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ODAK2023 Kick-Off Event

Sunrise for Concentrating Solar Thermal (CST) in Turkey
METU, Ankara, Turkey. 26th February 2020

PSA and the Spanish leadership on CST Technologies
&
Transnational Access Program to PSA R&D facilities

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PSA
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PSA and the Spanish leadership on CST Technologies
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Content:

- **PSA R&D facilities and activities**
- **PSA role in the Spanish leadership on CST technologies**
- **Transnational Access Program of SFERA-III project**

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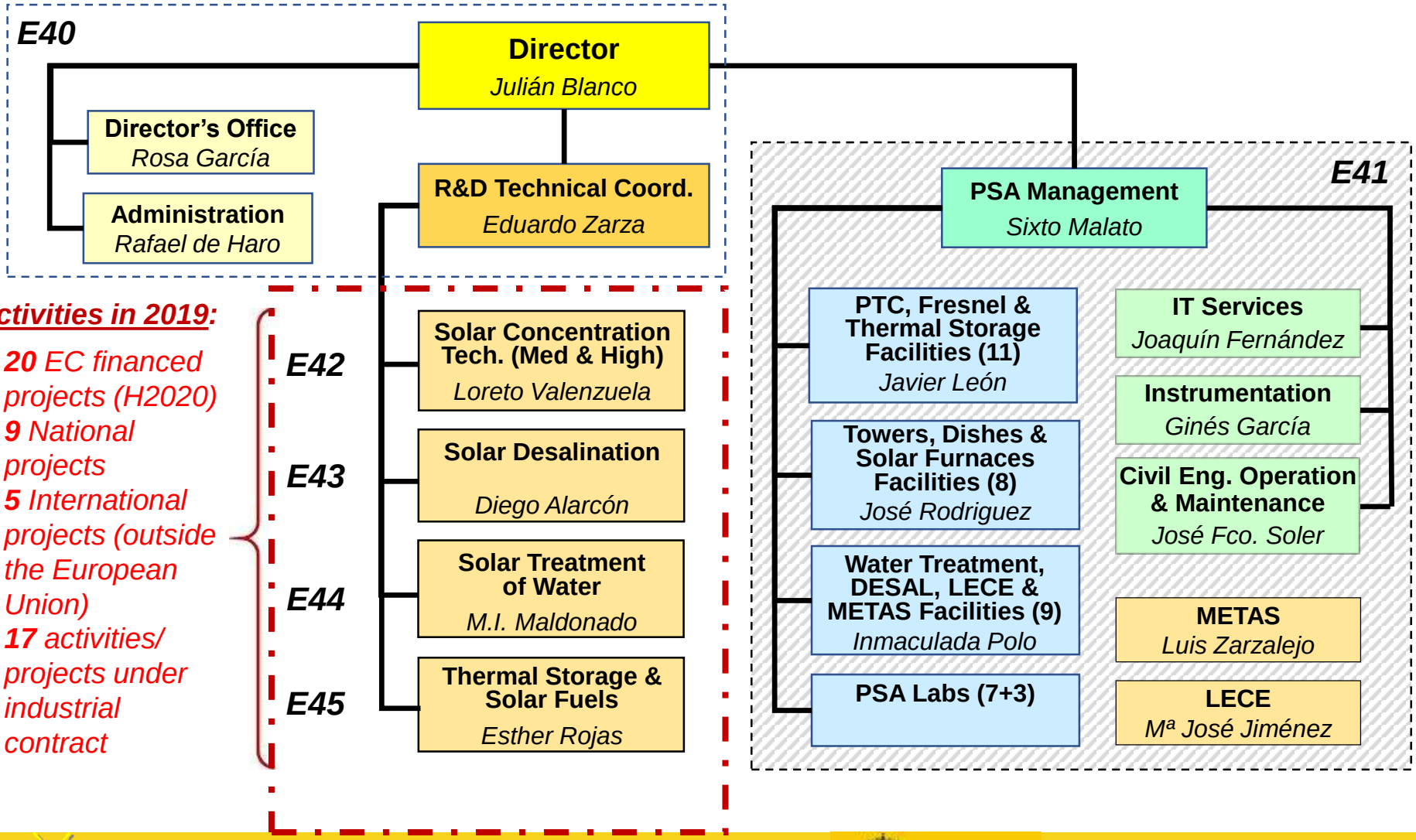
PSA: Main Test Facilities

PSA: Organization & Structure



Activities in 2019:

