

RENEWABLE ENERGIES Chair

University of Évora

An overview: history, strategy, on going projects

Abril 2015

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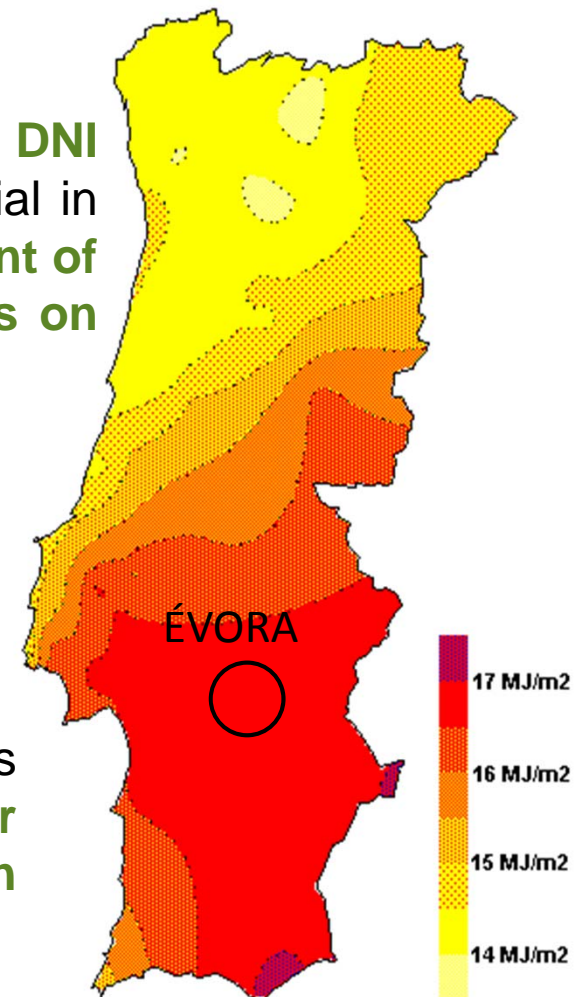
| Renewable Energies NB Chair : background

□ Solar Energy at U.Évora

Located in the heart of the **region with highest DNI potential in Portugal** (and one of the highest potential in Europe) the Univ. Évora is investing in the **development of activities in the field of RE with a particular focus on Solar Energy**:

- Engineering License in RE (first in Portugal)
- Master Sc. degree in Solar Energy Engineering
- Doctoral program in Mechatronics and Energy

Aiming at establishing world class R&D activities in this field, the **RE NB Chair was created in November 2010**, with a particular **focus on solar concentration technologies and applications**.



| Renewable Energies NB Chair : team

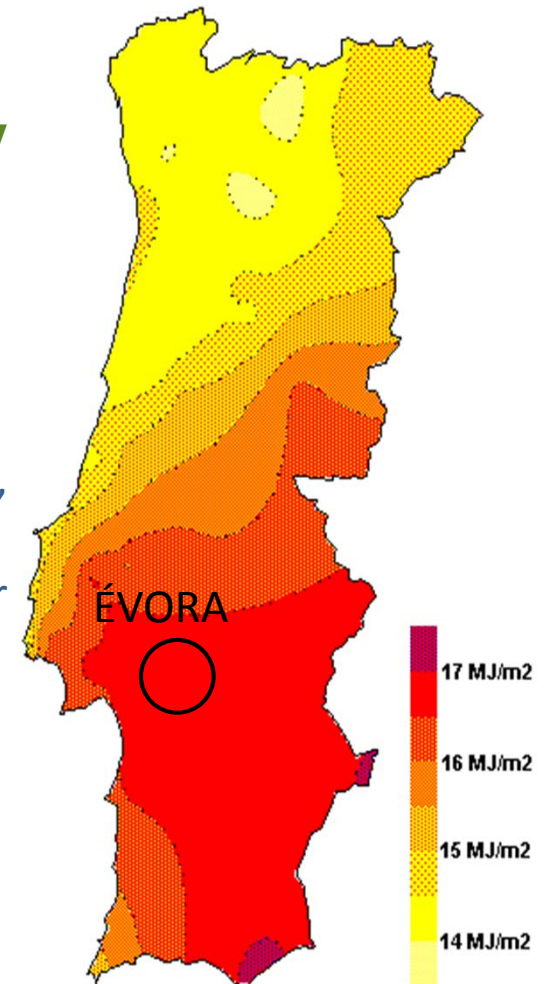
- ❑ **Multidisciplinary team** covering different topics in solar concentration systems and applications

