

## SFERA-III

## Solar Facilities for the European Research Area

## D3.1 "State of the art of existing research infrastructure facilities and services"

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# **Executive Summary**

This deliverable is part of Work Package 3 - Advanced Integrating Activities, in which one of the objectives is to identify the missing infrastructures and services required to accomplish the strategic targets identified in the 'Initiative for Global Leadership in Concentrated Solar Power – Implementation Plan'.

The first step to achieve this objective was to map all the existing facilities and services within the consortium. This will enable the definition of the new needed research facilities together with the best potential locations (organisations) to such improvement.

Data has been sourced through a detailed template questionnaire sent to all SFERA-III partners. All SFERA-III partners replied to the questionnaire and provided the necessary information about their facility. In this report the information received is analysed in order to form an updated state of the art of existing research infrastructure facilities and services in Europe.

**Appendix 1** contains all facilities and services offered for TA in SFERA-III project. **Appendix 2** contains all other existing facilities and services available within SFERA-III partners.



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# 1. Guideline

On **October 17, 2019**, a questionnaire form has been sent by email to SFERA-III partners as an Excel file. The text of the email explained the objectives of such a questionnaire as well as the way to properly fill the questionnaire in. Partners were asked to send back their contribution not later than **November 15, 2019**.

## 1.1. What for

The main objective of the questionnaire is to collect detailed up-to-date information from SFERA-III partners about all existing RI facilities and the associated services in the field of CST (this is to say not only Facilities & Services proposed for TA during the project).

## 1.2. How to

It was asked partners to follow the instructions of the first sheet entitled "**How to**", fill one Excel file per facility and rename the file with the **Research Institute short** *name* and the **Facility name**.

sheet	what to do?
Facility Type	General information (type, year, name, location, area) and photos
Facility	Detail description depending on type (Central Receiver, Parabolic Trough, Linear Fresnel, Parabolic Dish, Solar Furnace, Solar Simulator, Other Type)
Secondary Optic Device	Detail description regarding secondary optic device (if any)
Auxiliary infrastructure	Detail description regarding all auxiliaries
Methods	Information about tracking, cleaning, etc
Meteorological Monitoring	Detail description regarding meteorological measurement and devices
Measuring Equipment	Detail description regarding other measurements and devices

The questionnaire is composed of the following sheets:



sheet	what to do?
Modelling Data Codes	Detail description regarding simulation software and codes used
Activities	Financial breakdown of activities performed (research, industry, education, international collaboration, other)
Services Offered	Available Services (offered or not offered for TA during SFERA)

Following extra sheets will be used later in order to identify the missing infrastructures and services, excluding those already "in the pipes".

sheet	what to do?		
Forthcoming Upgrades	Upgrades already "in the pipes" and associated new services		
New Facility & Services	New facilities already "in the pipes" and associated new services		



# 2. Outcomes

The main outcomes of this work are an exhaustive set of Excel files including the up-to-date inventory of existing RI facilities and associated services in the field of CST among SFERA-III partners.

## **2.1. Existing Facilities**

Inside SFERA-III consortium, there are a total of 87 existing facilities in the field of CST. SFERA-III partners are offering access to 53 of these facilities.

It can be noticed that CIEMAT is owning more than 32% of the existing facilities (21% of the facilities offered for TA during SFERA-III). It shows the leading place of Spain in the CST field and reflect the effectiveness of the market in this European country.

BENEFICIARY	Total number of facilities	Number of facilities in TA
CIEMAT	28	11
CNRS	5	4
ENEA	9	8
DLR	9	1
CEA	9	5
UEVORA	4	4
ETHZ	3	2
IMDEA	4	4
СҮІ	3	3
Fraunhofer	5	5
LNEG	6	4
METU	1	1
UAL	1	1



More than 59% of the referenced facilities are of type "**Other**". In this type have been grouped laboratories with equipment dedicated to research on a wide range of topics (ex: optical characterisation, thermal characterisation, simulation, thermal storage, water treatment...). To better address the future needs in the (extended) field of CST, one of the forthcoming tasks will be to create new relevant types in order to obtain a clearer mapping.

Not surprisingly, if we exclude "**Other Type**", the most represented types of facilities are **Parabolic Trough, Central Receiver** and **Solar Furnace**. This is linked to past and actual states of the art of industrial deployment of CSP in the world. **Linear Fresnel** and **Parabolic Dish** are little represented with only one facility of LF type and two of PD type offered for TA during SFERA-III. **Solar Simulator** looks like a popular type of facility for RI in countries with low DNI / solar resources (DLR, ETHZ).

TYPE	Total number of facilities	Number of facilities in TNA
Central Receiver	8	5
Parabolic Trough	10	4
Linear Fresnel	3	1
Parabolic Dish	4	2
Solar Furnace	7	5
Solar Simulator	4	3
Other	51	33

The distribution of the type of facilities is detailed in the following table.



BENEFICIARY	Central Receiver	Parabolic Trough	Linear Fresnel	Parabolic Dish	Solar Furnace	Solar Simulator	Other
CIEMAT	2	5		1	3		17
CNRS	1	1		1	2		
ENEA		2		1			6
DLR	1	1			1	2	4
CEA			2				7
UEVORA		1					3
ETHZ				1		1	1
IMDEA	1					1	2
CYI	2		1				
Fraunhofer							5
LNEG	1				1		4
METU							1
UAL							1
Total	8	10	3	4	7	4	51

## **2.2. Existing Services**

Inside SFERA-III consortium, there are a total of 126 existing services in the field of CST. 104 of these services are accessible through SFERA-III call for TA. The services are classified as follows:



Service Categories\ Beneficiary	Solar Resource (DNI) and Meteorological Parameters Assessment	Services on Reflectors and Concentrators	Experimental Services on Absorbers and Receivers	Services on Heat Transfer Fluids	Services on Auxiliary Equipment	Services on Thermal Energy Storage (Media & Systems)	Services on Engines and Power Blocs	Services on Calibration of Key Sensors & Measurements for STE	Services on Solar Chemistry	Services on Materials Testing and Qualification	Services Using Extreme Temperature Conditions in Solar Concentrators
CIEMAT		CR, PT, OT	CR, PT, OT		PT, OT	<b>OT</b> , PD	CR, PD	PD, SF, OT	CR, OT	PD, SF, OT	PD, SF, CR, OT
CNRS	<b>CR,</b> <b>PT,</b> <b>SF</b> , PD	<b>CR,</b> <b>PT,</b> <b>SF</b> , PD	<b>CR,</b> <b>PT,</b> <b>SF</b> , PD	<b>CR,</b> <b>PT,</b> <b>SF</b> , PD	<b>CR,</b> <b>PT,</b> <b>SF</b> , PD	<b>CR,</b> <b>PT,</b> <b>SF</b> , PD	<b>CR,</b> <b>PT,</b> <b>SF</b> , PD	<b>CR,</b> <b>PT,</b> <b>SF</b> , PD	<b>CR,</b> <b>PT,</b> <b>SF</b> , PD	CR, SF, PD	<b>CR,</b> <b>PT,</b> <b>SF</b> , PD
ENEA	<b>PD,</b> <b>PT</b> , OT	PD, PT, OT	PD, PT	<b>от</b> , рт	PD, PT, OT	РТ, ОТ	ОТ	РТ, ОТ	от	от	
DLR	CR, PD, PT, SF, SS, OT	<b>SS</b> , CR, PT, SF, OT	<b>SS,</b> PT, OT		ОТ	CR, OT		SF, SS, OT	CR, OT		<b>SS</b> , SF
CEA		ОТ	<b>0T</b> , LF			<b>0T</b> , LF		LF			
UEVORA	ОТ	РТ, ОТ	ОТ	РТ	РТ	РТ, ОТ					
ETHZ		ОТ	SS			ОТ			<b>SS,</b> <b>OT</b> , PD	SS, OT	SS, OT
IMDEA		CR, SS, OT	CR, SS, OT	от		ОТ	ОТ		CR, SS, OT	ОТ	CR, SS
СҮІ		CR	CR, LF		CR				CR		
Fraunhofer	ОТ	ОТ	ОТ	от	ОТ	ОТ			ОТ	ОТ	
LNEG	ОТ	ОТ	ОТ			ОТ			ОТ	<b>OT</b> , SF	SF
METU											ОТ
UAL	ОТ	ОТ				ОТ			ОТ	ОТ	

It can be noticed that CNRS is offering more than 59% of the services accessible through SFERA-III call for TA.



It is quite surprising that most of SFERA-III partners are not claiming for services other than those offered for TA. Only 22 services have been reported in addition to the actual SFERA-III list of services.

BENEFICIARY	Total number of services*	Number of services in TNA
CIEMAT	74	27
CNRS	57	57
ENEA	57	43
DLR	49	6
CEA	36	20
UEVORA	19	19
ETHZ	17	16
IMDEA	38	38
CYI	8	8
Fraunhofer	25	25
LNEG	30	27
METU	3	3
UAL	11	11
Total	126	104
*including 22 service	s not listed in SFERA-III list of service	8

Some categories of importance for both research and industry could be added, like **Simulation Services** or **Training services**.

Looking now to the relationship between Facility Type and Services, conclusions are the following:

- **"Other Type**" facilities are gathering the most important number of services.
- Solar Furnace, Central Receiver and Parabolic Dish facilities are offering



more than 50 services each,

- Surprisingly, the 4 Parabolic Dish facilities are offering more services than the 10 Parabolic Trough facilities,
- Solar Simulator and Linear Fresnel facilities are offering less than 20 services each. The figure is quite questioning about the future of Linear Fresnel as only 2 services are offered for TA in this type of facility.

TYPE	Total number of services	Number of services in TA
Central Receiver	52	49
Parabolic Trough	48	43
Linear Fresnel	12	2
Parabolic Dish	52	15
Solar Furnace	56	53
Solar Simulator	18	14
Other	97	81



# **3. Conclusions**

It is clear from all these tables that the next step is to create new relevant facility types in order to obtain a clearer view of the existing facilities and services. This will greatly help to address the future needs in the (extended) field of CST. For example, this is quite obvious that one of the missing facility types is **Storage**. A discussion will be initiated soon in order to jointly define those relevant new facility types.



### List of abbreviations

CR	Central Receiver
CSP	Concentrating Solar Power
CST	Concentrating Solar Thermal
DNI	Direct Normal Irradiance
LF	Linear Fresnel
OT	Other Type
PD	Parabolic Dish
PT	Parabolic Trough
RI	Research Infrastructures
SF	Solar Furnace
SS	Solar Simulator
ТА	Trans-national Access



## Annexes

You can access to the details of the following Facilities and associated Services on SFERA-III website. All excel files are saved in the 3.1 directory.



# Annex 1. RI Facilities available for SFERA-III'TA

<u>CEA</u>





facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	2012	LHASSA	France: Latitude N 45°11'48.4" Longitude E 5°42'24.6"	60
			Pressurizer Electric heaters Air cooler Pump	Condenser Condenser Condenser Condenser Condenser Condenser Condenser Condenser Condenser Condenser Condenser
		Service Name		TNA?
Optimization of the o	perating procedures			Y
Qualification of Heat	Storage using PCM unde	er experimental co	nditions	Y

Validation of numerical model of thermal storage systems

Validation of the thermo-hydraulic behaviour of storage systems under operating conditions similar to Y commercial CSP plants,

Y



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )	
Other	2014	Opti-Lab	France: Latitude N 45°38'40.9" Longitude E 5°52'26.6"	100	
Colorime Colorime Reflectomete	er Microscope		Image: state s		
		Service Maine			
Characterization of Opt	lical Properties of Sola	ar Reflectors		ľ	
Measurements on mate	erial properties			Ŷ	
Optical Properties of M	lirrors. Reflectance me	easurement. Facets	characterization	Ŷ	
Optical properties of sc	olar glass envelopes w	ith and without and	i-reflective coatings	Y	
Optical Properties/Char	racterization of Absor	bers & Receivers a	nd their coating	Y	
Outdoor exposure of So	olar Reflectors			Y	
Parabolic Trough Collec	ctor's Characterization	1		Y	
Static Contact Angle me	easurements on the su	urface of Anti-Refle	ctive Coatings	Y	
Surface Properties of A	bsorbers & Receivers	and their coating		Y	
Surface Properties of A	nti-Reflective coatings	s for solar receivers		Y	
Optical Properties of M	Optical Properties of Mirrors. Reflectance measurement. Facets characterization				

Optical Properties of Mirrors. Reflectance measurement. Facets characterization



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)		
Other	2016	Shape	France: Latitude N 45°38'40.9" Longitude E 5°52'26.6"	2000		
		Phot	os			
		Service Name		TNA?		
Geometrical assessmen	t of Solar Concentrate	ors (Single Facets, P	oint and Line Focus Collectors)	Y		
Heliostat(s) Performanc	e Qualification			Y		
Optical and thermal cha	aracterization of solar	concentrators		Y		
Outdoor optical and the	Jutdoor optical and thermal performance of PTC linear receivers					



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	2010	STONE	France: Latitude N 45°11'48.4" Longitude E 5°42'24.6"	60
		Service Name		TNA?
Optimization of the ope	rating procedures			Y
Performance and durab	ility assessment of th	ermal storages		Y
Testing TES prototypes	using oil as HTF			Y
Validation of averaginal				v

Validation of numerical model of thermal storage systems Validation of the thermo-hydraulic behaviour of storage systems under operating conditions similar to

commercial CSP plants,

Υ



#### **CIEMAT**

facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Central receiver	1981	CSR	Spain: Latitude N 37,097005 Longitude: W 2,364750	25000
	Aerial view o	f the CRS tower fac	ility with its heliostat field	
		Service Name		TNA?
Qualification of Solar Driv	ven Processes under	realistic conditions	5	Y
Solar Hydrogen Production	on Process Qualificat	tion		Y
Thermal and Thermodyn Technologies under Real	amic characterizatio Operating Conditior	n of prototype Rec 15	eivers for Central Receiver on Tower	Y
Qualification of high radi	ative flux processes			N
Solar Fuels and Thermoc	hemistry			N
Testing of Solarized gas t	urbine in Real Condi	tions		N
Water splitting thermoch	nemical cycles			Ν



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Other	2011	HYWATOX	Spain: Latitude N 37°05'34.8"N Longitude W 2°21'23.6"	10
N2 inlet H20 from CPC Process GC	s flow controllers NortHs H20 to Pun rect	to GC		
		Service Name		TNA?
Solar Hydrogen product	tion and wastewater t	treatment		Y



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Other	2006-2016	MDTF	Spain: Latitude N 37° 5' 34.49" Longitude O 2° 21' 16.77"	800
		Service Name		TNA?
novative membrane	desalination technolo	gies (MD, FO)		Y
ar Thermal Desalina	tion by Membrane Di	stillation		Y
aracterisation and Te	esting of Membranes	for Water treatmer	nt	N



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	1988-2012	MED	Spain: Latitude N 37° 5' 35.08" Longitude O 2° 21' 19.29"	3500
			<image/>	
<b>((</b> ) <b>· · · ·</b> · · · · · · · · · · · ·	<u>()</u>	Service Name		TNA?
fficiency improvement	of IOW temperature	aistillation processe	es by absorption neat pumps	r V
miciency improvement	OT IVIED processes by	absorption heat p	umps	i V
inovative membrane d		gies (IVID, FU)		i V
olar Thormal Docalizat	ion by Mombrane Di	tillation		· · · · · · · · · · · · · · · · · · ·



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	1992-2016	SOLWATER	Spain: Latitude N 37°05'34.9"N Longitude W 2°21'24.8"	500
		Service Name		TNA?
Solar photocatalytic tre	atment of urban and	industrial wastewa	ters	Ŷ
Solar Photocatalytic Wa	ater Disinfection			Y
Solar Reactors Develop	ment for Water Treat	ment		Y





facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	2015	WetOx	Spain: Latitude N 37°05'34.8"N Longitude W 2°21'23.6"	10
		manual of the second seco		
		Service Name		TNA?
ılar Hydrogen produc	tion and wastewater t	Service Name		<b>ТNA?</b> Ү





facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	2010	MOSA	Spain: Latitude N 37,097005 Longitude: W 2,364750	1500
		Service Name		INA?

