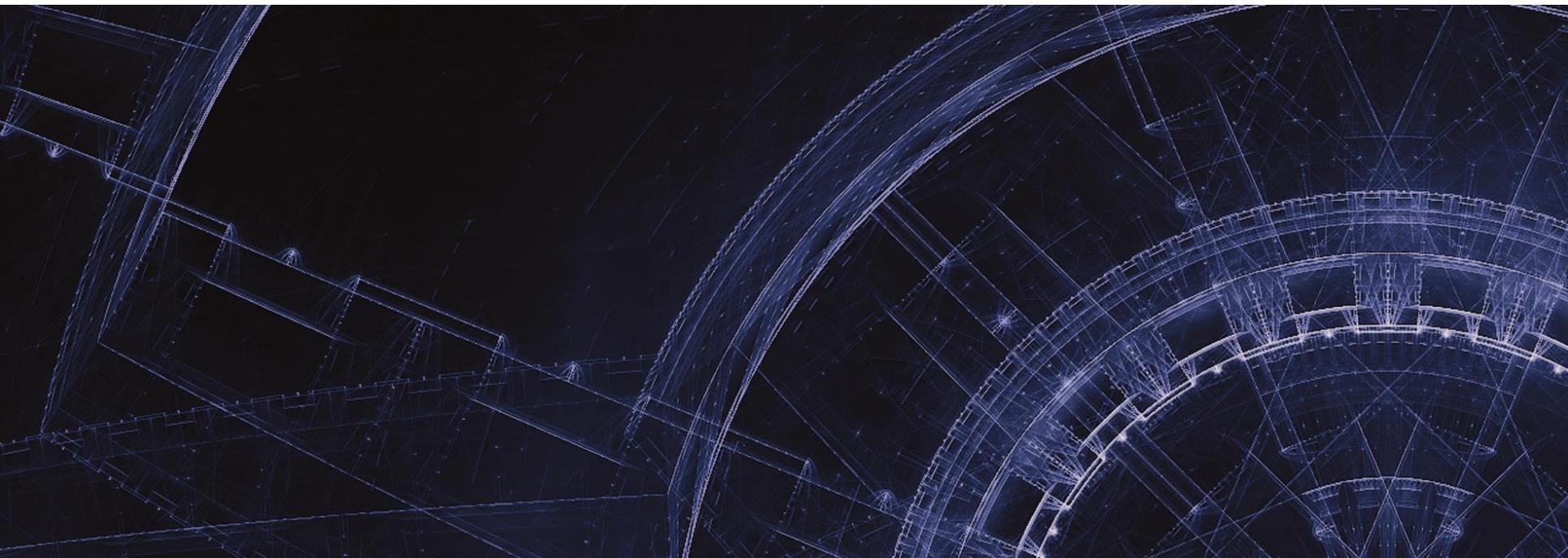


March 2014

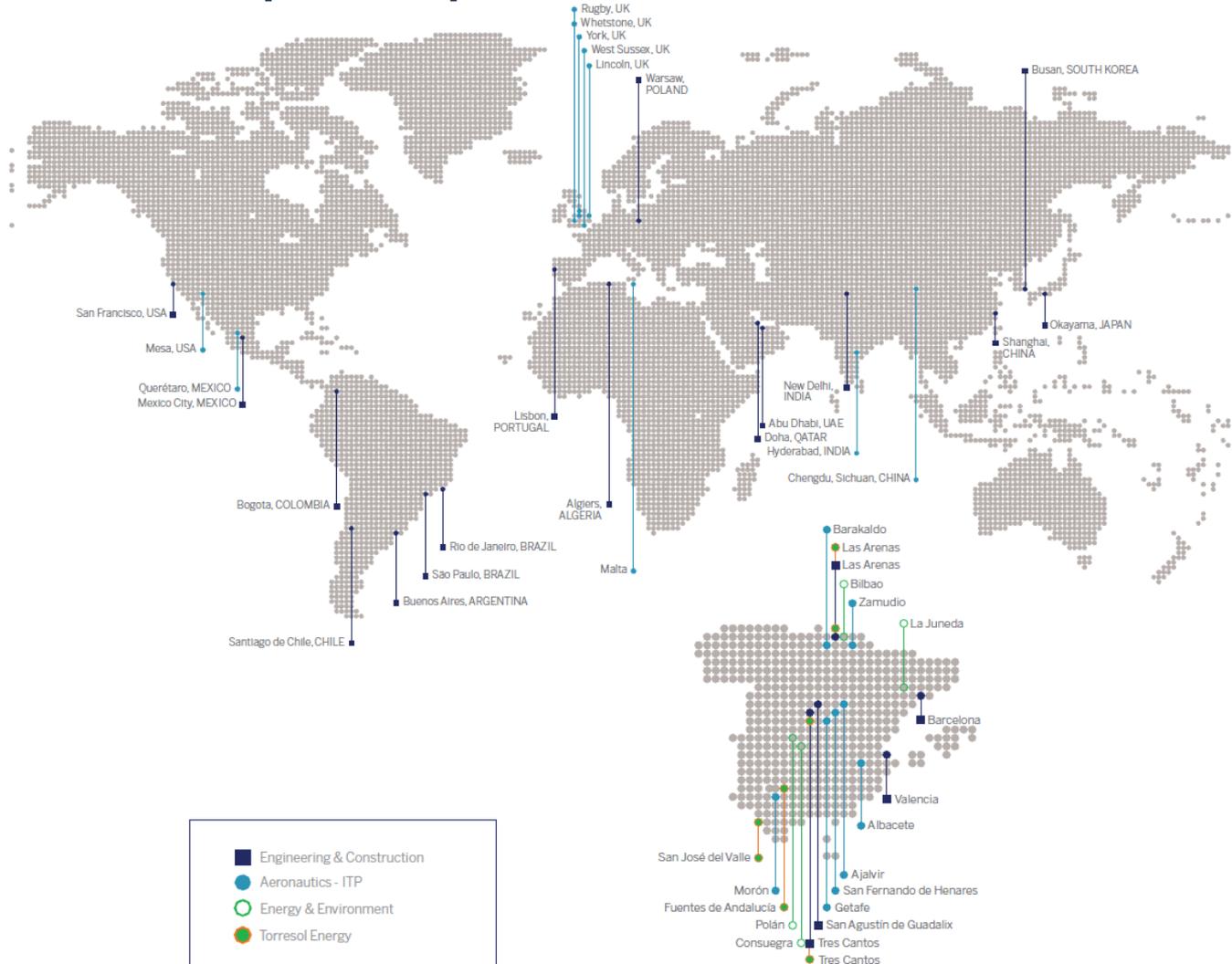


# Energy & Environment