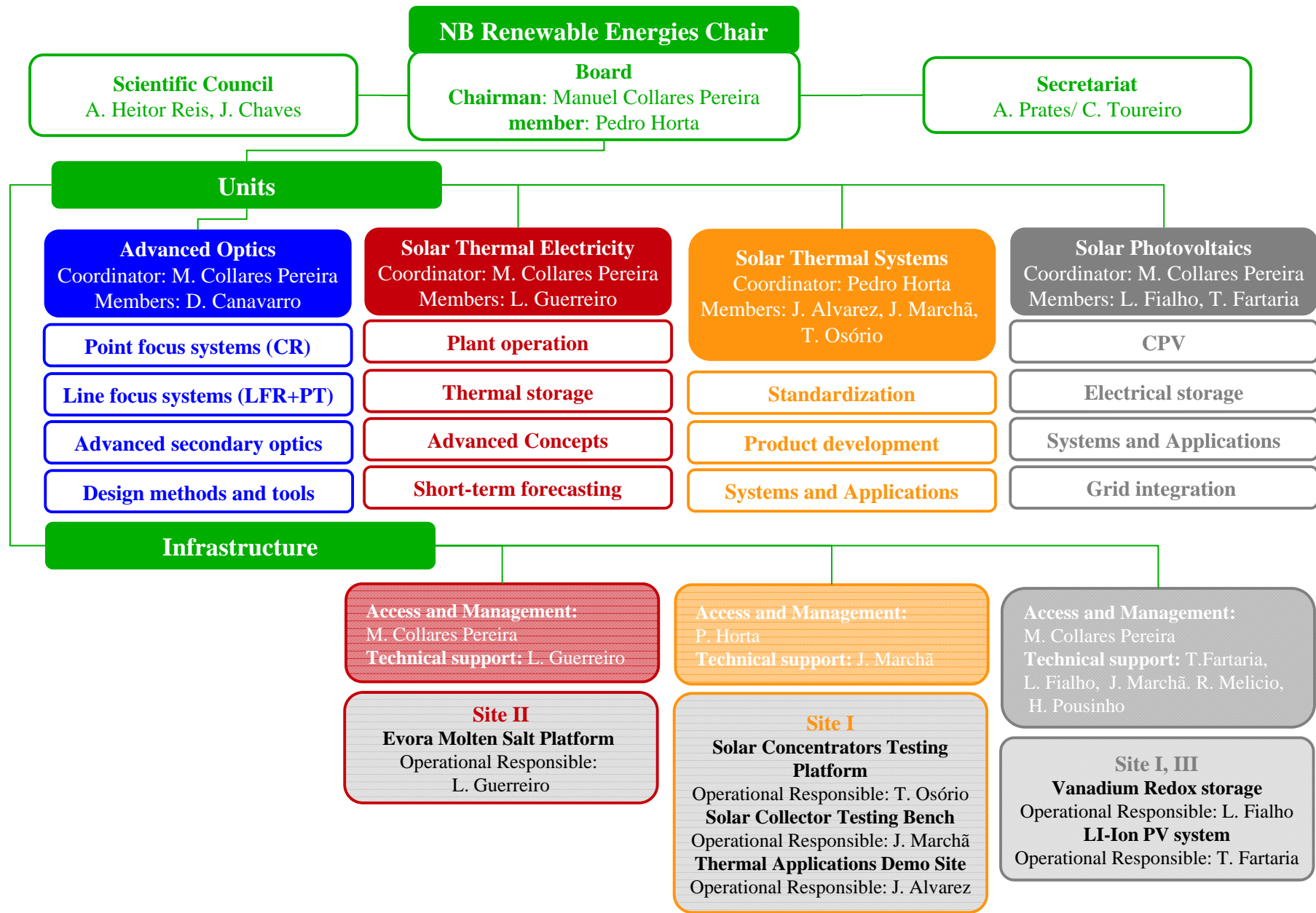
~4 years after its creation the **Chair's team currently comprises:**

- Chairman: Prof. Dr. Manuel Collares Pereira
- Principal Researcher: Dr. Pedro Horta
- PostDoc /Aux. Researcher : Diogo Canavarro (Ph.D. U Évora)
- Research Assistant: João Marchã
- 6 PhD students: Luís Guerreiro, Tiago Osório, Tomás Fartaria, Luis Fialho, Afonso Cavaco, José Alvarez