Characterization of Materials and Components for TES systems with molten salts	Y
Feasibility of Materials for Sensible and Latent Thermal Storage Systems	Y
Testing TES prototypes using oil as HTF	Y
Two-tank molten salt storage system for simulation models validation	Y
Testing in molten salt loop of auxiliary components (valves, heat tracing, instrumentation)	Ν



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )	
Dish	1996	Aging Test Bed	Spain: Latitude N 37,097005 Longitude: W 2,364750	300	
		Service Name		TNA?	
Metallography Micro h	ardness analysis. The	ermogravimotric and	alveic	Y	
Non-Contact Tomporati	aruness analysis. The	Solar Euroacos	פונעוג	· · · · · · · · · · · · · · · · · · ·	
Surface materials treatm	nent	Solar runaces		Ŷ	
Surface Treatment and I	Metallic Coatings			Y	
Synthesis of materials at	t high temperature			Y	
Testing of high tempera				Y	
Testing of materials at h	ligh flux			Ŷ	
Testing of materials at h	ligh temperature			Y	
Thermal treatment of m	aterials at high tem	perature		Y	
Accelerated aging by the	ermal cycling			N	
Testing of solarized Stril	ing engines in real or	perating conditions		Ν	



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Furnace	2012	SF-5	Spain: Latitude N 37,097005 Longitude: W 2,364750	75
View of the 54 hexagor	al mirror segments, C	0.16 m2 each, comp	in the SF5 concentrator	
		Service Name		TNA?
Material synthesis				Y
Metallography. Micro-h	nardness analysis. The	rmogravimetric an	alysis	Y
Non-Contact Temperat	ure Measurement at S	Solar Furnaces		Y
Surface materials treat	ment			Y
Surface Treatment and	Metallic Coatings			Y
Synthesis of materials a	at high temperature			Y
Testing of high tempera	ature processes			Y
Testing of materials at	high flux			Y
Testing of materials at	high temperature			Y
Thermal treatment of n	naterials at high temp	erature		Y





facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Furnace	2013	SF-40	Spain: Latitude N 37,097005 Longitude: W 2,364750	350
		h concentrator of t	with the set of the set	
		Service Name		TNA?
Material synthesis				Y
Metallography. Micro-h	ardness analysis. The	rmogravimetric and	alysis	Y
Non-Contact Temperature Measurement at Solar Furnaces				Y
Surface materials treatr	nent			Y
Surface Treatment and Metallic Coatings				Y
Synthesis of materials at high temperature				
Testing of high tempera	ture processes			Y
Testing of materials at h	nigh flux			Y
Testing of materials at h	nigh temperature			Y
Thermal treatment of m	naterials at high temp	erature		Y



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )	
Furnace	1991	SF-60	Spain: Latitude N 37,097005 Longitude: W 2,364750	500	
View of the 140 m2 heli	ostat and the shutter	of the PSA SF60	BUEVILVOS TE-ST		
		Service Name		TNA?	
Material synthesis				Y	
Metallography. Micro-h	ardness analysis. The	ermogravimetric and	alysis	Y	
Non-Contact Temperatu	ure Measurement at S	Solar Furnaces		Ŷ	
Surface materials treatr	Surface materials treatment				
Surface Treatment and	Ŷ				
Synthesis of materials a	t high temperature			Ŷ	
Testing of high tempera	Υ				
Testing of materials at h	Testing of materials at high flux				
Testing of materials at h	nigh temperature			Υ	
Thermal treatment of m	naterials at high temp	erature		Ŷ	



## <u>CNRS</u>

facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Central receiver	1983	Thémis	France: Latitude N 42.501 Longitude E 1.970	35000
		Service Name		TNA?

Service Name	TNA?
Advanced solid concepts for thermal energy storage	Y
Atmosferic air packed bed test bench for simulation models validation	Y
Calibration of Concentrated solar irradiance sensors	Y
Characterization of HTF thermal properties	Y
Characterization of HTF/HSM chemical stability	Y
Development and characterization of Materials and Components for TES	Y
Gas analysis	Y
Heat Exchangers Characterization	Y
Heliostat control algorithms	Y
High flux sensors qualification	Y
High Temperature Thermochemical Research Units	Y
Material synthesis	Y
Non-Contact Temperature Measurement at Solar Furnaces	Y
Online and offline diagnostics	Y
Optical and thermal characterization of solar concentrators	Y
Outdoor exposure of Solar Reflectors	Y



Qualification HSM/HTF	Y
Qualification HTF based on particles	Y
Qualification of Heat Storage using concrete under experimental conditions	Y
Qualification of Heat Storage using Packed beds under Real Operating Conditions	Y
Qualification of Heat Storage using PCM under experimental conditions	Y
Qualification of high radiative flux processes	Y
Qualification of Solar Driven Processes under realistic conditions	Y
Sensor development and testing	Y
Solar Fuels and Thermochemistry	Y
Solar Hydrogen production and wastewater treatment	Y
Solar Hydrogen Production Process Qualification	Y
Solar pumped LASER testing	Y
Solar Radiation Measurement and Weather Station	Y
Solar Thermochemical Hydrogen/Syngas	Y
Surface materials treatment	Y
Synthesis of materials at high temperature	Y
Testing of high temperature processes	Y
Testing of materials at high flux	Y
Testing of materials at high temperature	Y
Testing of small steam turbines powered by molten salt steam generator	Y
Testing of Solarized gas turbine in Real Conditions	Y
Testing of Solarized Stirling Engines in Real Conditions	Y
Testing TES prototypes using oil as HTF	Y
Thermal & thermochemical properties evaluation for thermal storage materials	Y
Thermal and Thermodynamic characterization of prototype Reactors for Central Receiver on Tower Technologies under real operating conditions	Y
Thermal and Thermodynamic characterization of prototype Receivers for Central Receiver on Tower Technologies under Real Operating Conditions	Y
Water splitting thermochemical cycles	Y



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Central receiver	1983	Thémis	France: Latitude N 42.501 Longitude E 1.970	35000
		Service Name		TNA?
Advanced solid concepts	tor thermal energy	storage		Y
Atmosferic air packed be	a test bench for sim	ulation models vali	dation	ř
Calibration of Concentrat	ed solar irradiance s	sensors		r v
		i+\/		ı V
		ily	s for TES	v
Gas analysis			3 IUI 1 L3	· · · · · · · · · · · · · · · · · · ·
Heat Exchangers Charact	erization			· Y
Heliostat control algorith	ms			· · · · · · · · · · · · · · · · · · ·
High flux sensors qualifies	ation			Ŷ
High Temperature Thorm	ochemical Research	llnits		· · ·
Material synthesis				· · · · · · · · · · · · · · · · · · ·
Non-Contact Temperatur	e Measurement at 9	Solar Eurnaces		Ŷ
Online and offline diagno	stics			Ŷ
Optical and thermal char	acterization of solar	concentrators		Ŷ
Outdoor exposure of Sola	ar Reflectors			Y
Qualification HSM/HTF				Y

#### GA No: 823802



Qualification HTF based on particles	Y
Qualification of Heat Storage using concrete under experimental conditions	Y
Qualification of Heat Storage using Packed beds under Real Operating Conditions	Y
Qualification of Heat Storage using PCM under experimental conditions	Y
Qualification of high radiative flux processes	Y
Qualification of Solar Driven Processes under realistic conditions	Y
Sensor development and testing	Y
Solar Fuels and Thermochemistry	Y
Solar Hydrogen production and wastewater treatment	Y
Solar Hydrogen Production Process Qualification	Y
Solar pumped LASER testing	Y
Solar Radiation Measurement and Weather Station	Y
Solar Thermochemical Hydrogen/Syngas	Y
Surface materials treatment	Y
Synthesis of materials at high temperature	Y
Testing of high temperature processes	Y
Testing of materials at high flux	Y
Testing of materials at high temperature	Y
Testing of small steam turbines powered by molten salt steam generator	Y
Testing of Solarized gas turbine in Real Conditions	Y
Testing of Solarized Stirling Engines in Real Conditions	Y
Testing TES prototypes using oil as HTF	Y
Thermal & thermochemical properties evaluation for thermal storage materials	Y
Thermal and Thermodynamic characterization of prototype Reactors for Central Receiver on Tower Technologies under real operating conditions	Y
Thermal and Thermodynamic characterization of prototype Receivers for Central Receiver on Tower Technologies under Real Operating Conditions	Y
Water splitting thermochemical cycles	Y



GA	No:	823802

facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Parabolic Trough	2016	MicroSo'R	France: Latitude N 42.494 Longitude E 2.030	2000
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Service Name

TNA?

Advanced solid concepts for thermal energy storage	Y
Atmosferic air packed bed test bench for simulation models validation	Y
Calibration of synthetic oil mass flow meters	Y
Characterization of HTF/HSM chemical stability	Y
Development and characterization of Materials and Components for TES	Y
Heat Exchangers Characterization	Y
Non-Contact Temperature Measurement at Solar Furnaces	Y
Online and offline diagnostics	Y
Outdoor exposure of Solar Reflectors	Y
Outdoor optical and thermal performance of PTC linear receivers	Y
Parabolic Trough Collector's Characterization	Y
Qualification HSM/HTF	Y
Qualification of Heat Storage using concrete under experimental conditions	Y
Qualification of Heat Storage using Packed beds under Real Operating Conditions	Y
Qualification of Heat Storage using PCM under experimental conditions	Y
Qualification of Solar Driven Processes under realistic conditions	Y


Sensor development and testing	Y
Solar Radiation Measurement and Weather Station	Y
Testing of components for parabolic troughs solar fields with oil under real operating conditions	Y
Testing of high temperature processes	Y
Testing of Rotating Connections for PT receivers (Flexible hoses, ball-joints, etc.)	Y
Testing of small steam turbines powered by molten salt steam generator	Y
Testing of Solarized gas turbine in Real Conditions	Y
Testing of Solarized Stirling Engines in Real Conditions	Y
Testing TES prototypes using oil as HTF	Y
Thermal & thermochemical properties evaluation for thermal storage materials	Ŷ





facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Furnace	1969	MSSF Bastion Ouest	France: Latitude N 42.494 Longitude E 2.0293	300
Accolorated Aging of abo	arbors & abcarbing	Service Name		<u> </u>
Advanced solid concents	for thormal operation	storago		Y
Atmosferic air packed be	ad tost bonch for sim	ulation models vali	dation	Y
Calibration of Concentra	ted solar irradiance s			Y
Characterization of HTE	thermal properties	5013013		Ŷ
Characterization of HTE/	HSM chemical stabili	ity		Y
Deposits of coatings at h	nigh temperature			Y
Development and charac	cterization of Materia	als and Component	s for TES	Y
Durability tests of Anti-R	eflective Coatings or	n glass envelopes		Y
Gas analysis				Y
Heat Exchangers Charact	terization			Y
Heliostat control algorith	hms			Y
High flux sensors qualific	cation			Y
High temperature optica	al properties measure	ement		Y
Material synthesis				Y
Non-Contact Temperatu	re Measurement at S	Solar Furnaces		Y
Online and offline diagno	ostics			Y





Optical Properties/Characterization of Absorbers & Receivers and their coating	Y
Outdoor exposure of Solar Reflectors	Y
Qualification HSM/HTF	Y
Qualification HTF based on particles	Y
Qualification of Heat Storage using concrete under experimental conditions	Y
Qualification of Heat Storage using Packed beds under Real Operating Conditions	Y
Qualification of Heat Storage using PCM under experimental conditions	Y
Qualification of high radiative flux processes	Y
Qualification of Solar Driven Processes under realistic conditions	Y
Sensor development and testing	Y
Solar Fuels and Thermochemistry	Y
Solar Hydrogen production and wastewater treatment	Y
Solar Hydrogen Production Process Qualification	Y
Solar photocatalytic treatment of urban and industrial wastewaters	Y
Solar pumped LASER testing	Y
Solar Radiation Measurement and Weather Station	Y
Solar Thermochemical Hydrogen/Syngas	Y
Surface materials treatment	Y
Surface Properties of Absorbers & Receivers and their coating	Y
Surface Treatment and Metallic Coatings	Y
Synthesis of materials at high temperature	Y
Testing of high temperature processes	Y
Testing of materials at high flux	Y
Testing of materials at high temperature	Y
Testing of small steam turbines powered by molten salt steam generator	Y
Testing of Solarized gas turbine in Real Conditions	Y
Testing of Solarized Stirling Engines in Real Conditions	Y
Testing TES prototypes using oil as HTF	Y
Thermal & thermochemical properties evaluation for thermal storage materials	Y
Thermal analysis	Y
Thermal and Thermodynamic characterization of prototype Reactors for Central Receiver on Tower	Y
Thermal and Thermodynamic characterization of prototype Receivers for Central Receiver on Tower	Y
Technologies under Real Operating Conditions	-
Thermal treatment of materials at high temperature	Y
Water splitting thermochemical cycles	Y



