SOLAR TRACKING SYSTEM
From research and design to the construction and successful completion of the final project.

**Group 1
SABO**
- Large industrial scale projects & turn key plants.
- Design, construction and installation of machinery for the brick & tile industry.
- Systems for packaging, palletizing, handing and conveying products.
- Production lines for tile industry.

**Group 2
SABO ELECTRIC**
- Electrical installation of industrial machinery - production lines, industrial buildings and structured cabling.
- Medium and low voltage distribution boards.
- Automation using PLC, SCADA, control systems.

**Group 3
SICAP**
- Construction of new industrial units.
- Maintenance and modernization of existing industrial buildings.
- Construction of public and private roads, ports, hydraulic drainage systems with the use of modern machinery such as asphalt equipment and excavators.
- Dies for augers, moulds and cores.
- Anti wear coating, hard chrome plating to metal parts showing wear and tear.

**Group 4
SABO energy**
- Design and installation of turn key solar power plants, industrial roofing and residential solar power systems.
### SR 80 SQM
#### DOUBLE AXIS SOLAR TRACKER

<table>
<thead>
<tr>
<th>Physical Characteristics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration (rows – length)</td>
<td>4 X 12 rows – 6.8 X 12.4 m</td>
</tr>
<tr>
<td>Area (varies according to the module)</td>
<td>Up to 85 m²</td>
</tr>
<tr>
<td>Adjustable inclination angle</td>
<td>25°– 90°</td>
</tr>
<tr>
<td>Azimuthally sweep</td>
<td>300°</td>
</tr>
<tr>
<td>Azimuthally Automatic, Precision</td>
<td>±0.5°</td>
</tr>
<tr>
<td><strong>Type of tracking</strong></td>
<td></td>
</tr>
<tr>
<td>Inclination second axis</td>
<td>Automatic, Gear motor controlled by control room.</td>
</tr>
<tr>
<td>Annual energy consumption</td>
<td>Around 60 kWh/year</td>
</tr>
</tbody>
</table>

### Mechanical Characteristics

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
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<tbody>
<tr>
<td>Resistance to wind</td>
<td>Structure designed to resist up to 140km/h in safety position</td>
</tr>
<tr>
<td>Weight of the structure without modules</td>
<td>4500 kg</td>
</tr>
<tr>
<td>Sun tracking system</td>
<td>Astronomical data</td>
</tr>
<tr>
<td>Size of foundations</td>
<td>~ 13 m³</td>
</tr>
</tbody>
</table>
SR 90 SQM
DOUBLE AXIS SOLAR TRACKER

Physical Characteristics

<table>
<thead>
<tr>
<th>Configuration (rows – length)</th>
<th>54 panel - 6.8 x 14.2 m</th>
</tr>
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<tr>
<td>Area (varies according to the module)</td>
<td>Up to 95 m²</td>
</tr>
<tr>
<td>Adjustable inclination angle</td>
<td>25°- 90°</td>
</tr>
<tr>
<td>Azimuthally sweep</td>
<td>300°</td>
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<td>Azimuthally Automatic, Precision</td>
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Type of tracking

Inclination second axis

Annual energy consumption

Around 100 kWh/year

Mechanical Characteristics

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<td>~ 13.5 m³</td>
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DOUBLE AXIS SOLAR TRACKER

A range of competitive advantages of the system

Our objective is to guarantee you the highest levels of freedom and flexibility when designing your solar project, increasing its production with the highest levels of technological speed and simplicity.

