick and easy to assemble by lying out flat – then just erect the assembled units - ready: The tilt element integrated in the tracker pillar facilitates assembly.

IMO Flat roof systems

Single-axis tracker, up to 66 m²



Technical Data	IMO HA1A 10
Installed power max.:	10 kWp (per drive)
Number of panels:	40
Panel area up to:	66 m²
Storm protection/power failure:	Protection position with minimal windage surface
Wind speed:	Wind load zone 4 / DIN 1055
Snow load:	Up to snow load zone 3
Elevation drive:	IMO Slew Drive
Motor power:	0.55 kW (depending on individual layout)
Elevation angle:	± 45°
Controlling concept:	Astronomical
Mechanical tracking accuracy:	1°
Electrical tracking accuracy:	1°
Height/width/weight (with panels)	Approx. 1.25 m / 5-row à 8.5 m* / < 15 kg/m²**

* can be customized
** depending on panels

Advantages

- Up to 30 % more output thanks to astronomical tracking (depending on location)
- IMO's patented Slew Drives offer a long operating life
- Short assembly and set-up times
- Even distribution of load on the roof
- No roof penetration
- FEM optimized steel structure
- No rust – due to top-quality materials, stainless steel and aluminium
- Excellent stability using cross-bar connections
- Storm position
- Can be mounted on all flat roofs and corrugated metals
- Suitable for all common panels
- Low running consumption
- Astronomical tracking
- Shade-free tracking / backtracking possible

Follows the sun also from the roof – single-axis tracker / Flat roof system

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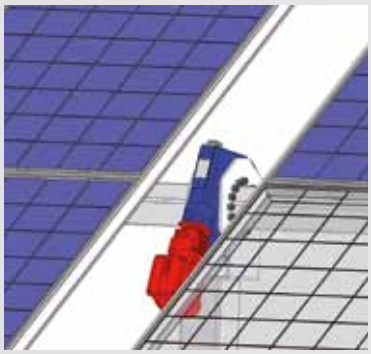
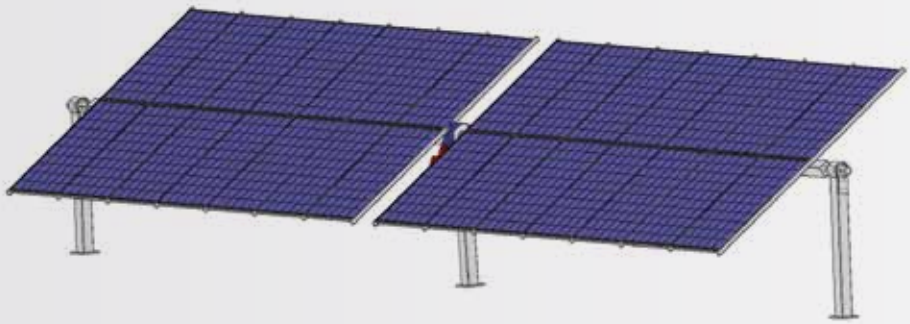
IMO Open space areas