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Furnace	1969	MSSF Bastion Ouest	France: Latitude N 42.494 Longitude E 2.0293	300
	A Martin		1	

Service Name	TNA?
Accelerated Aging of absorbers & absorbing coatings	Y
Advanced solid concepts for thermal energy storage	Y
Atmosferic air packed bed test bench for simulation models validation	Y
Calibration of Concentrated solar irradiance sensors	Y
Characterization of HTF thermal properties	Y
Characterization of HTF/HSM chemical stability	Y
Deposits of coatings at high temperature	Y
Development and characterization of Materials and Components for TES	Y
Durability tests of Anti-Reflective Coatings on glass envelopes	Y
Gas analysis	Y
Heat Exchangers Characterization	Y
Heliostat control algorithms	Y
High flux sensors qualification	Y
High temperature optical properties measurement	Y
Material synthesis	Y
Non-Contact Temperature Measurement at Solar Furnaces	Y
Online and offline diagnostics	Y





Optical Properties/Characterization of Absorbers & Receivers and their coating	Y
Outdoor exposure of Solar Reflectors	Y
Qualification HSM/HTF	Y
Qualification HTF based on particles	Y
Qualification of Heat Storage using concrete under experimental conditions	Y
Qualification of Heat Storage using Packed beds under Real Operating Conditions	Y
Qualification of Heat Storage using PCM under experimental conditions	Y
Qualification of high radiative flux processes	Y
Qualification of Solar Driven Processes under realistic conditions	Y
Sensor development and testing	Y
Solar Fuels and Thermochemistry	Y
Solar Hydrogen production and wastewater treatment	Y
Solar Hydrogen Production Process Qualification	Y
Solar photocatalytic treatment of urban and industrial wastewaters	Y
Solar pumped LASER testing	Y
Solar Radiation Measurement and Weather Station	Y
Solar Thermochemical Hydrogen/Syngas	Y
Surface materials treatment	Y
Surface Properties of Absorbers & Receivers and their coating	Y
Surface Treatment and Metallic Coatings	Y
Synthesis of materials at high temperature	Y
Testing of high temperature processes	Y
Testing of materials at high flux	Y
Testing of materials at high temperature	Y
Testing of small steam turbines powered by molten salt steam generator	Y
Testing of Solarized gas turbine in Real Conditions	Y
Testing of Solarized Stirling Engines in Real Conditions	Y
Testing TES prototypes using oil as HTF	Y
Thermal & thermochemical properties evaluation for thermal storage materials	Y
Thermal analysis	Y
Thermal and Thermodynamic characterization of prototype Reactors for Central Receiver on Tower	Y
Thermal and Thermodynamic characterization of prototype Receivers for Central Receiver on Tower	Y
Technologies under Real Operating Conditions	
Thermal treatment of materials at high temperature	Y
Water splitting thermochemical cycles	Y



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Furnace	1969	MSSF 6kW (Verticales)	France: Latitude N 42.494 Longitude E 2.0293	1600

Accelerated Aging of absorbers & absorbing coatings   Advanced solid concepts for thermal energy storage   Atmosferic air packed bed test bench for simulation models validation	Y Y Y Y
Advanced solid concepts for thermal energy storage Atmosferic air packed bed test bench for simulation models validation	Y Y Y
Atmosferic air packed bed test bench for simulation models validation	Y Y
	Y
Calibration of Concentrated solar irradiance sensors	
Characterization of HTF thermal properties	Y
Characterization of HTF/HSM chemical stability	Y
Deposits of coatings at high temperature	Υ
Development and characterization of Materials and Components for TES	Y
Durability tests of Anti-Reflective Coatings on glass envelopes	Υ
Gas analysis	Y
Heat Exchangers Characterization	Y
Heliostat control algorithms	Y
High flux sensors qualification	Y
High temperature optical properties measurement	Y
Material synthesis	Y
Non-Contact Temperature Measurement at Solar Furnaces	Y
Online and offline diagnostics	Y





Optical Properties/Characterization of Absorbers & Receivers and their coating	Y
Outdoor exposure of Solar Reflectors	Y
Qualification HSM/HTF	Y
Qualification HTF based on particles	Y
Qualification of Heat Storage using concrete under experimental conditions	Y
Qualification of Heat Storage using Packed beds under Real Operating Conditions	Y
Qualification of Heat Storage using PCM under experimental conditions	Y
Qualification of high radiative flux processes	Y
Qualification of Solar Driven Processes under realistic conditions	Y
Sensor development and testing	Y
Solar Fuels and Thermochemistry	Y
Solar Hydrogen production and wastewater treatment	Y
Solar Hydrogen Production Process Qualification	Y
Solar photocatalytic treatment of urban and industrial wastewaters	Y
Solar pumped LASER testing	Y
Solar Radiation Measurement and Weather Station	Y
Solar Thermochemical Hydrogen/Syngas	Y
Surface materials treatment	Y
Surface Properties of Absorbers & Receivers and their coating	Y
Surface Treatment and Metallic Coatings	Y
Synthesis of materials at high temperature	Y
Testing of high temperature processes	Y
Testing of materials at high flux	Y
Testing of materials at high temperature	Y
Testing of small steam turbines powered by molten salt steam generator	Y
Testing of Solarized gas turbine in Real Conditions	Y
Testing of Solarized Stirling Engines in Real Conditions	Y
Testing TES prototypes using oil as HTF	Y
Thermal & thermochemical properties evaluation for thermal storage materials	Y
Thermal analysis	Y
Thermal and Thermodynamic characterization of prototype Reactors for Central Receiver on Tower Technologies under real operating conditions	Y
Thermal and Thermodynamic characterization of prototype Receivers for Central Receiver on Tower Technologies under Real Operating Conditions	Y
Thermal treatment of materials at high temperature	Y
Water splitting thermochemical cycles	Y



GA No: 8	23802
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facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Furnace	1969	MSSF Centre Nord Est (Verticales 1.5m)	France: Latitude N 42.494 Longitude E 2.0293	1600
Accelerated Aging of a	hearbers & absorbing			<u> INA?</u> Y
Advanced solid concent	ts for thermal energy	storage		Ŷ
Atmosferic air nacked h	bed test bench for sin	nulation models value	dation	Y
Calibration of Concentr	rated solar irradiance	sensors		Y
Characterization of HTF	E thermal properties			Y
Characterization of HT	E/HSM chemical stabi	lity		Y

Characterization of HTF/HSM chemical stability Y Deposits of coatings at high temperature Υ Development and characterization of Materials and Components for TES Υ Durability tests of Anti-Reflective Coatings on glass envelopes Υ Gas analysis Y Heat Exchangers Characterization Υ Heliostat control algorithms Υ High flux sensors qualification Y High temperature optical properties measurement Υ Material synthesis γ Non-Contact Temperature Measurement at Solar Furnaces Y Online and offline diagnostics





Optical Properties/Characterization of Absorbers & Receivers and their coating	Y
Outdoor exposure of Solar Reflectors	Y
Qualification HSM/HTF	Y
Qualification HTF based on particles	Y
Qualification of Heat Storage using concrete under experimental conditions	Y
Qualification of Heat Storage using Packed beds under Real Operating Conditions	Y
Qualification of Heat Storage using PCM under experimental conditions	Y
Qualification of high radiative flux processes	Y
Qualification of Solar Driven Processes under realistic conditions	Y
Sensor development and testing	Y
Solar Fuels and Thermochemistry	Y
Solar Hydrogen production and wastewater treatment	Y
Solar Hydrogen Production Process Qualification	Y
Solar photocatalytic treatment of urban and industrial wastewaters	Y
Solar pumped LASER testing	Y
Solar Radiation Measurement and Weather Station	Y
Solar Thermochemical Hydrogen/Syngas	Y
Surface materials treatment	Y
Surface Properties of Absorbers & Receivers and their coating	Y
Surface Treatment and Metallic Coatings	Y
Synthesis of materials at high temperature	Y
Testing of high temperature processes	Y
Testing of materials at high flux	Y
Testing of materials at high temperature	Y
Testing of small steam turbines powered by molten salt steam generator	Y
Testing of Solarized gas turbine in Real Conditions	Y
Testing of Solarized Stirling Engines in Real Conditions	Y
Testing TES prototypes using oil as HTF	Y
Thermal & thermochemical properties evaluation for thermal storage materials	Y
Thermal analysis	Y
Thermal and Thermodynamic characterization of prototype Reactors for Central Receiver on Tower Technologies under real operating conditions	Y
Thermal and Thermodynamic characterization of prototype Receivers for Central Receiver on Tower Technologies under Real Operating Conditions	Y
Thermal treatment of materials at high temperature	Y
Water splitting thermochemical cycles	Y



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facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Furnace	1969	MSSF Centre Nord Ouest (Verticales 2m)	France: Latitude N 42.494 Longitude E 2.0293	1600
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Service Name	TNA?
Accelerated Aging of absorbers & absorbing coatings	Y
Advanced solid concepts for thermal energy storage	Y
Atmosferic air packed bed test bench for simulation models validation	Y
Calibration of Concentrated solar irradiance sensors	Y
Characterization of HTF thermal properties	Y
Characterization of HTF/HSM chemical stability	Y
Deposits of coatings at high temperature	Y
Development and characterization of Materials and Components for TES	Y
Durability tests of Anti-Reflective Coatings on glass envelopes	Y
Gas analysis	Y
Heat Exchangers Characterization	Y
Heliostat control algorithms	Y
High flux sensors qualification	Y
High temperature optical properties measurement	Y
Material synthesis	Y
Non-Contact Temperature Measurement at Solar Furnaces	Y
Online and offline diagnostics	Y





Optical Properties/Characterization of Absorbers & Receivers and their coating	Y
Outdoor exposure of Solar Reflectors	Y
Qualification HSM/HTF	Y
Qualification HTF based on particles	Y
Qualification of Heat Storage using concrete under experimental conditions	Y
Qualification of Heat Storage using Packed beds under Real Operating Conditions	Y
Qualification of Heat Storage using PCM under experimental conditions	Y
Qualification of high radiative flux processes	Y
Qualification of Solar Driven Processes under realistic conditions	Y
Sensor development and testing	Y
Solar Fuels and Thermochemistry	Y
Solar Hydrogen production and wastewater treatment	Y
Solar Hydrogen Production Process Qualification	Y
Solar photocatalytic treatment of urban and industrial wastewaters	Y
Solar pumped LASER testing	Y
Solar Radiation Measurement and Weather Station	Y
Solar Thermochemical Hydrogen/Syngas	Y
Surface materials treatment	Y
Surface Properties of Absorbers & Receivers and their coating	Y
Surface Treatment and Metallic Coatings	Y
Synthesis of materials at high temperature	Y
Testing of high temperature processes	Y
Testing of materials at high flux	Y
Testing of materials at high temperature	Y
Testing of small steam turbines powered by molten salt steam generator	Y
Testing of Solarized gas turbine in Real Conditions	Y
Testing of Solarized Stirling Engines in Real Conditions	Y
Testing TES prototypes using oil as HTF	Y
Thermal & thermochemical properties evaluation for thermal storage materials	Y
Thermal analysis	Y
Thermal and Thermodynamic characterization of prototype Reactors for Central Receiver on Tower	Y
Thermal and Thermodynamic characterization of prototype Receivers for Central Receiver on Tower	Y
Technologies under Real Operating Conditions	
Thermal treatment of materials at high temperature	Y
Water splitting thermochemical cycles	Y





facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Furnace	1969	MSSF Centre Sud Est (Verticales 2m)	France: Latitude N 42.494 Longitude E 2.0293	1600



TNA?
Y
Y
Y
Y
Y
Y
Y
Y
Y
Y
Y
Y
Y
Y
Y
Y
Y





Optical Properties/Characterization of Absorbers & Receivers and their coating	Y
Outdoor exposure of Solar Reflectors	Y
Qualification HSM/HTF	Y
Qualification HTF based on particles	Y
Qualification of Heat Storage using concrete under experimental conditions	Y
Qualification of Heat Storage using Packed beds under Real Operating Conditions	Y
Qualification of Heat Storage using PCM under experimental conditions	Y
Qualification of high radiative flux processes	Y
Qualification of Solar Driven Processes under realistic conditions	Y
Sensor development and testing	Y
Solar Fuels and Thermochemistry	Y
Solar Hydrogen production and wastewater treatment	Y
Solar Hydrogen Production Process Qualification	Y
Solar photocatalytic treatment of urban and industrial wastewaters	Y
Solar pumped LASER testing	Y
Solar Radiation Measurement and Weather Station	Y
Solar Thermochemical Hydrogen/Syngas	Y
Surface materials treatment	Y
Surface Properties of Absorbers & Receivers and their coating	Y
Surface Treatment and Metallic Coatings	Y
Synthesis of materials at high temperature	Y
Testing of high temperature processes	Y
Testing of materials at high flux	Y
Testing of materials at high temperature	Y
Testing of small steam turbines powered by molten salt steam generator	Y
Testing of Solarized gas turbine in Real Conditions	Y
Testing of Solarized Stirling Engines in Real Conditions	Y
Testing TES prototypes using oil as HTF	Y
Thermal & thermochemical properties evaluation for thermal storage materials	Y
Thermal analysis	Y
Thermal and Thermodynamic characterization of prototype Reactors for Central Receiver on Tower	Y
Thermal and Thermodynamic characterization of prototype Receivers for Central Receiver on Tower	Y
Technologies under Real Operating Conditions	-
Thermal treatment of materials at high temperature	Y
Water splitting thermochemical cycles	Y