Several final students at License and Master's levels, from year to year

The team will grow with the admission of new students and researchers (on a new projects base) and is completed through the **cooperation with different related U.Évora R&D Centres/ Departments (e.g. ICT-Geophysics, Mechatronics, Chemistry...)**

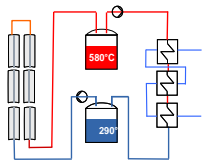




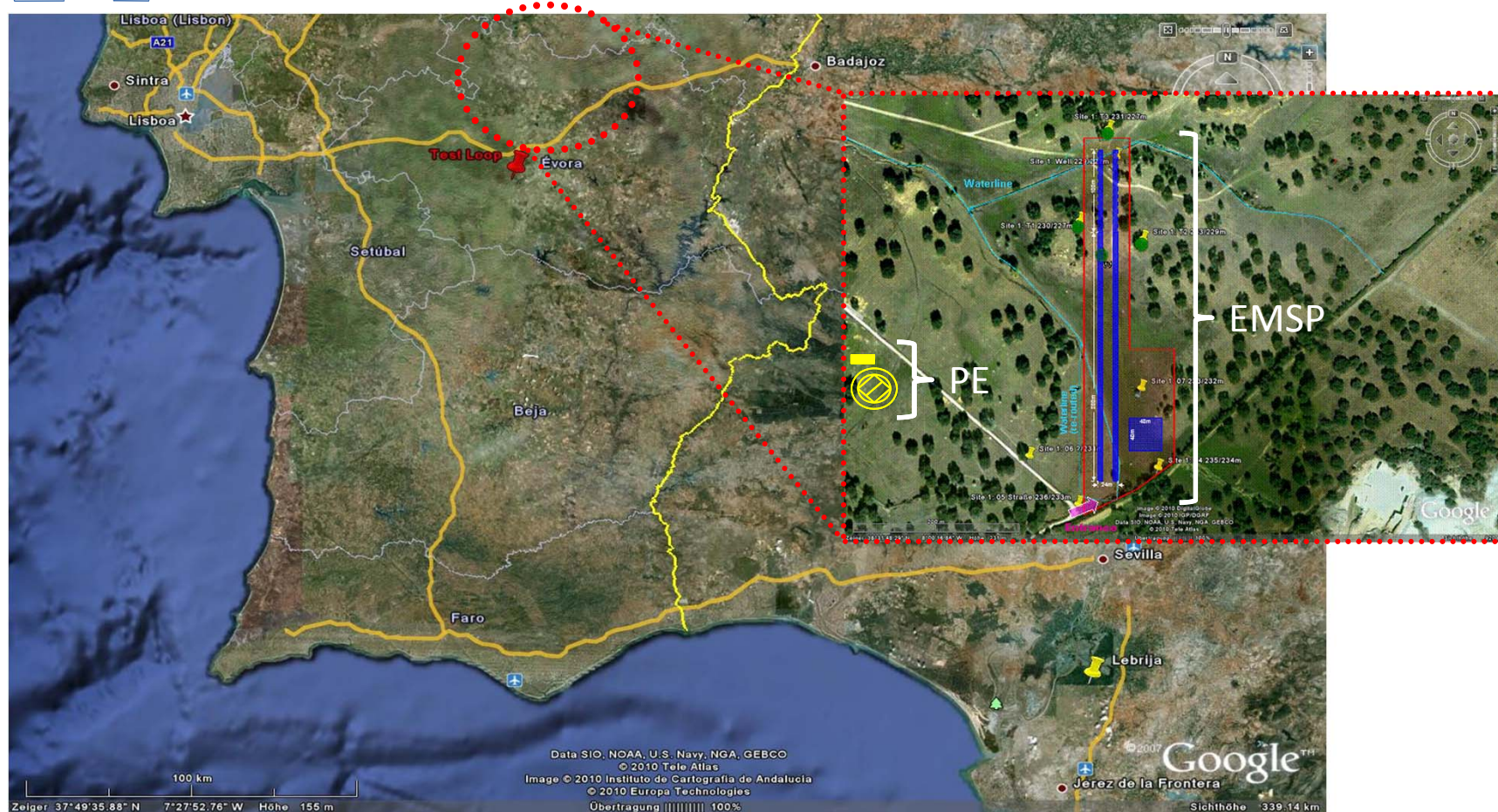
Research topics/results

- Advanced Optics
- Solar Thermal Electricity
- Solar Thermal Applications (Industrial Process Heat, Dessalination, Cooling...)
- PV- BIPV, grid interface engineering
- Energy Storage (thermal, electrochemical)
- (...)
- Publications: 12 in Major Journals
10 in International Solar
Conferences (Proceedings, Referees)