Single-axis tracking, up to 46 m²



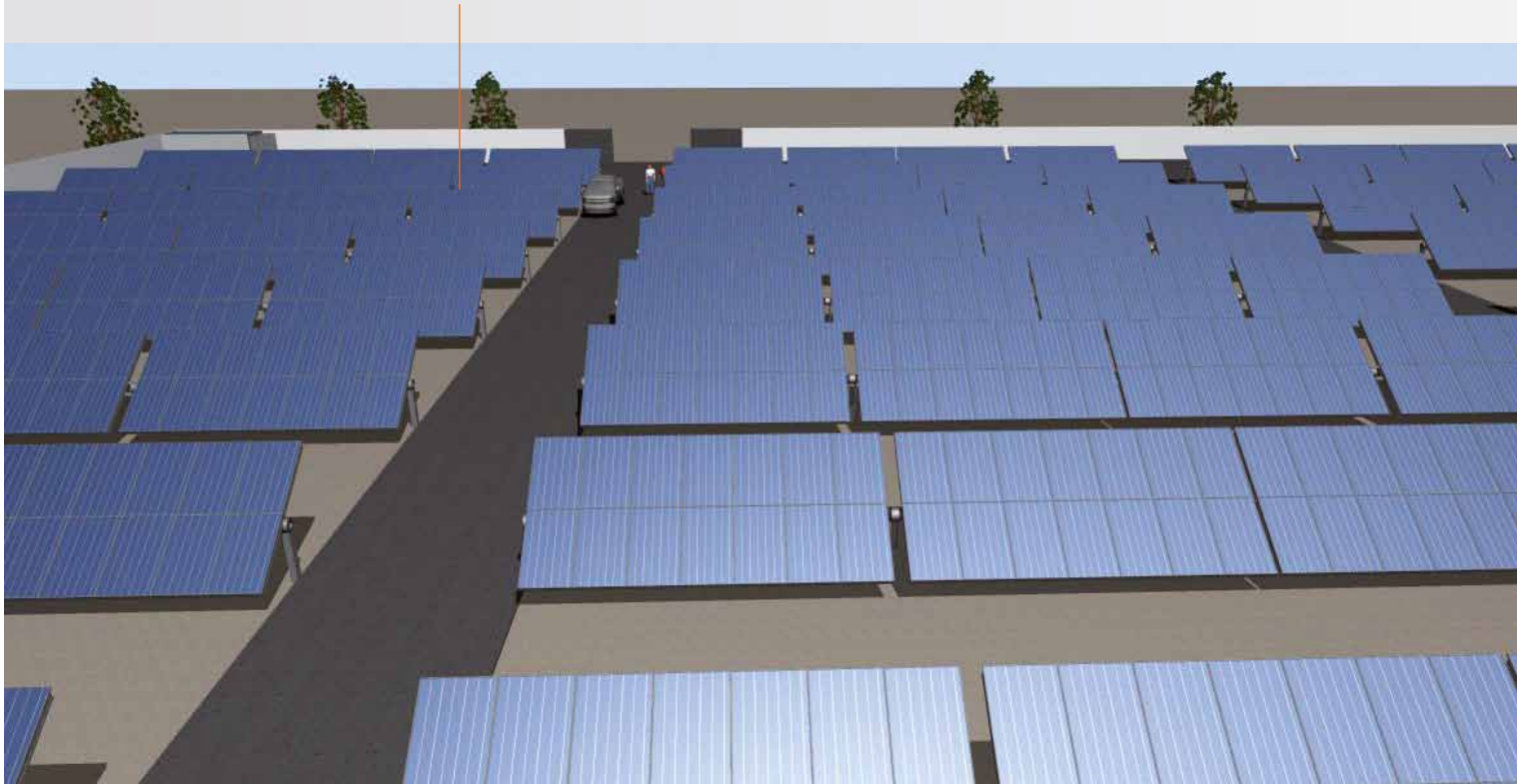


Technical Data	IMO HF1A 07
Installed power max.:	7 kWp (per drive)
Number of panels:	28
Panel area up to:	46 m²
Storm protection/power failure:	Safety position with minimal windage surface
Wind speed:	Up to 160 km/h
Snow load:	Up to snow load zone 3
Elevation drive:	IMO Slew Drive
Motor power:	0.75 kW (depending on individual layout)
Elevation angle:	± 45°
Controlling concept:	Astronomical
Mechanical tracking accuracy:	1°
Electrical tracking accuracy:	1°
Height/width:	2.80 m / 14 m

Advantages

- Up to 30 % more output thanks to astronomical tracking (depending on location)
- Long durability due to patented IMO Slew Drive
- Short assembly times
- Earth bolt foundations
- FEM optimized steel structure
- No rust – due to hot-dip galvanised steel structure
- Storm position
- Suitable for all common panels
- Low running consumption
- Astronomical tracking
- Shade-free tracking / backtracking possible