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Furnace	1969	MSSF Centre Sud Ouest (Verticales 1.5m)	France: Latitude N 42.494 Longitude E 2.0293	1600



Service Name	TNA?
Accelerated Aging of absorbers & absorbing coatings	Y
Advanced solid concepts for thermal energy storage	Y
Atmosferic air packed bed test bench for simulation models validation	Y
Calibration of Concentrated solar irradiance sensors	Y
Characterization of HTF thermal properties	Y
Characterization of HTF/HSM chemical stability	Y
Deposits of coatings at high temperature	Y
Development and characterization of Materials and Components for TES	Y
Durability tests of Anti-Reflective Coatings on glass envelopes	Y
Gas analysis	Y
Heat Exchangers Characterization	Y
Heliostat control algorithms	Y
High flux sensors qualification	Y
High temperature optical properties measurement	Y
Material synthesis	Y
Non-Contact Temperature Measurement at Solar Furnaces	Y
Online and offline diagnostics	Y





Optical Properties/Characterization of Absorbers & Receivers and their coating	Y
Outdoor exposure of Solar Reflectors	Y
Qualification HSM/HTF	Y
Qualification HTF based on particles	Y
Qualification of Heat Storage using concrete under experimental conditions	Y
Qualification of Heat Storage using Packed beds under Real Operating Conditions	Y
Qualification of Heat Storage using PCM under experimental conditions	Y
Qualification of high radiative flux processes	Y
Qualification of Solar Driven Processes under realistic conditions	Y
Sensor development and testing	Y
Solar Fuels and Thermochemistry	Y
Solar Hydrogen production and wastewater treatment	Y
Solar Hydrogen Production Process Qualification	Y
Solar photocatalytic treatment of urban and industrial wastewaters	Y
Solar pumped LASER testing	Y
Solar Radiation Measurement and Weather Station	Y
Solar Thermochemical Hydrogen/Syngas	Y
Surface materials treatment	Y
Surface Properties of Absorbers & Receivers and their coating	Y
Surface Treatment and Metallic Coatings	Y
Synthesis of materials at high temperature	Y
Testing of high temperature processes	Y
Testing of materials at high flux	Y
Testing of materials at high temperature	Y
Testing of small steam turbines powered by molten salt steam generator	Y
Testing of Solarized gas turbine in Real Conditions	Y
Testing of Solarized Stirling Engines in Real Conditions	Y
Testing TES prototypes using oil as HTF	Y
Thermal & thermochemical properties evaluation for thermal storage materials	Y
Thermal analysis	Y
Thermal and Thermodynamic characterization of prototype Reactors for Central Receiver on Tower	Y
Thermal and Thermodynamic characterization of prototype Receivers for Central Receiver on Tower	Y
Technologies under Real Operating Conditions	-
Thermal treatment of materials at high temperature	Y
Water splitting thermochemical cycles	Y



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Furnace	1969	MSSF Est Nord Est (Verticales 2m)	France: Latitude N 42.494 Longitude E 2.0293	1600
		Service Name		TNA?

Service Name	INA (
Accelerated Aging of absorbers & absorbing coatings	Y
Advanced solid concepts for thermal energy storage	Y
Atmosferic air packed bed test bench for simulation models validation	Y
Calibration of Concentrated solar irradiance sensors	Y
Characterization of HTF thermal properties	Y
Characterization of HTF/HSM chemical stability	Y
Deposits of coatings at high temperature	Y
Development and characterization of Materials and Components for TES	Y
Durability tests of Anti-Reflective Coatings on glass envelopes	Y
Gas analysis	Y
Heat Exchangers Characterization	Y
Heliostat control algorithms	Y
High flux sensors qualification	Y
High temperature optical properties measurement	Y
Material synthesis	Y
Non-Contact Temperature Measurement at Solar Furnaces	Y
Online and offline diagnostics	Υ





Optical Properties/Characterization of Absorbers & Receivers and their coating	Y
Outdoor exposure of Solar Reflectors	Y
Qualification HSM/HTF	Y
Qualification HTF based on particles	Y
Qualification of Heat Storage using concrete under experimental conditions	Y
Qualification of Heat Storage using Packed beds under Real Operating Conditions	Y
Qualification of Heat Storage using PCM under experimental conditions	Y
Qualification of high radiative flux processes	Y
Qualification of Solar Driven Processes under realistic conditions	Y
Sensor development and testing	Y
Solar Fuels and Thermochemistry	Y
Solar Hydrogen production and wastewater treatment	Y
Solar Hydrogen Production Process Qualification	Y
Solar photocatalytic treatment of urban and industrial wastewaters	Y
Solar pumped LASER testing	Y
Solar Radiation Measurement and Weather Station	Y
Solar Thermochemical Hydrogen/Syngas	Y
Surface materials treatment	Y
Surface Properties of Absorbers & Receivers and their coating	Y
Surface Treatment and Metallic Coatings	Y
Synthesis of materials at high temperature	Y
Testing of high temperature processes	Y
Testing of materials at high flux	Y
Testing of materials at high temperature	Y
Testing of small steam turbines powered by molten salt steam generator	Y
Testing of Solarized gas turbine in Real Conditions	Y
Testing of Solarized Stirling Engines in Real Conditions	Y
Testing TES prototypes using oil as HTF	Y
Thermal & thermochemical properties evaluation for thermal storage materials	Y
Thermal analysis	Y
Thermal and Thermodynamic characterization of prototype Reactors for Central Receiver on Tower	Y
Thermal and Thermodynamic characterization of prototype Receivers for Central Receiver on Tower	Y
Technologies under Real Operating Conditions	
Thermal treatment of materials at high temperature	Y
Water splitting thermochemical cycles	Y



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Furnace	1969	MSSF Est Nord Ouest (Verticales 1.5m)	France: Latitude N 42.494 Longitude E 2.0293	1600



Service Name	TNA?
Accelerated Aging of absorbers & absorbing coatings	Y
Advanced solid concepts for thermal energy storage	Y
Atmosferic air packed bed test bench for simulation models validation	Y
Calibration of Concentrated solar irradiance sensors	Y
Characterization of HTF thermal properties	Y
Characterization of HTF/HSM chemical stability	Y
Deposits of coatings at high temperature	Y
Development and characterization of Materials and Components for TES	Y
Durability tests of Anti-Reflective Coatings on glass envelopes	Y
Gas analysis	Y
Heat Exchangers Characterization	Y
Heliostat control algorithms	Y
High flux sensors qualification	Y
High temperature optical properties measurement	Y
Material synthesis	Y
Non-Contact Temperature Measurement at Solar Furnaces	Y
Online and offline diagnostics	Y





Optical Properties/Characterization of Absorbers & Receivers and their coating	Y
Outdoor exposure of Solar Reflectors	Y
Qualification HSM/HTF	Y
Qualification HTF based on particles	Y
Qualification of Heat Storage using concrete under experimental conditions	Y
Qualification of Heat Storage using Packed beds under Real Operating Conditions	Y
Qualification of Heat Storage using PCM under experimental conditions	Y
Qualification of high radiative flux processes	Y
Qualification of Solar Driven Processes under realistic conditions	Y
Sensor development and testing	Y
Solar Fuels and Thermochemistry	Y
Solar Hydrogen production and wastewater treatment	Y
Solar Hydrogen Production Process Qualification	Y
Solar photocatalytic treatment of urban and industrial wastewaters	Y
Solar pumped LASER testing	Y
Solar Radiation Measurement and Weather Station	Y
Solar Thermochemical Hydrogen/Syngas	Y
Surface materials treatment	Y
Surface Properties of Absorbers & Receivers and their coating	Y
Surface Treatment and Metallic Coatings	Y
Synthesis of materials at high temperature	Y
Testing of high temperature processes	Y
Testing of materials at high flux	Y
Testing of materials at high temperature	Y
Testing of small steam turbines powered by molten salt steam generator	Y
Testing of Solarized gas turbine in Real Conditions	Y
Testing of Solarized Stirling Engines in Real Conditions	Y
Testing TES prototypes using oil as HTF	Y
Thermal & thermochemical properties evaluation for thermal storage materials	Y
Thermal analysis	Y
Thermal and Thermodynamic characterization of prototype Reactors for Central Receiver on Tower	Y
Thermal and Thermodynamic characterization of prototype Receivers for Central Receiver on Tower	Y
Technologies under Real Operating Conditions	-
Thermal treatment of materials at high temperature	Y
Water splitting thermochemical cycles	Y

Land Area

occupied (m<sup>2</sup>)



facility type

Year of

construction

Furnace	1969	MSSF Est Sud Est (Verticales 1.5m)	France: Latitude N 42.494 Longitude E 2.0293	1600
		Service Name		TNA?
Accelerated Aging of abso	orbers & absorbing c	Service Name		<u>тNA?</u> Ү
Accelerated Aging of abso Advanced solid concepts f	orbers & absorbing c for thermal energy s	Service Name oatings torage		<u>ТNA?</u> Ү Ү
Accelerated Aging of abso Advanced solid concepts f Atmosferic air packed bec	orbers & absorbing c for thermal energy s d test bench for simu	Service Name oatings torage ulation models vali	dation	ТNА? Y Y Y
Accelerated Aging of abso Advanced solid concepts f Atmosferic air packed bec Calibration of Concentrate	orbers & absorbing c for thermal energy s d test bench for simu ed solar irradiance s	Service Name oatings torage ulation models valio ensors	dation	ТNА? Y Y Y Y Y
Accelerated Aging of abso Advanced solid concepts f Atmosferic air packed bec Calibration of Concentrate Characterization of HTF th	orbers & absorbing c for thermal energy s d test bench for simu ed solar irradiance s nermal properties	Service Name oatings torage ulation models valid ensors	dation	ТNA? Y Y Y Y Y Y
Accelerated Aging of abso Advanced solid concepts f Atmosferic air packed bec Calibration of Concentrate Characterization of HTF th Characterization of HTF/H	orbers & absorbing c for thermal energy s d test bench for simu ed solar irradiance s hermal properties ISM chemical stabili	Service Name oatings torage ulation models vali ensors	dation	TNA?     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y
Accelerated Aging of abso Advanced solid concepts f Atmosferic air packed bec Calibration of Concentrate Characterization of HTF th Characterization of HTF/H Deposits of coatings at hig	orbers & absorbing c for thermal energy s d test bench for simu ed solar irradiance s hermal properties ISM chemical stabili gh temperature	Service Name oatings torage ulation models valid ensors	dation	TNA?     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y
Accelerated Aging of abso Advanced solid concepts f Atmosferic air packed bec Calibration of Concentrate Characterization of HTF th Characterization of HTF/H Deposits of coatings at hig Development and character	orbers & absorbing c for thermal energy s d test bench for simu ed solar irradiance s hermal properties HSM chemical stabili gh temperature terization of Materia	Service Name oatings torage ulation models vali ensors ty	dation s for TES	TNA?     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y
Accelerated Aging of abso Advanced solid concepts f Atmosferic air packed bec Calibration of Concentrate Characterization of HTF/H Deposits of coatings at hig Development and charact Durability tests of Anti-Re	orbers & absorbing c for thermal energy s d test bench for simu ed solar irradiance s hermal properties ISM chemical stabili gh temperature terization of Materia eflective Coatings on	Service Name oatings torage ulation models valid ensors ty ils and Component glass envelopes	dation s for TES	TNA?     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y
Accelerated Aging of abso Advanced solid concepts f Atmosferic air packed bec Calibration of Concentrate Characterization of HTF th Characterization of HTF/H Deposits of coatings at hig Development and charact Durability tests of Anti-Re Gas analysis	orbers & absorbing c for thermal energy s d test bench for simu ed solar irradiance s hermal properties ISM chemical stabili gh temperature terization of Materia flective Coatings on	Service Name oatings torage ulation models vali ensors ty uls and Component glass envelopes	dation s for TES	TNA?     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y
Accelerated Aging of abso Advanced solid concepts f Atmosferic air packed bec Calibration of Concentrate Characterization of HTF th Characterization of HTF/H Deposits of coatings at hig Development and charact Durability tests of Anti-Re Gas analysis Heat Exchangers Characte	orbers & absorbing c for thermal energy s d test bench for simu ed solar irradiance s hermal properties ISM chemical stabili gh temperature terization of Materia effective Coatings on	Service Name oatings torage ulation models valid ensors ty ils and Component glass envelopes	dation s for TES	TNA?     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y
Accelerated Aging of abso Advanced solid concepts f Atmosferic air packed bec Calibration of Concentrate Characterization of HTF th Characterization of HTF/H Deposits of coatings at hig Development and charact Durability tests of Anti-Re Gas analysis Heat Exchangers Characte Heliostat control algorithm	orbers & absorbing c for thermal energy s d test bench for simu ed solar irradiance s hermal properties ISM chemical stabili gh temperature terization of Materia iflective Coatings on erization ms	Service Name oatings torage ulation models valie ensors ty uls and Component glass envelopes	dation s for TES	TNA?     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y
Accelerated Aging of abso Advanced solid concepts f Atmosferic air packed bec Calibration of Concentrate Characterization of HTF th Characterization of HTF/H Deposits of coatings at hig Development and charact Durability tests of Anti-Re Gas analysis Heat Exchangers Characte Heliostat control algorithm High flux sensors qualifica	orbers & absorbing c for thermal energy s d test bench for simu ed solar irradiance s nermal properties ISM chemical stabili gh temperature terization of Materia effective Coatings on erization ms ation	Service Name oatings torage ulation models vali ensors ty ils and Component glass envelopes	dation s for TES	TNA?     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y
Accelerated Aging of abso Advanced solid concepts f Atmosferic air packed bec Calibration of Concentrate Characterization of HTF/H Deposits of coatings at hig Development and charact Durability tests of Anti-Re Gas analysis Heat Exchangers Characte Heliostat control algorithm High flux sensors qualifica High temperature optical	orbers & absorbing c for thermal energy s d test bench for simu ed solar irradiance s nermal properties ISM chemical stabili gh temperature terization of Materia effective Coatings on erization ms ation properties measure	Service Name oatings torage ulation models vali ensors ty uls and Component glass envelopes ment	dation s for TES	TNA?     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y
Accelerated Aging of abso Advanced solid concepts f Atmosferic air packed bed Calibration of Concentrate Characterization of HTF th Characterization of HTF/H Deposits of coatings at hig Development and charact Durability tests of Anti-Re Gas analysis Heat Exchangers Characte Heliostat control algorithm High flux sensors qualifica High temperature optical Material synthesis	orbers & absorbing c for thermal energy s d test bench for simu ed solar irradiance s hermal properties HSM chemical stabili gh temperature terization of Materia effective Coatings on erization ms ation properties measure	Service Name oatings torage ulation models vali ensors ty ils and Component glass envelopes ment	dation s for TES	TNA?     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y
Accelerated Aging of abso Advanced solid concepts f Atmosferic air packed bec Calibration of Concentrate Characterization of HTF th Characterization of HTF/H Deposits of coatings at hig Development and charact Durability tests of Anti-Re Gas analysis Heat Exchangers Characte Heliostat control algorithm High flux sensors qualifica High temperature optical Material synthesis Non-Contact Temperature	orbers & absorbing c for thermal energy s d test bench for simu ed solar irradiance s nermal properties ISM chemical stabili gh temperature terization of Materia erization ms ation properties measure e Measurement at S	Service Name oatings torage ulation models vali ensors ty ils and Component glass envelopes ment olar Furnaces	dation s for TES	TNA?     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y     Y