- ***20*** *EC financed projects (H2020)*
- ***9*** *National projects*
- ***5*** *International projects (outside the European Union)*
- ***17*** *activities/ projects under industrial contract*

Solar Concentration Technologies

HIGH CONCENTRATION SOLAR SYSTEMS

- R&D on components and systems for point focusing systems (500ºC-1500ºC) (solar towers, parabolic dishes, solar furnaces) for electricity and industrial process heat
- R&D on receivers for different heat transfer fluids

MEDIUM CONCENTRATION SOLAR SYSTEMS

- R&D in parabolic troughs and linear Fresnel collectors (125°C-500°C) for electricity and process heat
- Development/testing of components: reflectors, receiver tubes, optical coatings, tracking systems, etc.
- R&D on heat transfer fluids: direct steam generation, pressurized gases, new synthetic oils

Horizontal activities

- Accelerated ageing and durability analysis of components. Modelling and simulation
- Optical coatings

Solar Desalination

RESEARCH ACTIVITIES

- Large-capacity thermal processes with special emphasis in multi-effect distillation (LT-MED, TVC-MED, ABS-MED). Co-generation of electricity and desalinated water (CSP+D)
- Small-capacity thermal processes with special emphasis in membrane distillation (MD) and forward osmosis (FO). Salinity-gradient power generation: reverse electrodialysis (RED) and pressure-retarded osmosis (PRO)
- Thermal-driven separation processes for brine concentration and industrial waste water treatment

Solar Treatment of Water

RESEARCH ACTIVITIES

- Solar photocatalytic and photochemical processes as tertiary treatment of wastewater. Removal of micro-contaminants and water pathogens (water disinfection) for reusing purposes.
- Integration of Solar Advanced Oxidation Processes (AOPs) with Advanced Treatment Technologies for remediation of industrial and urban wastewaters containing hazardous pollutants and pathogens to improve water treatment efficiency.
- Assessment of photocatalytic efficiency of new materials under real solar light conditions, including the development, testing and assessment of new concepts of solar photo-reactors.
- Solar photocatalytic generation of Hydrogen using Vis-light active materials: pilot scale solar reactor for testing.

Thermal Storage and Solar Fuels

THERMAL ENERGY STORAGE (TES) ACTIVITIES

- Development of TES systems 140ºC – 800ºC of temp. range
- Testing and evaluation of innovative systems, components and storage materials for latent or sensible heat storage
- Modeling and simulation tools for TES systems under different boundary conditions
- Development of new standards for qualification and evaluation of TES systems

SOLAR FUELS ACTIVITIES

- Research activities related to high temperature Solar Thermochemistry
- Development of hybrid solar/fossil endothermic processes, including solar reactor technology
- Demonstrate multi-step thermochemical processes and cycles for the solar production of hydrogen

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STE commercial deployment status

(Year 2019)

NOMINAL POWER	Operation	Construction	Advanced Development	TOTAL
Parabolic Trough	4.670 MW_e	1174 MW_e	150 MW_e	5.994 MW_e
Tower Systems	909 MW_e	981 MW_e	510 MW_e	2.400 MW_e
Linear Fresnel	265 MW_e	150 MW_e	---	415 MW_e
TOTAL	5.844 MW_e	2.305 MW_e	660 MW_e	8.809 MW_e

Number of Projects	94	22	8	124

Contribution of Spanish companies

78 % ***54 %***

www.protermosolar.com

PSA projects in collaboration with the Spanish Industry: Parabolic Trough Collectors

Acronym	Full Name	Industries	Years
DISTOR	Energy Storage for Direct Steam Solar Power Plants	Inasmet, Solucar, Siscalor, Iberinco	2004–2007
CO_2	Captadores cilindroparabólicos con CO2 como fluido de trabajo	Acciona, Abengoa, SENER	2008
Repow PS20	Desarrollo y ensayo de technologia para generación de vapor saturado en captadores cilindroparabólicos y vapor sobrecalentado en torres solares	Abengoa	2006-2008
ANDASOL	AndaSol 50 MWe Eurotrough Solar Thermal Plant with Thermal Storage in the Marquesado valley (Granada, Spain)	Inabensa, Milenio Solar	2003–2008
INDITEP	Integration of DSG Technology for Electricity production	Iberinco, Initec, Inabensa	2002–2005
DISS	Technological program for the development of the DSG (Direct Steam Generation) technology	Iberdrola, Endesa, Initec, Abengoa, Inabensa, Unión Fenosa,	1999–2001
EURO-TROUGH	Development of a Low Cost European Parabolic Trough Collector	Inabensa	1998–2005
TUBDISS	Receptor avanzado para captadores solares domesticos y de generación de vapor	Iberdrola, Viessmann	1999–2000
ACE-20	Desarrollo de un CCP de tamaño medio	Inabensa	1989–1991