<table>
<thead>
<tr>
<th>Structural Advantages</th>
<th>Other Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Low height and minimum visual impact.</td>
<td>-Astronomical tracking system for increase focus precision.</td>
</tr>
<tr>
<td>-Reduction of the number of trackers for the same level of power.</td>
<td>-Minimum consumption per machine.</td>
</tr>
<tr>
<td>-Optimization of occupied space by increasing the power density of the park.</td>
<td>-Independence of tracking movement, free from grid variations.</td>
</tr>
<tr>
<td>-Infrastructure savings: brackets cables foundations.</td>
<td>-2 days autonomy provided from battery in the control room.</td>
</tr>
<tr>
<td>-Increased reliability and robustness of the control system compared with other smaller size solutions.</td>
<td>-Orientation the system through electronic controls without mechanical equipments.</td>
</tr>
<tr>
<td>-Rapid assembly and start-up by reducing the number of machines to install.</td>
<td>-All movements with DC motors.</td>
</tr>
<tr>
<td>-Important reduction of the whole life maintenance cost of your solar park, regarding the other solutions based on smaller trackers.</td>
<td>-Available monitoring of the tracking system.</td>
</tr>
</tbody>
</table>
**Design Advantages**

Arrangement of module rows at different levels and on two slopes.

- Improved ventilation for the modules, which increases their efficiency and useful life.
- Possibility of adapting any module (standard design for panels maximum length up to 1700 mm). Other lengths please contact SABO.

- Perfect stability of the assembly and improved coefficient of wind resistance for the machine, due to the “steps” design of our modules structure.
  
  Self-ventilated arms:
  - Elements with airways that enable the heat generated to be dissipated over the parts of the machine.

**EFFECT OF THE TRACKER ON THE EFFICIENCY OF THE INVERTER**

Solar tracker has a positive impact on the total gain of the whole system, making the inverter to work as much time as possible at a better level of performance.

10 years guarantee for tracker structure. 2 year guarantee in components and works, with the option to extend to 5 or 10 years (preventative and corrective maintenance performed by SABO technicians).

We also offer a training service for your staff regarding maintenance of the machines. Contact with us for more information.
DOUBLE AXIS SOLAR TRACKER

System Safety Devices: our primary obligation

- Guaranteed sliding movement without structural damage under strong winds.
- Reduction of strengths on the machine under windy circumstances.
- Solar project includes anemometers, as part of supplies.

- Automatic positioning in safety position under winds over 60 km/h.
- Trackers take the horizontal position during the night which also protects them from theft.

Under worst weather conditions (wind from back of machine), and failure of park security systems, the structure supports up to 140 km/h.
When designing your facility, not only will you benefit from the logistics planning of SABO for the delivery of your trackers but you will also have access to the consultancy services of our technical office.

Below are the distances for avoiding significant losses in production caused by shadows or the unsuitable use of land.

These figures are approximate as the design must be adapted to your land and your installation.

Feel free to show us your land maps so that we can advise you on the preparation of your solar plant.

<table>
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<tr>
<th>SR 90</th>
<th>SR 80</th>
</tr>
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<tbody>
<tr>
<td>We recommend a rectangular installation:</td>
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</tr>
<tr>
<td>North - South = 18 - 21 m</td>
<td>North - South = 16 - 18 m</td>
</tr>
<tr>
<td>East - West = 23 - 26 m</td>
<td>East - West = 21 - 25 m</td>
</tr>
<tr>
<td>For a flat terrain and latitude 40°, we calculate no shadows for a solar height &gt; 20°</td>
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</table>
ISOBOX ROOM FOR INVERTERS AND AC EQUIPMENT

POWER BACK UP SYSTEM FOR THE MOVEMENT OF TRACKERS

AC SWITCH BOARD
DC SWITCH BOARD

CONTROL SYSTEM OF TRACKERS

TRACKING MOVEMENT SYSTEM
TRACKER SABO SR 80

PV PARK IN OPERATION

TRACKERS IN SAFETY POSITION
CENTRAL CONTROL OF THE SYSTEM

TRACKERS CONTROL VIA SCADA SYSTEM

CLIMATIC CONDITIONS DATA LOG VIEWER
MONITORING OF PLANT’S PRODUCTION

DAILY POWER GRAPH

DAILY YIELD OF THE PLANT
CERTIFICATE

Management system as per
EN ISO 9001: 2008
in accordance with TÜV NORD CERT procedures, it is hereby certified that
SABO HELLAS S.A.
Vasiliko Halkidos
34002 Evia
Greece
applies a management System in line with the above standard for the following scope:
Design & manufacturing of bricks & tiles machinery, handling & packaging machinery - Manufacturing of solar trackers - Installation of P/V parks