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Location (GPS)

Facility Name





Optical Properties/Characterization of Absorbers & Receivers and their coating	Y
Outdoor exposure of Solar Reflectors	Y
Qualification HSM/HTF	Y
Qualification HTF based on particles	Y
Qualification of Heat Storage using concrete under experimental conditions	Y
Qualification of Heat Storage using Packed beds under Real Operating Conditions	Y
Qualification of Heat Storage using PCM under experimental conditions	Y
Qualification of high radiative flux processes	Y
Qualification of Solar Driven Processes under realistic conditions	Y
Sensor development and testing	Y
Solar Fuels and Thermochemistry	Y
Solar Hydrogen production and wastewater treatment	Y
Solar Hydrogen Production Process Qualification	Y
Solar photocatalytic treatment of urban and industrial wastewaters	Y
Solar pumped LASER testing	Y
Solar Radiation Measurement and Weather Station	Y
Solar Thermochemical Hydrogen/Syngas	Y
Surface materials treatment	Y
Surface Properties of Absorbers & Receivers and their coating	Y
Surface Treatment and Metallic Coatings	Y
Synthesis of materials at high temperature	Y
Testing of high temperature processes	Y
Testing of materials at high flux	Y
Testing of materials at high temperature	Y
Testing of small steam turbines powered by molten salt steam generator	Y
Testing of Solarized gas turbine in Real Conditions	Y
Testing of Solarized Stirling Engines in Real Conditions	Y
Testing TES prototypes using oil as HTF	Y
Thermal & thermochemical properties evaluation for thermal storage materials	Y
Thermal analysis	Y
Thermal and Thermodynamic characterization of prototype Reactors for Central Receiver on Tower	Y
Thermal and Thermodynamic characterization of prototype Receivers for Central Receiver on Tower	Y
Technologies under Real Operating Conditions	-
Thermal treatment of materials at high temperature	Y
Water splitting thermochemical cycles	Y



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Furnace	1969	MSSF Centre Sud Ouest (Verticales 2m)	France: Latitude N 42.494 Longitude E 2.0293	1600
				PA
	A LANK LANK			
E E				
			6	
. /	111	-		

Service Name	TNA?
Accelerated Aging of absorbers & absorbing coatings	Y
Advanced solid concepts for thermal energy storage	Y
Atmosferic air packed bed test bench for simulation models validation	Y
Calibration of Concentrated solar irradiance sensors	Y
Characterization of HTF thermal properties	Y
Characterization of HTF/HSM chemical stability	Y
Deposits of coatings at high temperature	Y
Development and characterization of Materials and Components for TES	Y
Durability tests of Anti-Reflective Coatings on glass envelopes	Y
Gas analysis	Y
Heat Exchangers Characterization	Y
Heliostat control algorithms	Y
High flux sensors qualification	Y
High temperature optical properties measurement	Y
Material synthesis	Y
Non-Contact Temperature Measurement at Solar Furnaces	Y



Online and offline diagnostics	Y
Optical Properties/Characterization of Absorbers & Receivers and their coating	Y
Outdoor exposure of Solar Reflectors	Y
Qualification HSM/HTF	Y
Qualification HTF based on particles	Y
Qualification of Heat Storage using concrete under experimental conditions	Y
Qualification of Heat Storage using Packed beds under Real Operating Conditions	Y
Qualification of Heat Storage using PCM under experimental conditions	Y
Qualification of high radiative flux processes	Y
Qualification of Solar Driven Processes under realistic conditions	Y
Sensor development and testing	Y
Solar Fuels and Thermochemistry	Y
Solar Hydrogen production and wastewater treatment	Y
Solar Hydrogen Production Process Qualification	Y
Solar photocatalytic treatment of urban and industrial wastewaters	Y
Solar pumped LASER testing	Y
Solar Radiation Measurement and Weather Station	Y
Solar Thermochemical Hydrogen/Syngas	Y
Surface materials treatment	Y
Surface Properties of Absorbers & Receivers and their coating	Y
Surface Treatment and Metallic Coatings	Y
Synthesis of materials at high temperature	Y
Testing of high temperature processes	Y
Testing of materials at high flux	Y
Testing of materials at high temperature	Y
Testing of small steam turbines powered by molten salt steam generator	Y
Testing of Solarized gas turbine in Real Conditions	Y
Testing of Solarized Stirling Engines in Real Conditions	Y
Testing TES prototypes using oil as HTF	Y
Thermal & thermochemical properties evaluation for thermal storage materials	Y
Thermal analysis	Y
Thermal and Thermodynamic characterization of prototype Reactors for Central Receiver on Tower Technologies under real operating conditions	Y
Thermal and Thermodynamic characterization of prototype Receivers for Central Receiver on Tower Technologies under Real Operating Conditions	Y
Thermal treatment of materials at high temperature	Y
Water splitting thermochemical cycles	Y



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Furnace	1969	MWSF	France: Latitude N 42.494 Longitude E 2.0293	30000



Service Name	TNA?
Advanced materials analysis and characterization techniques	Y
Advanced solid concepts for thermal energy storage	Y
Atmosferic air packed bed test bench for simulation models validation	Y
Calibration of Concentrated solar irradiance sensors	Y
Characterization of HTF thermal properties	Y
Characterization of HTF/HSM chemical stability	Y
Deposits of coatings at high temperature	Y
Development and characterization of Materials and Components for TES	Y
Heat Exchangers Characterization	Y
Heliostat control algorithms	Y
High flux sensors qualification	Y
High temperature optical properties measurement	Y
High Temperature Thermochemical Research Units	Y
Material synthesis	Y
Non-Contact Temperature Measurement at Solar Furnaces	Y
Online and offline diagnostics	Y
Optical and thermal characterization of solar concentrators	Y





Optical Properties/Characterization of Absorbers & Receivers and their coating	Y
Outdoor exposure of Solar Reflectors	Y
Qualification HSM/HTF	Y
Qualification HTF based on particles	Y
Qualification of Heat Storage using concrete under experimental conditions	Y
Qualification of Heat Storage using Packed beds under Real Operating Conditions	Y
Qualification of Heat Storage using PCM under experimental conditions	Y
Qualification of high radiative flux processes	Y
Qualification of Solar Driven Processes under realistic conditions	Y
Sensor development and testing	Y
Solar Fuels and Thermochemistry	Y
Solar Hydrogen production and wastewater treatment	Y
Solar Hydrogen Production Process Qualification	Y
Solar pumped LASER testing	Y
Solar Radiation Measurement and Weather Station	Y
Solar Thermochemical Hydrogen/Syngas	Y
Surface materials treatment	Y
Surface Properties of Absorbers & Receivers and their coating	Y
Synthesis of materials at high temperature	Y
Testing of high temperature processes	Y
Testing of materials at high flux	Y
Testing of materials at high temperature	Y
Testing of small steam turbines powered by molten salt steam generator	Y
Testing of Solarized gas turbine in Real Conditions	Y
Testing of Solarized Stirling Engines in Real Conditions	Y
Testing TES prototypes using oil as HTF	Y
Thermal & thermochemical properties evaluation for thermal storage materials	Y
Thermal analysis	Y
Thermal and Thermodynamic characterization of prototype Reactors for Central Receiver on Tower Technologies under real operating conditions	Y
Thermal and Thermodynamic characterization of prototype Receivers for Central Receiver on Tower Technologies under Real Operating Conditions	Y
Thermal treatment of materials at high temperature	Y
Water splitting thermochemical cycles	Y



<u>CYI</u>

facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Central receiver	2014	ATHLab	Cyprus: Latitude N 35° 08' 28.14" Longitude E 33° 22' 51.85"	200





facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Central receiver	2015	PROTEAS	Cyprus: Latitude N 34° 42' 26.56' Longitude E 33° 15' 38.89'	160000
Outdoor exposure of So	lar Reflectors	Service Name		<u>ΓΝΑ ?</u> γ
Sensor development and	d testing			Y
Solar Thermal Desalinat	ion by Multi-Effect Di	stillation		Y
Testing in molten salt lo	op of auxiliary compo	onents (valves, hea	t tracing, instrumentation)	Y
Thermal and Thermodyr Technologies under Rea	namic characterizatio I Operating Conditior	n of prototype Rec	eivers for Central Receiver on Tower	Y



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Linear Fresnel	2016	LFR	Cyprus: Latitude N 35° 8' 27.8592" Longitude E 2° 33° 22' 50.3364"	288
		Service Name		TNA?
Linear Fresnel control a	lgorithms			Y
Outdoor optical and the	door optical and thermal performance of Linear Fresnel receivers			

Outdoor optical and thermal performance of Linear Fresnel receivers



<u>DLR</u>

facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)		
Solar Simulator	2017	Synlight	Jülich, Germany			
		Service Name		TNA?		
Accelerated Aging of abs	orbers & absorbing	coatings		Y		
Corrosion and material p	Corrosion and material protection studies under artificial aging tests					
Testing of high temperat	Testing of high temperature processes					
Testing of materials at hi	Testing of materials at high flux					
Testing of materials at hi	Testing of materials at high temperature					
Thermal treatment of materials at high temperature						
High flux sensors qualification						
Indoor qualification of linear receivers for LFC						
Indoor qualification of linear receivers for PTC				Ν		



<u>ENEA</u>

facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Parabolic Trough	2003	PCS	Italy: Latitude N 42°03.0' Longitude E 12°18.0'	2000
		Service Name		TNA?
Calibration of solar Irrac	liation, Temperature	and pressure meas	surement sensors	Y
Characterization of Mat	erials and Componen	ts for TES		Y
Characterization of Mat	erials and Componen	ts for TES systems	with molten salts	
Development and chara	cterization of Materi	als and Component	s for TES	Y
Flexible or ball-joints co				Y Y
Indoor qualification of li	nnections testing for	molten salt loop		Y Y Y
Indoor qualification of li	nnections testing for inear receivers for LF	molten salt loop		Y Y Y Y
•	nnections testing for inear receivers for LFG inear receivers for PT	molten salt loop C		Y Y Y Y Y
Online and offline diagn	nnections testing for inear receivers for LFG inear receivers for PT iostics	molten salt loop		Y Y Y Y Y Y
Online and offline diagn Optical and thermal cha	nnections testing for inear receivers for LFG inear receivers for PT ostics iracterization of solar	molten salt loop C C concentrators		Y Y Y Y Y Y Y
Online and offline diagn Optical and thermal cha Optical Properties of Mi	nnections testing for inear receivers for LFG inear receivers for PT iostics iracterization of solar irrors. Reflectance me	molten salt loop C C concentrators easurement. Facets	characterization	Y Y Y Y Y Y Y
Online and offline diagn Optical and thermal cha Optical Properties of Mi Outdoor exposure of So	nnections testing for inear receivers for LFG inear receivers for PT ostics iracterization of solar irrors. Reflectance me lar Reflectors	molten salt loop C C concentrators easurement. Facets	characterization	Y Y Y Y Y Y Y Y Y
Online and offline diagn Optical and thermal cha Optical Properties of Mi Outdoor exposure of So Outdoor optical and the	nnections testing for inear receivers for LFG inear receivers for PT iostics irracterization of solar irrors. Reflectance me ilar Reflectors ermal performance of	molten salt loop C C concentrators easurement. Facets PTC linear receiver	characterization	Y Y Y Y Y Y Y Y Y Y
Online and offline diagn Optical and thermal cha Optical Properties of Mi Outdoor exposure of So Outdoor optical and the Parabolic Trough Collect	nnections testing for inear receivers for LFG inear receivers for PT ostics iracterization of solar irrors. Reflectance me lar Reflectors ermal performance of tor's Characterization	molten salt loop C C concentrators easurement. Facets PTC linear receiver	characterization	Y Y Y Y Y Y Y Y Y Y Y
Online and offline diagn Optical and thermal cha Optical Properties of Mi Outdoor exposure of So Outdoor optical and the Parabolic Trough Collect Sensor development an	nnections testing for inear receivers for LFG inear receivers for PT ostics irracterization of solar irrors. Reflectance me lar Reflectors ermal performance of tor's Characterization d testing	molten salt loop C C concentrators easurement. Facets PTC linear receiver	characterization	Y Y Y Y Y Y Y Y Y Y Y Y Y
Online and offline diagn Optical and thermal cha Optical Properties of Mi Outdoor exposure of So Outdoor optical and the Parabolic Trough Collect Sensor development an Simulation and modellir	nnections testing for inear receivers for LFG inear receivers for PT ostics racterization of solar rrors. Reflectance me lar Reflectors ermal performance of tor's Characterization d testing ng of thermal storage	molten salt loop C C concentrators easurement. Facets PTC linear receiver systems. Integratic	characterization rs on in STE plants or industrial heat process	Y Y Y Y Y Y Y Y Y Y Y Y Y Y