PSA projects in collaboration with the Spanish Industry: Parabolic Trough Collectors

Fields of collaboration with the Spanish industrial sector

✓ Development of parabolic-trough collectors for both STE plants and Process heat applications (ACE-20. CAPSOL and EuroTrough)

PSA projects in collaboration with the Spanish Industry: Parabolic Trough Collectors

Some Parabolic Trough Colectors jointly developed with industrial partners

Collector EuroTrough

Collector CAPSOL

PSA projects in collaboration with the Spanish Industry: Parabolic Trough Collectors

Fields of collaboration with the Spanish industrial sector

✓ Development of parabolic-trough collectors for both STE plants and Process heat applications (ACE-20. CAPSOL and EuroTrough)

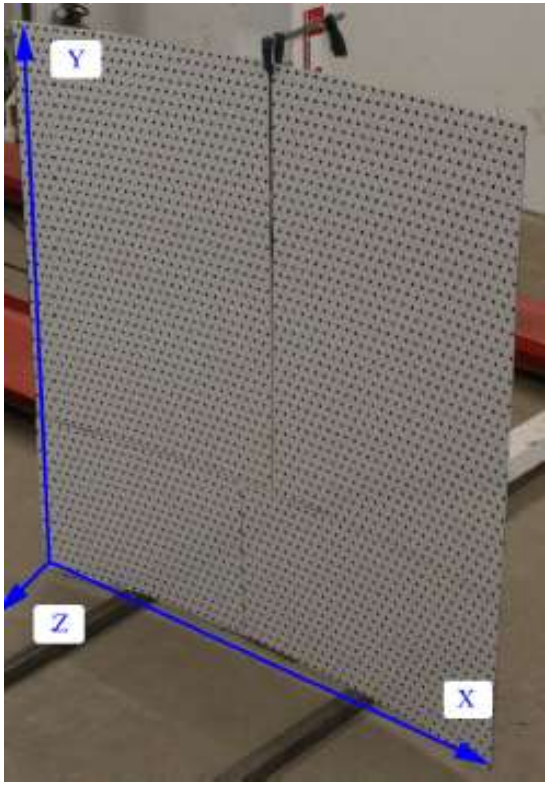
✓ Development of the Direct Steam Generation (DSG) technology for both STE plants and Process Heat Applications

✓ STE plants yield assessments required for the business plans

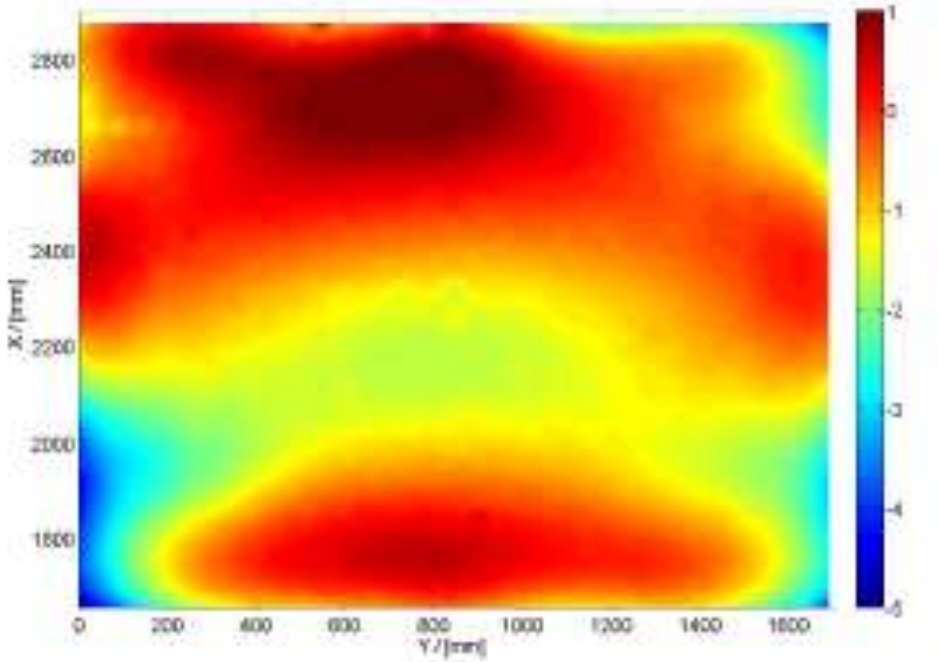
✓ Collaboration with engineering companies and components manufacturers for the development of new components and improvement of existing ones (receiver tubes, solar reflectors , hydraulic units, solar tracking systems,…)