Certificate Registration No: 04 100 064525
Audit Report No: GRT - 1808/2010
Valid until: 2012-03-06
Initial certification: 2006

SABO HELLAS S.A.
ELECTROMECHANICAL CONSTRUCTIONS
INSTALLATIONS, PLC AUTOMATIONS
VASILIKO CHALKIS, EVIA
34002 GREECE

This certification was conducted in accordance with the TÜV NORD CERT auditing and certification procedures and is subject to regular surveillance audits.

TÜV NORD CERT GmbH
Langemannstrasse 20
45141 Essen
www.tuev-nord-cert.com

CERTIFICATE

This is to certify that the static design of the metallic structure “Monoassial Tracker 18 m2” of the company:
SABO S.A.
ELECTROMECHANICAL CONSTRUCTIONS
INSTALLATIONS, PLC AUTOMATIONS
VASILIKO CHALKIS, EVIA
34002 GREECE
complies with the requirements of the codes:
Eurocode 1, 3, 7, 9 and EAK 2000 (as it was amended in 2003) which define the requirements for the constructions design in Greece.
Certification: No: TUV H-1180/11
TÜV HELLAS order No: 02.07.438
The range of validity and details of the inspection can be seen in our Report no: 1180/11
(This certificate is valid in conjunction with the Reports mentioned)

Place, Date
Athens, 03/06/2011
Responsible for Certification
I. Konstantaropoulos

Headquarters
TÜV HELLAS (TÜV NORD) S.A.
24, El. Venizelou Str, 153 41, Ag. Paraskevi – Greece
Phone: +30-210-6540195, Fax: +30-210-6528025
info@tuvHELLAS.gr – www.tuvHELLAS.gr

CERTIFICATE

This is to certify that the static design Fix System Report V01-03.06.2011 of the Photovoltaic Frame Supports 16 m2 of the company:
SABO S.A.
ELECTROMECHANICAL CONSTRUCTIONS
INSTALLATIONS, PLC AUTOMATIONS
VASILIKO CHALKIS, EVIA
34002 GREECE
complies with the requirements of the codes:
Eurocode 1, 3, 7, 9 and EAK 2000 (as it was amended in 2003) which define the requirements for the constructions design in Greece.
Certification: No: TUV H-1196/11
TÜV HELLAS order No: 02.07.438
The range of validity and details of the inspection can be seen in our Report no: 1196/11
(This certificate is valid in conjunction with the Reports mentioned)

Place, Date
Athens, 07/06/2011
Responsible for Certification
I. Konstantaropoulos

Headquarters
TÜV HELLAS (TÜV NORD) S.A.
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Phone: +30-210-6540195, Fax: +30-210-6528025
info@tuvHELLAS.gr – www.tuvHELLAS.gr

CERTIFICATE

This is to certify that the static design of the metallic structure “Solar Tracker 80QM Drawing T-29444-0001.00” of the company:
SABO S.A.
34002 Vassiliko
Chalkida Greece
complies with the requirements of the codes:
Eurocode 1, 2, 7, 9 and EAK 2000 (as it was amended in 2003) which define the requirements for the constructions design in Greece.
Certification: No: TUV H-1807/10
TÜV HELLAS order No: 02.07.438
The range of validity and details of the inspection can be seen in our Report no: 1807/10
(This certificate is valid in conjunction with the Reports mentioned)

Place, Date
Athens, 10/09/2010
Responsible for Certification
I. Konstantaropoulos

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All together can save energy reduce pollutant emissions ensure a better future
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Fax: +30 22210 54073
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www.saboenergy.gr