Study on molten salts in Parabolic Trough Collectors and pipe section	Y
Testing in molten salt loop of auxiliary components (valves, heat tracing, instrumentation)	Y
DNI Measurement and Analysis	Ν
Geometrical assessment of Solar Concentrators (Single Facets, Point and Line Focus Collectors)	Ν
Heat Exchangers Characterization	Ν
Molten salt pool to steam heat exchangers	Ν
Optical Properties/Characterization of Absorbers & Receivers and their coating	Ν
Photogrammetry Measurement of Concentrator's shape	Ν
Testing of Rotating Connections for PT receivers (Flexible hoses, ball-joints, etc.)	Ν
Testing of small steam turbines powered by molten salt steam generator	N





facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Dish	2017	OMSoP	Italy: Latitude N 42°03.0' Longitude E 12°18.0'	150
Characterization of the	rmal performance of a	Service Name	s for solar dish technology coupled with M0	INA? GT Y
engine				
Geometrical assessmen	t of Solar Concentrate	ors (Single Facets, F	Point and Line Focus Collectors)	Y
Optical and thermal cha	aracterization of solar	concentrators		Y
Outdoor exposure of So	olar Reflectors			Y
Solar Radiation Measur	ement and Weather S	Station		Y

DNI Measurement and Analysis

Ν



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	na	TFC-LAB	Italy: Latitude N 42.0413818, Longitude E 12.3020906	na



Service Name	TNA?
Advanced materials analysis and characterization techniques	Y
Advanced solid concepts for thermal energy storage	Y
Characterization of HTF thermal properties	Y
Characterization of HTF/HSM chemical stability	Y
Characterization of Materials and Components for TES	Y
Characterization of Materials and Components for TES systems with molten salts	Y
Development and characterization of Materials and Components for TES	Y
Feasibility of Materials for Sensible and Latent Thermal Storage Systems	Y
Gas analysis	Y
Material synthesis	Y
Qualification HSM/HTF	Y
Solar Fuels and Thermochemistry	Y
Solar Hydrogen Production Process Qualification	Y
Thermal & thermochemical properties evaluation for thermal storage materials	Y
Thermal analysis	Y
Water splitting thermochemical cycles	Y
Qualification HTF based on particles	N



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Other	2018	SMQ2	Italy: Latitude N 42.0437868 Longitude E 12.2997093	1.5
	car	mera	Screen	)
	can	nera	screen	
		Service Name		TNA?
Characterization of Opt	tical Properties of Sola	ar Reflectors		Y
Optical Properties of N	lirrors. Reflectance m	easurement. Facets	characterization	Y



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Other	2015	VISdish	Italy: Latitude N 42.0437868 Longitude E 12.2997093	20
		Service Name		TNA?
Geometrical assessmer	nt of Solar Concentrate	ors (Single Facets, P	Point and Line Focus Collectors)	Y

Photogrammetry Measurement of Concentrator's shape

Y





facility type	e Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	2010	VISfield	Italy: Latitude N 42.0437868 Longitude E 12.2997093	12
		Service Name		TNA?
Geometrical asses	ssment of Solar Concentrat	ors (Single Facets, F	Point and Line Focus Collectors)	Y




facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Other	2018	VISproLF	Italy: Latitude N 42.0437868 Longitude E 12.2997093	20
		Service Name		TNA?
Deflectometry Measure	ement of Concentrato	r's shape		Y
Geometrical assessmer	ometrical assessment of Solar Concentrators (Single Facets, Point and Line Focus Collectors)			





facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Other	2020	VISproPT	Italy: Latitude N 42.0437868 Longitude E 12.2997093	20
	Service Name			TNA?
Deflectometry Measur	ement of Concentrato	r's shape		Y
Geometrical assessmen	eometrical assessment of Solar Concentrators (Single Facets, Point and Line Focus Collectors)			



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facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )	
Other	2014	ATES	Italy: Latitude N 42°04.1' Longitude E 12°30.2'	4	
		Service Name		TNA?	
Characterization of Materials and Components for TES					
Characterization of Materials and Components for TES systems with molten salts					
Development and characterization of Materials and Components for TES					
Feasibility of Materials for Sensible and Latent Thermal Storage Systems					
Heat Exchangers Characterization					
Qualification of Heat Sto	orage using PCM und	er experimental cor	nditions	Y	
Testing TES prototypes u	using oil as HTF			Y	
Thermal & thermochem	Thermal & thermochemical properties evaluation for thermal storage materials				





facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Parabolic Trough	2018	ORC-PLUS	Italy: Latitude N 42°03.0' Longitude E 12°18.0'	30
		Service Name		TNA?
Calibration of synthetic of	oil mass flow meters			Y
Heat Exchangers Charact	terization			Y
Online and offline diagno	ostics			Y
Sensor development and	d testing			Y
Characterization of Mate	erials and Componen	ts for TES		Ν
Characterization of Mate	erials and Componen	ts for TES systems	with molten salts	Ν
Development and charac	cterization of Materi	als and Component	s for TES	N
Feasibility of Materials for	or Sensible and Later	nt Thermal Storage	Systems	Ν
Qualification HSM/HTF				N
Qualification of Heat Sto	rage using PCM und	er experimental co	nditions	Ν
Simulation and modellin	g of thermal storage	systems. Integration	on in STE plants or industrial heat processe	s N
Testing TES prototypes u	ising oil as HTF			N
Thermal & thermochem	ical properties evalua	ation for thermal st	orage materials	N



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	2019	REslag thermocline tank	Italy: Latitude N 42°03.0' Longitude E 12°18.0'	100 m <sup>2</sup>
Characterization of Mat	erials and Componer	nts for TES		Y Y
Characterization of Mat	erials and Componer	nts for TES systems v	vith molten salts	Y
Online and offline diagn	ostics			Y
Qualification of Heat Sto	orage using Packed b	eds under Real Ope	rating Conditions	Y
Development and chara	cterization of Materi	ials and Component	s for TES	Ν
Simulation and modellin	ng of thermal storage	systems, Integratio	n in STE plants or industrial heat pro	ocesses N

Simulation and modelling of thermal storage systems. Integration in STE plants or industrial heat processes



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Other	2015	SOLTECA	Italy: Latitude N 42°04.1' Longitude E 12°30.2'	10
		Service Name		TNA?
Characterization of Mat	erials and Componen	ts for TES		Y
Characterization of Materials and Components for TES systems with molten salts				
Development and characterization of Materials and Components for TES				Y
Feasibility of Materials for Sensible and Latent Thermal Storage Systems				
Heat Exchangers Charac	cterization			Y
Qualification of Heat St	orage using concrete	under experimenta	l conditions	Y
Qualification of Heat St	orage using PCM unde	er experimental co	nditions	Y
Testing TES prototypes	using oil as HTF			Y

Thermal & thermochemical properties evaluation for thermal storage materials

Y



# <u>ETH</u>

facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Thermal and Chemical Analytics Laboratory	2013	PREC CHEM	France: Latitude N 48° 51' 45.81'' Longitude E 2° 17' 15.331''	15
		Service Name		TNA?
Advanced materials analy	sis and characteriza	ation techniques		Y
Gas analysis				Y
High Temperature Therm	ochemical Research	h Units		Y
Measurements on materi	al properties			Y
Solar Fuels and Thermoch	emistry			Y
Solar Thermochemical Hy	drogen/Syngas			Y
Synthesis of materials at I	nigh temperature			Y
Testing of materials at hig	sh temperature			Y
Thermal & thermochemic	al properties evalu	ation for thermal st	orage materials	Y
Thermal treatment of ma	terials at high temp	perature		Y
Water splitting thermoch	emical cycles			Y



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
High Flux Solar Simulators	2009 & 2012	PREC HFSS	Switzerland: Latitude N 47°22'38.5" Longitude E 28°32'51.4"	24
				TNA2
Gas analysis		Service indiffe		Y
Lab-scale test hed used t	for the evaluation of	open volumetric re	eceivers	Y
Qualification of Solar Dri	iven Processes under	r realistic condition	s	Y
Solar Hydrogen Producti	ion Process Qualifica	tion	5	Y
Solar Thermochemical H	lydrogen/Syngas			Ŷ
Testing of high temperat				Y
Testing of materials at h	igh flux			Y
Water colitting thermos	hemical cycles			Y



# F-ISE

facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	2016	CD-Lab	Germany: 48°00'36.2"N 7°50'04.6"E	



Accelerated Ageing of absorbers & absorbing coatings	Y
Corrosion and material protection studies under artificial aging tests	Y
Durability of Solar Reflectors under Accelerated Aging	Y
Outdoor exposure of Solar Reflectors	Y
Solar Radiation Measurement and Weather Station	Y
Thermal and Thermodynamic characterization of prototype Receivers for Central Receiver on Tower Technologies under Real Operating Conditions	Y





facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	2016	C-Lab Field	Germany: 48°00'36.2"N 7°50'04.6"E	
Characterisation of Soilir	וק	Service Name		<b>ТNA?</b> ү
Corrosion and material r	rotection studies un	ider outdoor exposi	Ire	· · · · · · · · · · · · · · · · · · ·
Heliostat control algorith	nms			Y

Heliostat(s) Performance Qualification

Photogrammetry Measurement of Concentrator's shape

Υ

Y



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Other	2016	C-Lab	Germany: 48°00'36.2"N 7°50'04.6"E	
		Service Name		TNA?

Service Name	TNA?
3D Optical surface metrology	Y
Characterization of Optical Properties of Solar Reflectors	Y
Deflectometry Measurement of Concentrator's shape	Y
Geometrical assessment of Solar Concentrators (Single Facets, Point and Line Focus Collectors)	Y
Indoor qualification of linear receivers for LFC	Y
Optical Properties of Mirrors. Reflectance measurement. Facets characterization	Y
Optical Properties/Characterization of Absorbers & Receivers and their coating	Y
Sensor development and testing	Y
Surface Properties of Absorbers & Receivers and their coating	Y





1.31-	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Other	2016	TES-Lab	Germany: 48°00'36.2"N 7°50'04.6"E	
				Re
		Service Name		TNA?
haracterization of HTF		Service Name		<u>траз</u>
haracterization of HTF	-/HSM chemical stabil terials and Componen	Service Name ity its for TES		<u>тка?</u> ү ү
haracterization of HTF haracterization of Ma haracterization of Ma	F/HSM chemical stabil terials and Component terials and Componen	Service Name ity its for TES its for TES systems of	with molten salts	<mark>ТNА?</mark> Y Y Y
haracterization of HTF haracterization of Mar haracterization of Mar haracterization of Mar	T/HSM chemical stabil terials and Componen terials and Componen Iten salt mixtures	Service Name ity its for TES its for TES systems of	with molten salts	<mark>ТNА?</mark> Y Y Y Y Y
haracterization of HTF haracterization of Ma haracterization of Ma haracterization of mo vevelopment and chara	F/HSM chemical stabil terials and Component terials and Component terials and Component terials and Component	Service Name ity its for TES its for TES systems of als and Component	with molten salts s for TES	TNA?           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y
haracterization of HTF haracterization of Mar haracterization of Mar haracterization of Mar haracterization of mo revelopment and chara easibility of Materials	F/HSM chemical stabil terials and Componen terials and Componen Iten salt mixtures acterization of Materia for Sensible and Later	Service Name ity its for TES its for TES systems i als and Component it Thermal Storage	with molten salts s for TES Systems	TNA?           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y
haracterization of HTF haracterization of Ma haracterization of Ma haracterization of Ma evelopment and chara easibility of Materials qualification HSM/HTF	HSM chemical stabil terials and Componen terials and Componen Iten salt mixtures acterization of Materia for Sensible and Later	Service Name ity its for TES its for TES systems w als and Component it Thermal Storage	with molten salts s for TES Systems	TNA?           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y
haracterization of HTF haracterization of Ma haracterization of Ma haracterization of Mo evelopment and chara easibility of Materials qualification HSM/HTF qualification of Heat St	HSM chemical stabil terials and Component terials and Component terials and Component terials and Component terials and Component ter salt mixtures acterization of Materia for Sensible and Later	Service Name ity its for TES its for TES systems of als and Component it Thermal Storage er experimental cor	with molten salts s for TES Systems nditions	TNA?           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y           Y



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	2016	WT-Lab	Germany: 48°00'36.2"N 7°50'04.6"E	
		Service Name		TNA?
Characterisation and Te	esting of Membranes	for Water treatmer	nt	Y
Innovative membrane	desalination technolog	gies (MD, FO)		Y
Solar Thermal Desalina	tion by Membrane Dis	stillation		Y



# <u>IMDEA</u>

facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Central receiver	2016	Very High Concentration Solar Tower	Spain (Móstoles): Latitude N 40°20'21.1" Longitude W 3°52'53.3"	2500
-		6		
-				The second secon
	CONTRACT OF STREET			
			15 Q 169	

Service Name	TNA?
Accelerated Aging of absorbers & absorbing coatings	Y
Corrosion and material protection studies under outdoor exposure	Y
Heliostat control algorithms	Y
Heliostat(s) Performance Qualification	Y
Optical and thermal characterization of solar concentrators	Y
Outdoor exposure of Solar Reflectors	Y
Qualification of Solar Driven Processes under realistic conditions	Y
Solar Thermochemical Hydrogen/Syngas	Y
Synthesis of materials at high temperature	Y
Testing of high temperature processes	Y
Testing of materials at high flux	Y
Testing of materials at high temperature	Y
Thermal and Thermodynamic characterization of prototype Reactors for Central Receiver on Tower Technologies under real operating conditions	Y
Thermal and Thermodynamic characterization of prototype Receivers for Central Receiver on Tower Technologies under Real Operating Conditions	Y
Thermal treatment of materials at high temperature	Y
Water splitting thermochemical cycles	Y







Simulation and modelling of thermal storage systems. Integration in STE plants or industrial heat processes