Herdade da Mitra- platforms for concentrator testing and solar field+ energy storage testing



Circuito de sais fundidos ($T < 580^{\circ}\text{C}$) - EMSP

Plataforma de $18 \times 13 \text{ m}^2$ para ensaio de módulos de grande dimensão ($T < 400^{\circ}\text{C}$) - PE



**Evora Molten Salt Platform-
EMSP**; $T < 580^{\circ}\text{C}$; with storage
and steam production (540°C ,
100bar)

- 1,6MWth- Ultimate Trough
(Flabeg)
- 1.5MWth- LFR Ematched
(InnovLFR : Project H2020)

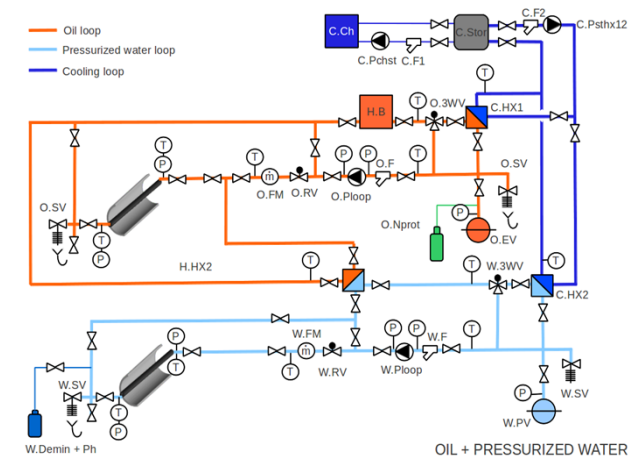
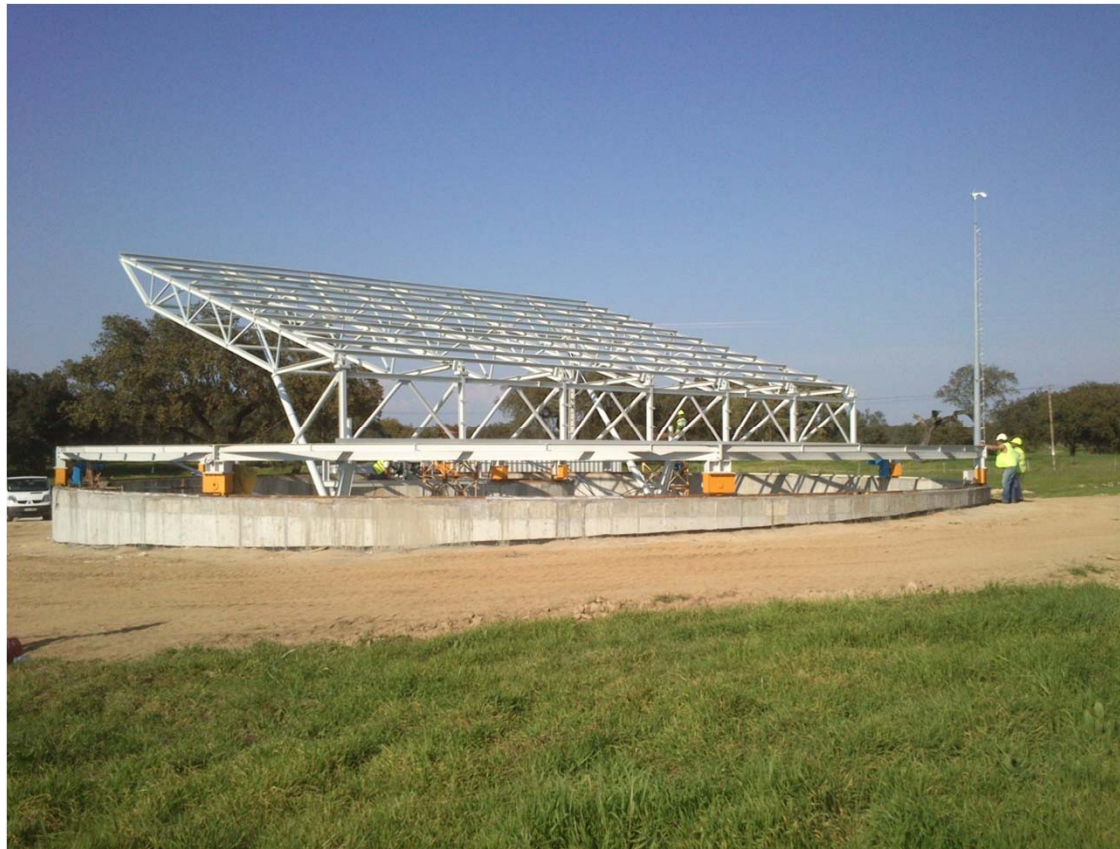