PSA projects in collaboration with the Spanish Industry: Parabolic Trough Collectors

Geometric evaluation of a parabolic trough reflector using Photogrammetry



Reflector ready for Photogrammetry test



Geometric deviations from the theoretical shape

PSA projects in collaboration with the Spanish Industry: Central Receiver Technology

Acrónimo	Nombre del Proyecto	Empresas	Años
SOLAR TRES	Molten salt solar thermal power 15MWe demonstration plant	SENER	2007 - 2010
SOLHYCO	Solar-Hybrid Power and Cogeneration Plants	Abengoa Solar NT, Solúcar	2006 -2010
SOLAIR	Advanced solar volumetric air receiver for commercial solar tower power plants	Iberese, Solúcar Energía	2000 - 2004
SOLGATE	Solar Hybrid gas turbine electric power system	Abengoa, Solúcar Energía	2001 - 2003
PS10	10 MW Solar Thermal Power Plant for Southern Spain (PS10)	ABENGOA	2000 - 2025
COLON SOLAR	Sistema solar de torre para generación de eelctricidad	Sevillana, Endesa, Inabensa	1994 - 1997
SOLGAS	Sistema de Torre Solar para generación industrial de vapor	Sodean, Sevillana, Abengoa	1995
GAST	Gas-cooled Solar Tower Project	ASINEL	1981 - 1986

PSA projects in collaboration with the Spanish Industry: Central Receiver Technology

Fields of collaboration with the Spanish industrial sector

✓ Experimental study on different working fluids (water/steam, molten salts, atmospheric air and compressed air)

✓ Collaboration with engineering companies and components manufacturers for the development of new heliostats and components (complete new heliostats, new mirror facets and new drive units)

PSA projects in collaboration with the Spanish Industry: Central Receiver Technology

Evaluation of heliostat prototypes at PSA

PSA projects in collaboration with the Spanish Industry: Central Receiver Technology

Evaluation of molten-salt receiver before commercial implementtaion

PSA projects in collaboration with the Spanish Industry: Central Receiver Technology

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✓ Collaboration with engineering companies and components manufacturers for the development of new heliostats and components (complete new heliostats, new mirror facets and new drive units)

✓ Annual yield assessments for the business plan of commercial projects

✓ Collaboration in plant designs providing scientific support

Continuous Support to the Spanish Industry

✓ Collaboration with Spanish industrial partners to transfer them the know-how and technology developed in R+D projects

✓ Continuous collaboration with the STE Spanish and European associations: **PROTERMOSOLAR** (www.protermosolar.com) and **ESTELA** (www.estelasolar.org)

✓ Defense of the interest of the Spanish industrial sector in all the national and international forums where PSA participates

✓ Outstanding participation in the Spanish and International standardization committees (UNE and IEC/TC-117) to develop new standards