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	2011	HTPU-LAB	Spain: Latitude N 40° 20' 23.47'' Longitude O 3° 52' 52.10''	300
		Service Name		TNA?
Advanced materials and	alysis and characteriza	ation techniques		Y
Advanced solid concept	ts for thermal energy	storage		Y
Analytical Services (Oth	er Materials)			Y
Characterization of Mat	terials and Componer	nts for TES		Y
Characterization of Optical Properties of Solar Reflectors				
Development and chara	acterization of Materi	als and Componen	ts for TES	Y
Gas analysis				Y
High Temperature Ther	mochemical Research	n Units		Y
Lab-scale test bed used	for the evaluation of	open volumetric re	eceivers	Y
Material synthesis				Y
Measurements on mate	erial properties			Y
Metallography. Micro-h	hardness analysis. The	ermogravimetric an	alysis	Y
Optical properties of so	olar glass envelopes w	ith and without an	ti-reflective coatings	Y
Optical Properties/Char	racterization of Absor	bers & Receivers a	nd their coating	Y
Qualification HTF based	d on particles			Y
Solar Hydrogen Product	tion Process Qualifica	tion		Y
Surface materials treat	ment			Y
Thermal & thermochen	nical properties evalu	ation for thermal s	corage materials	Y
Thermal analysis				Y

Y Y

Υ

Υ

Υ

Υ

Y

Υ



Solar Fuels and Thermochemistry

Testing of materials at high flux

Solar Thermochemical Hydrogen/Syngas

Testing of high temperature processes

Testing of materials at high temperature

Water splitting thermochemical cycles

Thermal treatment of materials at high temperature

Synthesis of materials at high temperature

facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Solar Simulator	2016	KIRAN42	Spain: Latitude N 40° 20' 21.39" Longitude O 3° 52' 52.96"	45
		Service Name		TNA?
Accelerated Aging of ab	Y			
Lab-scale test bed used	for the evaluation of	open volumetric re	eceivers	Y
Optical and thermal cha	racterization of solar	concentrators		Y
Qualification of Solar Dr	iven Processes unde	r realistic condition	S	Y



**LNEG** 

facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	2017	High-Performance Computing Facility	Portugal, Lisbon: Latitude N 38º 46' 21" Longitude W 9º 10' 40"	12 (Shared)
/	The second second			

*if "Other" please describe it* High-Performance Computing facility equiped with a computational cluster and software tools for modeling and simulation of CSP systems and components.

Service Name	TNA?
Simulation and modelling of thermal storage systems. Integration in STE plants or industrial heat processes	Y
Computer fluid dynamics simulation for CSP components	Ν
Computing time for user developed software	Ν
Modelling and simulation	Ν
Optical simulation of solar concentrating systems using ray-tracing	Ν
Transient simulation of CSP plants and components	Ν





facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	NA	Material Characterization Laboratory	Portugal, Lisboa: Latitude N 38° 46' 17" Longitude W 9° 10' 47"	
if "Other" please descri	be it			
Laboratory for material	l characterization sup	porting relevant act	ivities in the CSP field	TNA2
Accelerated Aging of at	osorbers & absorbing	coatings		Y
Advanced materials and	alysis and characteriz	ation techniques		Y
Characterization of Ma	terials and Compone	nts for TES systems	with molten salts	Y
Characterization of Poly	ymeric Materials (ela	stomers and other p	oolymers)	Y
Corrosion and material	protection studies u	nder artificial aging t	tests	Y
Corrosion and material	protection studies u	nder outdoor exposi	ure	Y
Durability of Solar Refle	ectors under Accelera	ited Aging		Y
Durability tests of Anti-	Reflective Coatings o	n glass envelopes		Y
Measurements on mate	erial properties			Y
Organic Coatings Qualif	fication			Y
Outdoor exposure of So	olar Reflectors			Y
Surface Treatment and	Metallic Coatings			Y
Thermal analysis				Y
Analytical Services (Oth	ner Materials)			N
Characterization of HTF	HSM chemical stabi	lity		Ν



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	1993	Solar Energy Laboratory (LES)	Portugal, Lisboa: Latitude N 38° 46' 25" Longitude W 9° 10' 39"	170
	spectrodotometer L	V-VIS-HIR- Perkin Elmer Lamb		
		Service Name		INA?
Advising on Solar Radia	tion Measurement &	Data Processing		N
Calibration of solar Irra	diation and Tempera	ture measurement s	ensors	N
DNI Measurement and	Analysis			N
Low-temperature solar	collectors			N
Solar Radiation Measur	ement and Weather	Station		N
Characterization of Opt	ical Properties of Sol	ar Reflectors		Y
Optical Properties of M	lirrors. Reflectance m	easurement. Facets	characterization	Y
Optical properties of so	olar glass envelopes w	vith and without ant	-reflective coatings	Y
Optical Properties/Chai	racterization of Absor	rbers & Receivers an	d their coating	Y
Surface Properties of A	bsorbers & Receivers	and their coating		Y
Surface Properties of A	nti-Reflective coating	s for solar receivers		Y



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other		Fuel Cells and Hydrogen facility (H2)	Portugal, Lisboa: Latitude N 38° 46' 17" Longitude W 9° 10' 47"	N/A
		Photo	OS	τω2
Gas analysis		controo Hame		Y
Material synthesis (relate	ed to Catalists for So	lar Fuels productior	)	Y
Solar Fuels and Thermoc	hemistry	-		Y
Solar Hydrogen productio	on and wastewater	treatment		Y
Solar photocatalytic treat	tment of urban and	industrial wastewat	ers	Y
Solar Thermochemical Hy	/drogen/Syngas			Y

Solar Thermochemical Hydrogen/Syngas



<u>METU</u>

facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Other	2018	GUNSOLSIM	Turkey N 39° 53' 23.0" E 32°46' 59.5"	36
Exterior of Sola for cooling and	Ir Simulator. Vei exhausts to out	ntilation syste side.	m is 3 lamps a vertical li (top lamp	arranged in ine o not shown).

GA No: 823802

Service Name	TNA?
Testing of high temperature processes	Y
Testing of materials at high flux	Y
Testing of materials at high temperature	Y
Thermal treatment of materials at high temperature	Y



UAL

facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Other	<mark>200</mark> 5	CIESOL	SPAIN 36°49'45"N 2°24'16"O	500
		Service Name		INA?
Advising on Solar Radiati	on Measurement &	Data Processing		Y
Analytical Services (Othe	er Materials)			Ý
Gas analysis				Ý
Heliostat control algorith	nms			Ý
Innovative membrane de	esalination technolog	gies (MD, FO)		Ý
Simulation and modellin	g of thermal storage	systems. Integration	in STE plants or industrial heat process	es Y
Solar photocatalytic trea	tment of urban and	industrial wastewate	rs	Ý
Solar Photocatalytic Wat	er Disinfection			Y
Solar Radiation Measure	ment and Weather S	Station		Y
Solar Reactors Developm	nent for Water Treat	ment		Y
Solar Thermal Desalinati	on by Membrane Dis	stillation		Y

Solar Thermal Desalination by Membrane Distillation



<u>UEVORA</u>

facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	2010	CER	Portugal: Latitude 38°34'0.01"N Longitude 7°54'0"W	N/A
	C/ RE	ÁTED Enov	RA ENERG ÁVEIS	IAS
		Service Name		TNA?





facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	2016	DNI-N	Portugal: Latitude 38°34'0.01"N Longitude 7°54'0"W	56 (estimation)
		Service Name		TNA?
Advising on Solar Radia	tion Measurement &	Data Processing		Y
DNI Measurement and	Analysis			Y
Solar Radiation Measur	rement and Weather S	Station		Y





facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	2014	PECS	France: Latitude 38°34'0.01"N Longitude 7°54'0"W	234
				OIL + PRESSURIZED WATER
		Service Name		TNA?
Optical and thermal ch	aracterization of solar	concentrators		Y
Outdoor optical and the	ermal performance of	Linear Fresnel rece	eivers	Y
Outdoor optical and th	ermal performance of	PTC linear receiver	rs	Υ
Parabolic Trough Collect	ctor's Characterizatior	1		Y

Parabolic Trough Collector's Characterization





facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Parabolic Trough	Still under construction	INIESC/EMSP	Portugal: Latitude 38°34'0.01"N Longitude 7°54'0"W	31576
Advanced solid concepts	for thermal energy	Service Name		TNA?
Characterization of HTF	thermal properties			Y
Characterization of Mate	erials and Componen	its for TES		Y
Characterization of Mate	erials and Componen	its for TES systems	with molten salts	Y

Characterization of Materials and Components for TES systems with molten salts	ř
Development and characterization of Materials and Components for TES	Y
Feasibility of Materials for Sensible and Latent Thermal Storage Systems	Y
Optical Properties of Mirrors. Reflectance measurement. Facets characterization	Y
Qualification HSM/HTF	Y
Qualification of Heat Storage using concrete under experimental conditions	Y
Testing in molten salt loop of auxiliary components (valves, heat tracing, instrumentation)	Y
Two-tank molten salt storage system for simulation models validation	Y



# Annex 2. Others RI Facilities inside SFERA-III consortium

facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup>
∟inear Fresnel	2012	A300	France: Latitude N 43°41′59.8″ Longitude E 5°44′24.3″	5030
	2012		Longitude E 5°44'24.3"	3030
-				214
		to an an an all the same of		1





### Service Name

Control algorithms development for multi-thermal (Storage, Desalination, Chiller) LFR plants in oil

Control algorithms test for multi-thermal (Storage, Desalination, Chiller) LFR plants in oil

Simulation and modelling of multi-thermal (Storage, Desalination, Chiller) LFR plants in oil

Testing of components and sensors for multi-thermal (Storage, Desalination, Chiller) LFR plants in oil in real operating conditions

Training in the piloting and maintenance of multi-thermal (Storage, Desalination, Chiller) LFR plants in oil



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Linear Fresnel	2016	A450	France: Latitude N 43°41'59.8" Longitude E 5°44'24.3"	6400
		Service N	lame	
Control algorithms dev	elopment for LFR plan	its in DSG with or w	vithout Storage	

GA No: 823802

Control algorithms test for LFR plants in DSG with or without Storage

Simulation and modelling of LFR plants in DSG with or without Storage

Testing of components and sensors for LFR plants in DSG in real operating conditions

Training in the piloting and maintenance of LFR plants in DSG with or without Storage





facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Other	2017	cTES	France: Latitude N 43° 41' 59.1216' Longitude E 5° 44' 23.1858"	60
		Service N	lame	

Optimization of the operating procedures

Performance and durability assessment of thermal storages

Testing TES prototypes water as HTF

Validation of numerical model of thermal storage systems

Validation of the thermo-hydraulic behaviour of storage systems under operating conditions similar to commercial CSP plants,



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	2019	DURASSEL	France: Latitude N 45°11'48.4" Longitude E 5°42'24.6"	20
Corrosion tests for PCM	Corrosion tests for PCM storage			
CONDSION LESIS IOF PCIVI	stolage			

Performance and durability assessment of thermal storages



### **CIEMAT**

facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Central receiver	<mark>1983</mark>	CESA-1	Spain: Latitude N 37,097005 Longitude: W 2,364750	80000
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		1	and the second second	
	100		- Anna Ch	
		the states		
	12002		1. 2 - Y - T - L	
	© PLATAFOR	MA SOLAR DE ALMERIA	CIEMAT	

Service Name

Heliostat control algorithms

Heliostat(s) Performance Qualification

Optical Properties/Characterization of Absorbers & Receivers and their coating

Testing of materials at high flux

Testing of materials at high temperature

Testing of Solarized gas turbine in Real Conditions

Thermal and Thermodynamic characterization of prototype Receivers for Central Receiver on Tower Technologies under Real Operating Conditions



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Dish	2000	Eurodish	Spain: Latitude N 37,097005 Longitude: W 2,364750	200
	Vi	ew of one EURODI.	FH prabolic dish	
		Service N	lame	
Accelerated aging by th	nermal cycling			
Testing of materials at	high SOLAR FLUX			
Testing of materials at	high temperature			
Testing of Solarized Stir	rling Engines in Real Co	onditions		

Thermal treatment of materials at high temperature



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)			
Other	2008	GeoLab	Spain: Latitude N 37,097005 Longitude: W 2,364750	100			
	Photos						
Service Name							
Geometrical assessment of Solar Concentrators (Single Facets Point and Line Focus Collectors)							

Photogrammetry Measurement of Concentrator's shape



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Other	2014	MaterLab	Spain: Latitude N 37,097005 Longitude: W 2,364750	65
View of				
view oj	the Microscopy roo	om	Thermogravimetric b	alance
	the Microscopy roo	Service N	Thermogravimetric be	alance
Accelerated Aging of al	the Microscopy roo	Service N coatings	Thermogravimetric b	alance
Accelerated Aging of al Advanced materials an	bsorbers & absorbing alysis and characteriza	Service N Coatings ation techniques	Thermogravimetric bo	alance

Surface Properties of Absorbers & Receivers and their coating

Surface Treatment and Metallic Coatings

Testing of materials at high flux

Testing of materials at high temperature

Thermal treatment of materials at high temperature



	construction	Facility Name	Location (GPS)	occupied (m <sup>2</sup> )
Other	2010	OPAC	Spain: Latitude N 37,097005 Longitude: W 2,364750	1000
View of the OPAC equipn	nent: devices to med	sure optical param	The ters (above) and accelerated agin	g chambers (below)
		e ser appril (spirit)		
		Service N	lame	

Corrosion and material protection studies under artificial aging tests

Corrosion and material protection studies under outdoor exposure

Durability of Solar Reflectors under Accelerated Aging

Optical Properties of Mirrors. Reflectance measurement. Facets characterization

Outdoor exposure of Solar Reflectors


facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Other	2012	POMELAB	Spain: Latitude: N 40.4167º Longitude E -3.7032º	20

Lab-scale test bed used for the evaluation of open volumetric receivers



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	2017	RadLab	Spain: Latitude N 37,097005 Longitude: W 2,364750	35
View of	the RadLab		IR sensor calibration using a bl	ack body
		Service N	lame	
Calibration of Concentr	ated solar irradiance	sensors		

Calibration of Infrared sensors for temperature measurement

High flux sensors qualification



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Other	2017	REPA	Spain: Latitude N 37,097005 Longitude: W 2,364750	100
View of the REPA Kine	ematic unit			
		Service N	lame	



construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
2016	SRTLab	Spain: Latitude N 37,097005 Longitude: W 2,364750	100
-	2016	2016 SRTLab	Facility NameLocation (GPS)2016SRTLabSpain: Latitude N 37,097005 Longitude: W 2,364750





View of the HEATREC test chamber to measure heat losses in solar receiver tubes (left) and RESOL test bench to measure receiver's optical efficiency (right).