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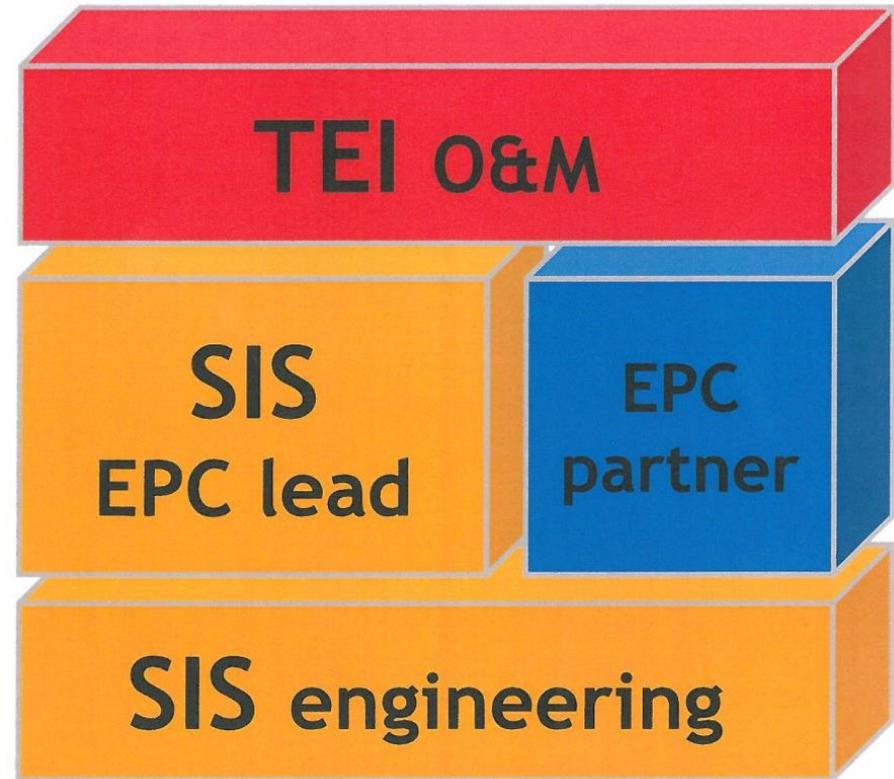
# 1. SENER Group footprint 2014