✓ Scientific support to solve problems in commercial STE plants

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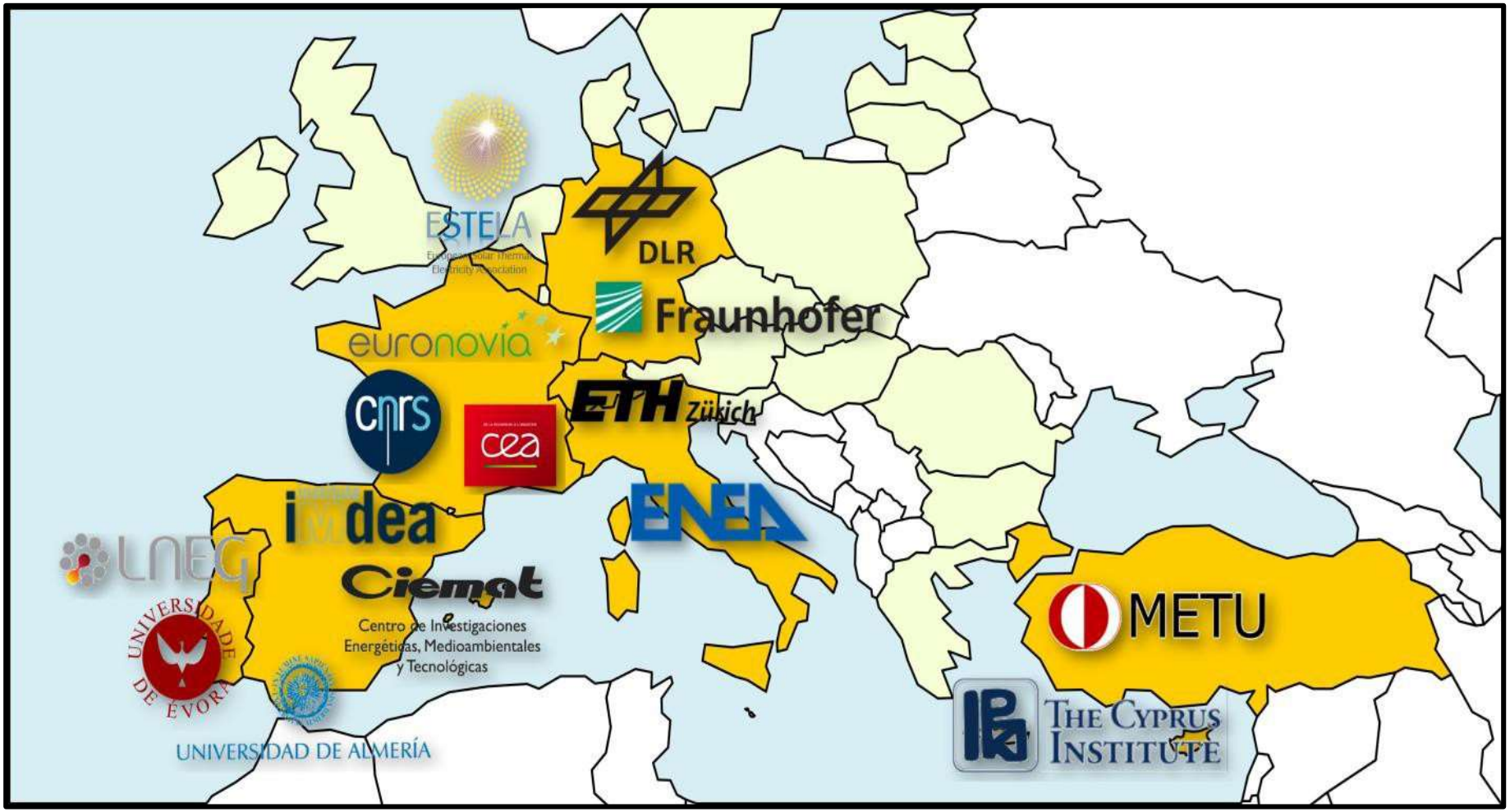
The SFERA-III project

Solar **F**acilities for the **E**uropean Solar **R**esearch **Area**

- EU H2020 – INFRAIA grant No. 823802
- **Duration**: Jan. 2019 – Dec. 2022
- **Total budget:** 9 102 631 €
- **Partners (15):** CIEMAT-PSA (ES), DLR (DE), CNRS (FR), ENEA (IT), ETHZ (CH), ESTELA (BE), CEA (FR), U. EVORA (PT), EURONOVIA (FR), U. Almería (ES), LNEG (PT), CEA (FR), IMDEA (ES), CYI (CY), METU (TK))

The SFERA-III project

Countries and partners involved



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SFERA-III activities:

- Networking activities
- Join R+D activities
- Transnational access to research infrastructures

The SFERA-III project

Objectives of the Trans-national Access Programme

✓Providing European and non-European research groups and industries with free-of–charge access to 13 CST solar laboratories and facilities owned by SFERA-III partners, covering a wide set of topics:

- thermal storage systems
- water desalination
- water treatment
- solar fuel production
- materials for solar receivers and STE components
- linear and point focusing systems

The SFERA-III project

The Trans-national Access Programme

What is funded ?:

- ✓ Expenses such as sample shipment, as well as the travel costs and related subsistence allowances of the selected Users
- ✓ The cost of the facilities providing the access

Basic requirements:

- ✓ The users must **work in a country other than the country where the facility of lab is located**
- ✓ Publication of the results is compulsory, except for SMEs

Duration of the access:

- ✓ Minimum: 3 days, maximum: 3 months

The SFERA-III project

The Trans-national Access Programme

How to get access ?:

- ✓ There is a **Call for Proposals** every year for all the facilities
- ✓ Proposals are evaluated with an **independent and transparent evaluation process**, taking into consideration the **quality of the proposals**
- ✓ There is a **Single Entry Point (SEP)** on the SFERA-III Project website, providing all the information that may be required by potential users

https://sfera3.sollab.eu/access/

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