Se	rvice	Name
		Humo

Indoor qualification of linear receivers for LFC

Indoor qualification of linear receivers for PTC

Outdoor optical and thermal performance of Linear Fresnel receivers

Outdoor optical and thermal performance of PTC linear receivers



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	2017	ATYCOS	Spain: Latitude: N 40.4167º Longitude E -3.7032º	25



The SBMA device (left) and the HDR device (right)

Characterization of Materials and Components for TES

Feasibility of Materials for Sensible and Latent Thermal Storage Systems



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	1998	OCTALAB	Spain: Latitude: N 40.4167° Longitude E -3.7032°	50
Perkin-Elmer Frontier F gold-coated integr	TIR spectrophotomet rated sphere manufac	er equipped with a ctured by Pike	LEICA DM4 M optical	microscopy
BRUKER DektakXT stylu	us profilometer with o oftware for surface	optical camera and	KSV CAM200 goniometer for me	asuring contact angles
		Service N	ame	
Deposits of coatings at	high temperature			
Durability tests of Anti-	Reflective Coatings or	n glass envelopes		
Optical properties of so	lar glass envelopes w	ith and without anti	-reflective coatings	
Optical Properties/Char	acterization of Absor	bers & Receivers and	d their coating	
Static Contact Angle me	easurements on the su	urface of Anti-Reflec	ctive Coatings	
Surface Properties of An	nti-Reflective coatings	for solar receivers		



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Other	1998	Solar Hygrogen Laboratory	Spain: Latitude: N 40.4167° Longitude E -3.7032°	35
1-+++		bile Is Et Treaklestoolles		
			The P	
Indoor Solar Simulatio	n Loop for evaluat	tion of materials f	for thermochemical cycles	
1 +			-	1
the State (				
Te				
1 h				
	Thermogravimet	ry analyser and ar	n a 1650 ° C electric furnace	
	1			
				TIN
Outdoor Solar Double		d a fluidised bod	reactor on the focur	
outdoor solar Double	Refrection disc an	Service N	lame	

Solar Fuels and Thermochemistry

Solar Hydrogen Production Process Qualification



Solar Thermochemical Hydrogen/Syngas

Water splitting thermochemical cycles



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Parabolic Trough	1998	DISS	Spain: Latitude N 37,097005 Longitude: W 2,364750	30000
	8			
	-	17		
			- And the stand	A MA
				THE DESIGNATION OF
			T	de la calencia
	and a subset			AN REAL
	-	Solar field of the	DISS facility	-

Study and development of control schemes for solar fields with direct steam generation Study and optimization of the operating procedures that must be implemented in solar fields with direct steam generation in PTC

Testing of components for parabolic troughs solar fields with direct steam generation under real operating conditions

Thermo-hydraulic study of two-phase of water/steam in horizontal tubes with non-homogeneous heat flux.



Parabolic Trough 1997 HTF Test Loop Spair: Latitude N 37,097005 Longitude: W 2,364750 5000   Optimized State
Companyants of the cill significant of the UTE facility
Accelerated Aging of absorbers & absorbing coatings
Durability tests of Anti-Reflective Coatings on glass envelopes
Ontical and thermal characterization of solar concentrators
Outdoor optical and thermal performance of Linear Fresnel receivers
Outdoor optical and thermal performance of PTC linear receivers
Parabolic Trough Collector's Characterization
Testing of components for parabolic troughs solar fields with oil under real operating conditions
Testing of Rotating Connections for PT receivers (Flexible hoses, ball-joints, etc.)



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Parabolic Trough	2010	Innovative Fluids Test Loop	Spain: Latitude N 37,097005 Longitude: W 2,364750	3750

Outdoor optical and thermal performance of PTC linear receivers

Sensor development and testing for sCO2 up to 500°C/100bar

Testing of gasses as HTF up to 500°C





facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Parabolic Trough	2009	KONTAS	Spain: Latitude N 37,097005 Longitude: W 2,364750	1300

Accelerated Aging of absorbers & absorbing coatings

Durability tests of Anti-Reflective Coatings on glass envelopes

Optical and thermal characterization of solar concentrators

Outdoor optical and thermal performance of Linear Fresnel receivers

Outdoor optical and thermal performance of PTC linear receivers

Parabolic Trough Collector's Characterization

Testing of components for parabolic troughs solar fields with oil under real operating conditions



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Parabolic Trough	2011	PROMETEO	Spain: Latitude N 37,097005 Longitude: W 2,364750	6600



View of the two PTC composing the solar field of the PSA PROMETEO facility

## Service Name

Accelerated Aging of absorbers & absorbing coatings

Optical and thermal characterization of solar concentrators

Outdoor optical and thermal performance of Linear Fresnel receivers

Outdoor optical and thermal performance of PTC linear receivers

Parabolic Trough Collector's Characterization

Testing of new thermal oils as HTF under real solar conditions



**CNRS** 

facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Dish	2004	EuroDish	France: Latitude N 42.494 Longitude E 2.030	100
		Service N	lame	

Advanced materials analysis and characterization techniques

Advanced solid concepts for thermal energy storage

Atmosferic air packed bed test bench for simulation models validation

Calibration of Concentrated solar irradiance sensors

Characterization of HTF thermal properties

Characterization of HTF/HSM chemical stability

Deposits of coatings at high temperature

Development and characterization of Materials and Components for TES

Heat Exchangers Characterization

High flux sensors qualification

High Temperature Thermochemical Research Units

Material synthesisGas analysis

Non-Contact Temperature Measurement at Solar Furnaces

Optical and thermal characterization of solar concentrators

Outdoor exposure of Solar Reflectors

Qualification HSM/HTF



Qualification HTF based on particles

Qualification of Heat Storage using concrete under experimental conditions

Qualification of Heat Storage using Packed beds under Real Operating Conditions

Qualification of Heat Storage using PCM under experimental conditions

Qualification of high radiative flux processes

Qualification of Solar Driven Processes under realistic conditions

Sensor development and testing

Solar Fuels and Thermochemistry

Solar Hydrogen production and wastewater treatment

Solar Hydrogen Production Process Qualification

Solar pumped LASER testing

Solar Radiation Measurement and Weather Station

Solar Thermochemical Hydrogen/Syngas

Surface materials treatment

Surface Treatment and Metallic Coatings

Synthesis of materials at high temperature

Testing of materials at high flux

Testing of materials at high temperature

Testing of Rotating Connections for PT receivers (Flexible hoses, ball-joints, etc.)

Testing of small steam turbines powered by molten salt steam generatorOnline and offline diagnostics

Testing of Solarized gas turbine in Real Conditions

Testing of Solarized Stirling Engines in Real Conditions

Testing TES prototypes using oil as HTF

Thermal & thermochemical properties evaluation for thermal storage materials

Thermal analysisTesting of high temperature processes

Thermal and Thermodynamic characterization of prototype Reactors for Central Receiver on Tower Technologies under real operating conditions

Thermal and Thermodynamic characterization of prototype Receivers for Central Receiver on Tower Technologies under Real Operating Conditions

Thermal treatment of materials at high temperature

Water splitting thermochemical cycles



<u>DLR</u>

facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Central receiver	2008	Solar Tower Jülich	Jülich, Germany	
		Service Name	9	
Atmosferic air packed be	ed test bench for sim	ulation models validation	on	
Deflectometry Measure	ment of Concentrato	r's shape		
Heliostat control algorit	hms			
Heliostat(s) Performance	e Qualification			
Photogrammetry Measu	irement of Concentra	ator's shape		
Qualification of Heat Sto	orage using Packed be	eds under Real Operatir	ng Conditions	
Qualification of Solar Dr	iven Processes under	realistic conditions		
Solar Fuels and Thermoo	chemistry			
Solar Radiation Measure	ement and Weather S	Station		
Thermal and Thermodyr real operating condition	namic characterizatio s	n of prototype Reactors	s for Central Receiver on Tower	Technologies under



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	2013	CeraStorE	Cologne, Germany	130
Advanced solid concept	s for thermal energy	storage		
Characterization of Mat	erials and Componen	ts for TFS		
Qualification of Heat St		undar avnarimantal car	ditions	
		and experimental condition		
	or age using PCIVI UND			
Simulation and modellin	ig of thermal storage	systems. Integration in	SIE plants or industrial neat pro	DCesses
Solar Fuels and Thermo	cnemistry			
Solar Hydrogen Product	ion Process Qualificat	tion		

Solar Thermochemical Hydrogen/Syngas



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)
Other	2016	HeliTep	Jülich, Germany	1.260 m²
Characterization of On	tical Properties of Sola	Service Name	9	
Deflectometry Measure	ement of Concentrato	r's shape		
Heliostat control algori	thms			
Heliostat(s) Performan	ce Qualification			

Optical Properties of Mirrors. Reflectance measurement. Facets characterization

Photogrammetry Measurement of Concentrator's shape



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Other	2011	METAS	Plataforma Solar de Almeria	6000
Service Name				
Calibration of PSD Salar	Irradiation Sancara	Data Processing		
Calibration of color land		and processo manage	romont concore	
	nation, remperature	and pressure measure	ement sensors	
Outdoor exposure of So	lar Reflectors			

Sensor development and testing

Solar Radiation Measurement and Weather Station



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)		
Other	2010	QUARZ	Cologne, Germany	500		
		Service Name	9			
Accelerated Aging of abs	orbers & absorbing o	coatings				
Characterization of Option	cal Properties of Sola	r Reflectors				
Deflectometry Measurer	ment of Concentrato	r's shape				
Durability tests of Anti-R	eflective Coatings on	i glass envelopes				
Geometrical assessment	of Solar Concentrate	ors (Single Facets, Point	and Line Focus Collectors)			
Indoor qualification of lin	near receivers for PT	С				
Measurements on mater	rial properties					
Optical and thermal char	racterization of solar	concentrators				
Optical Properties of Min	rrors. Reflectance me	easurement. Facets cha	racterization			
Optical Properties/Chara	Optical Properties/Characterization of Absorbers & Receivers and their coating					
Parabolic Trough Collect	or's Characterization					
Photogrammetry Measu	rement of Concentra	ator's shape				

Surface Properties of Absorbers & Receivers and their coating

Surface Properties of Anti-Reflective coatings for solar receivers





facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Parabolic Trough	1998	SOPRAN	Cologne, Germany	1000 m <sup>2</sup>
		Service Nam	e	
Outdoor exposure of Sola	ar Reflectors			
		DTC I'm and a single		

Solar Radiation Measurement and Weather Station

Testing of components for parabolic troughs solar fields with direct steam generation under real operating conditions



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)		
Furnace	1994	Solar Furnace	Cologne, Germany	2000		
Konzentrator				Heliostat		
		Service Nam	e			
High flux sensors qualif	ication	der artificial aging tests				
Non-Contact Temperat	ure Measurement at (	Solar Furnaces				
Qualification of high ray	Non-contact remperature Measurement at Solar Furnaces					
Solar Radiation Measur	ement and Weather	Station				
Testing of high tempera	ature processes					
Testing of materials at l	high flux					
Testing of materials at l	high temperature					
Thermal treatment of n	naterials at high temp	erature				
	5 1					



facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Solar Simulator	2010	Solar Simulator	Cologne, Germany	
		Service N	lame	
Corrosion and material	protection studies ur	ider artificial aging t	tests	
High flux sensors qualifi	cation			
Non-Contact Temperatu	are Measurement at a	Solar Furnaces		
Qualification of high rad	liative flux processes			
Solar Radiation Measure	ement and Weather S	Station		
Testing of high tempera	ture processes			
Testing of materials at h	nigh flux			
Testing of materials at h	nigh temperature			

Thermal treatment of materials at high temperature



<u>ENEA</u>

facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m²)	
Other	2003	MoSE	Italy: Latitude N 42°03.0' Longitude E 12°18.0'	200	
Photos					
		Service N	ame		
Characterization of HTF t	thermal properties				
Characterization of HTF/	HSM chemical stabili	ity			
Characterization of Mate	erials and Componen	ts for TES			
Characterization of Mate	erials and Componen	ts for TES systems v	vith molten salts		
Development and charac	cterization of Materia	als and Components	s for TES		
Heat Exchangers Charact	erization				
Optimization of exhaust	gas / molten salt hea	at exchangers by me	eans of numerical simulation and exper	imental test	
Qualification HSM/HTF					
Sensor development and	I testing				
Simulation and modelling	g of thermal storage	systems. Integratio	n in STE plants or industrial heat proces	sses	
Solar Fuels and Thermoc	hemistry				
Solar Hydrogen Production Process Qualification					
Solar Thermal Desalination	on by Membrane Dis	tillation			
Solar Thermochemical H	Solar Thermochemical Hydrogen/Syngas				
Testing in molten salt loop of auxiliary components (valves, heat tracing, instrumentation)					
Testing of components for parabolic troughs solar fields with oil under real operating conditions					
Water colitting thermost					
יימנכי אוונוווא נוופווווסנו	icinical cycles				



<u>ETH</u>



Water splitting thermochemical cycles



**LNEG** 

facility type	Year of construction	Facility Name	Location (GPS)	Land Area occupied (m <sup>2</sup> )
Furnace	2003	Fresnel Furnace (FF-1)	Portugal, Lisboa: Latitude N 38º 46' 25" Longitude W 9º 10' 37"	18
		Service N	ame	
Material synthesis*				
Synthesis of materials at	high temperature			

Testing of materials at high flux

Testing of materials at high temperature