## 2. SENER Group

SENER Ingeniería y Sistemas (SIS) services in Solar Thermal Electricity (STE) Plants:

- Engineering & Technology
- EPC major risk share and LEAD
- O & M

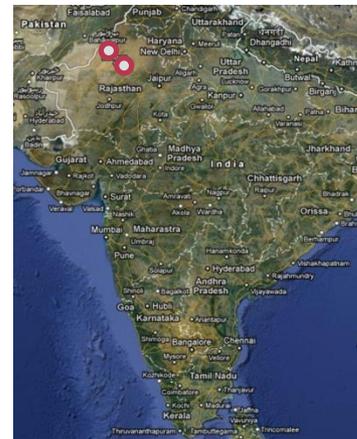


(TEI O & M - Torresol Energy)

# 2. SENER Group

## SENER STE PLANTS IN SPAIN, USA, INDIA, MOROCCO AND SOUTH AFRICA

SENER PARTICIPATES IN THE DESIGN AND CONSTRUCTION OF 27 PLANTS IN SPAIN, USA, INDIA, MOROCCO AND SOUTH AFRICA. WITH A TOTAL INSTALLED CAPACITY OF 1.710 MW



# 3. Energy & Environment Area

## Concentrated Solar Power

- SENER has developed important innovations in the area of generation from concentrated solar power and is recognized worldwide as one of the few technological leaders in this field, with 27 projects and 1.710 MW completed or in execution



Testing a tower receiver



'SENERtrough'



Molten salt heat storage system

- SENER owns 60% of Torresol Energy that operates solar generation utilities. This company focuses on new technologies for the reduction of investment costs and the increase of production hours and dispatching quality in order to make solar power increasingly competitive
- Torresol Energy has completed in 2011 the construction of its first solar tower plant and also of two 50 MW units with the SENERtrough parabolic collectors
- SENER is actively developing solar projects in several regions of the world.



SENER's heliostats

## 3. Energy & Environment Area

### GEMASOLAR (Seville, Spain)

- Key technologies: Central tower, high temperature receiver, molten salt storage, X-large heliostats
- Electrical power: 19,9 MW
- Production hours: 6,500 hpa
- Investment: 240 M€ (60% SENER)



## 3. Energy & Environment Area

### VALLE PROJECTS (TERMESOL AND ARCOSOL) (Cádiz, Spain)

- Key technologies: Parabolic trough, molten salt storage
- Electrical power: 2 \* 50 MW
- Production hours: 3,500 hpa
- Investment: 2 \* 322 M€ (60% SENER)



## 4. SENER Participation

### Main SENER participation in STAGE-STE Project

#### WP2

- Participate in the WP2 Spanish Working Group.

#### WP5

- Participate in the standardization activities and collaborate with the International Standardization Technical Committee. IEC/TC-117.

#### WP7

- To identify critical points in storage materials extracts from maintenance activities experience.
- Participate with commercial experience in storage materials and behaviors during operation phase of industrial molten salt storage.
- Contribute to the analysis of binary mixture in order to estimate the influence of these advanced storage concept.

## 4. SENER Participation

### WP8

- Definition and identification of the effects that influence in the degradation of equipment, components and systems under operation conditions.
- Participate in the definition of the accelerated ageing tests.
- Analysis of the accelerated ageing test results.
- Provide reflector samples that have been in use outdoors in commercial plants.
- Analysis of the influence of different climatic conditions on the degradation propagation.
- Expose new samples of reflectors on the outside of SENER's installations in Spain and annually evaluate the influence of the climatic conditions in its degradation.
- Identification of the characteristics of the most representative dust deposited on optical surfaces.

## 4. SENER Participation

### WP10

- STE + Desalination plants development and Techno-economic analysis of STE + Desalination plant configuration under different scenarios.

### WP11

- To develop testing dynamic solar field procedures and analyze procedures and equipment developed by other partners to compare performances.
- To analyze procedures to verify the optical and thermal status of the solar field components and of the transfer fluid.

## 4. SENER Participation

### WP12

- Review of state of the art and specifications of low cost heliostat fields.
- Collaboration in the definition of new concepts of low cost heliostat fields.
- Collaboration in the development of heliostat field control.
- Review of current calibration procedures and analysis of alternative options for large heliostat fields.
- Review of existing models and analysis of optimizations o new receiver concept for next generation solar tower.
- Collaboration in the selection of materials of new receiver concept for next generation solar tower.
- Review of current systems and procedures, collaboration in the functional specifications, analysis of testing results for receiver flux measurement.
- Review control strategies and algorithms to achieve specific flux distributions.