**Sun on large areas – ideal usage of property space:
single-axis tracker / Open space system.**



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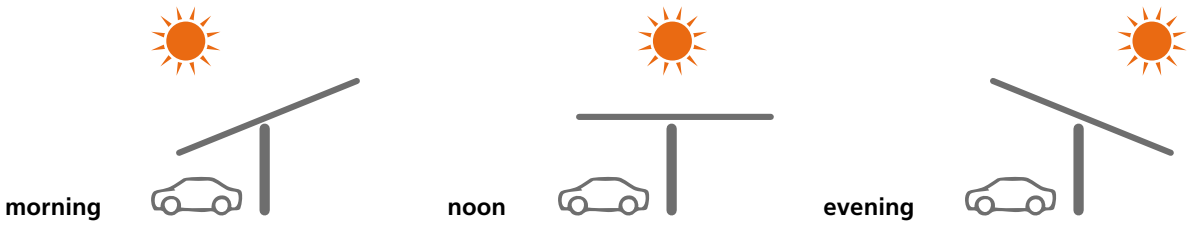
IMO Roofing for car parks

Take advantage of these already existing areas and produce energy for feed-in or self usage. By arranging the pillars appropriately there are no or only minimal disturbances in the parking process.

Astronomical tracking East/West



Innovative concept

- Unique construction with high-tech components
- Minimal base space required but with large PV area
- Up to 30 % more output thanks to astronomical tracking (depending on location)

Roofing for car parks – an excellent benefit

- Dual use of parking space: parking lots and power generation
- Multi-purpose use of the roofing: sun protection, power generation and night lighting
- The power generated can be used for recharging electro-vehicles

Simply very clever: During the day, sun and weather protection while generating power. At night, well-lit parking spaces thanks to the integrated lighting.

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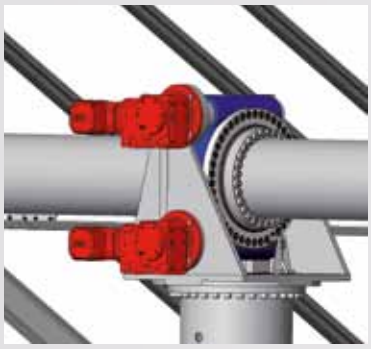
IMO Roofing for car parks

Single-axis tracker



Technical Data	IMO ST1A 16
Installed power max.:	24,75 kWp
Number of panels:	99
Panel area up to:	165 m^2
Storm protection/power failure:	Safe table position (solar panels switch to table position when a power failure occurs and if the wind speed exceeds the programmed value)
Wind speed:	Up to 140 km/h
Snow load:	75 kg/m^2
Elevation drive:	IMO Slew Drive WD-H 0373 twin drive (torque max. 94,832 Nm) in combination with 2 bevel gear motors (torque 700 Nm, per drive)
Motor power:	0.74 kW/axis
Own consumption approx.:	196 kWh/year
Elevation angle:	Freely adjustable
Controlling concept:	Astronomical tracking East/West
Mechanical tracking accuracy:	0.105° - 0.135°
Electrical tracking accuracy:	0.01°
Height/width/weight (without panels):	10 m / 15 m / 10,000 kg from foundation

Advantages

- Unique construction with high-tech components
- Minimal base space required but with large PV area
- Up to 30 % more output thanks to astronomical tracking (depending on location)

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IMO Group Manufacturing Sites

Plant I, Gremsdorf, Germany

Plant II, Gremsdorf, Germany

Plant III, Summerville, SC, USA

IMOGROUP

Strong partner

Profound Expert Knowledge

We have more than 20 years experience. Each company within the group is specialised, researches and develops in that particular area. Our experience covers the fields of tracking technologies for photovoltaic systems, mechanical engineering, slewing ring technology and gear manufacturing.

Dependable Quality

Complex further developments and solutions are based on technically sophisticated products. We have received awards at inventions and innovations fairs and hold many patents worldwide.

Quick Reaction Times

Long-term experience in intelligent-process control for mass production as well as in customer-oriented product development.

Worldwide Availability

You can depend on our network of IMO branches and our long-term co-operation partners to support you with products and services.

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All contact details of our global partners are to be found at **www.imo.de**