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2-axis Tracking Platform (13x18m²); financed from QREN- InAlentejo
Full large concentrator modules testing : Oil loop (T<400°C) ; pressurized water loop (T<250°C)



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Financial Situation:

~1.7 M€ (up to 2016), in European Projects /Networks

FP7-European Networks and Projects : EU-SOLARIS, STAGE- STE, SFERA 2 (solar thermal electricity)

Projects (FP7): PVCROPS, REELCOOP

and

support from FCT (**INIESC: Research Infrastructure-RI- 0.5 M€/yr** (for 6 years) with LNEG as partner)

+

~6M€ investment in H. Mitra molten salt facility- HSP2 (DLR+ 8 companies in consortium)

~1.7M€ in 3 Horizon2020 proposals



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Partners/contracts/network (2013)

	EUROPEAN	NON-EUROPEAN	INDUSTRY	UNIVERSITY	RESEARCH BODY	GOVERNAMENTAL BODY	NON PROFIT	PUBLIC	PRIVATE
PROJECT									
PVCROPS	9	1	6	3	0	1	1	4	5
EU-SOLARIS	14	0	1	2	9	2	3	11	0
REELCOOP	10	4	6	4	4	0	0	8	6
STAGE-STE	28	10	7	9	21	1	9	22	7
SFERA II	11	0	1	0	10	0	2	8	1
IEA-T49	33	7	22	10	8	0	1	17	22
ALL PROJECTS	81	21	40	27	32	3	11	52	39
TOTAL	102		102				102		
%	79%	21%	39%	26%	31%	3%	11%	51%	38%

TOTAL*	767,936.78 €	926,663.36 €	133,000.00 €	405,079.40 €	2,232,679.54 €	1,733,959.47 €	77.66%
PROJECT	Personnel costs	Subcontracting	Other direct costs	Indirect costs	Eligible costs	Requested EC contribution	Overall funding rate
PVCROPS	248,900.00 €	0.00 €	54,900.00 €	182,280.00 €	486,080.00 €	353,780.00 €	72.78%
EU-SOLARIS	46,000.00 €	20,000.00 €	20,000.00 €	51,600.00 €	137,600.00 €	100,175.00 €	72.80%
REELCOOP	130,149.00 €	0.00 €	19,000.00 €	89,489.40 €	238,638.40 €	176,021.20 €	73.76%
INALENTEJO	138,075.78 €	886,663.36 €	0.00 €	0.00 €	1,024,739.14 €	871,028.27 €	85.00%
EERA-STE	183,812.00 €	20,000.00 €	31,100.00 €	64,310.00 €	299,222.00 €	200,070.00 €	66.86%
SFERA II	21,000.00 €	0.00 €	8,000.00 €	17,400.00 €	46,400.00 €	32,885.00 €	70.87%

* CONTRACTED PROJECTS

Research agreements

- DLR
- Fraunhofer ISE
- **HSP-2** : DLR+U. Evora + 8 companies and a total of ~**6Meuro**
- SCHOTT Solar CSP
- BASF
- SBP Sonne GmbH
- YARA Industrial GmbH
- TSK Flagsol Engineering GmbH
- FLABEG FE GmbH
- SOLBEL GmbH
- STEINMÜLLER Engineering GmbH



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Horizon 2020 proposals

6 proposals

3 still under evaluation :

InnovLFR (U.Evora) -Innovative LFR concentrator for cost competitive Solar Thermal Electricity

Maslowaten (U.Politecnica de Madrid) Market uptake of an innovative irrigation Solution based on **LOW WATER-ENERGY** consumption

PreFlexMS (Alstom) Predictable & Flexible Molten Salts Solar Power Plant (PreFlexMS)

INIESC-the opportunity

- Brings together the two leading institutions in Portugal with competence in Solar Concentration in its multiple aspects : U. Évora (Renewable Energies NB Chair) and LNEG
- High complementarity
- Presently with strong and active pursue of several important R&D topics in SEC
- Substantial Infrastructure type investment already made
- Strong integration with ESFRI and other european R&D networks and projects



Linear Fresnel Etendue matched

XX-SMS

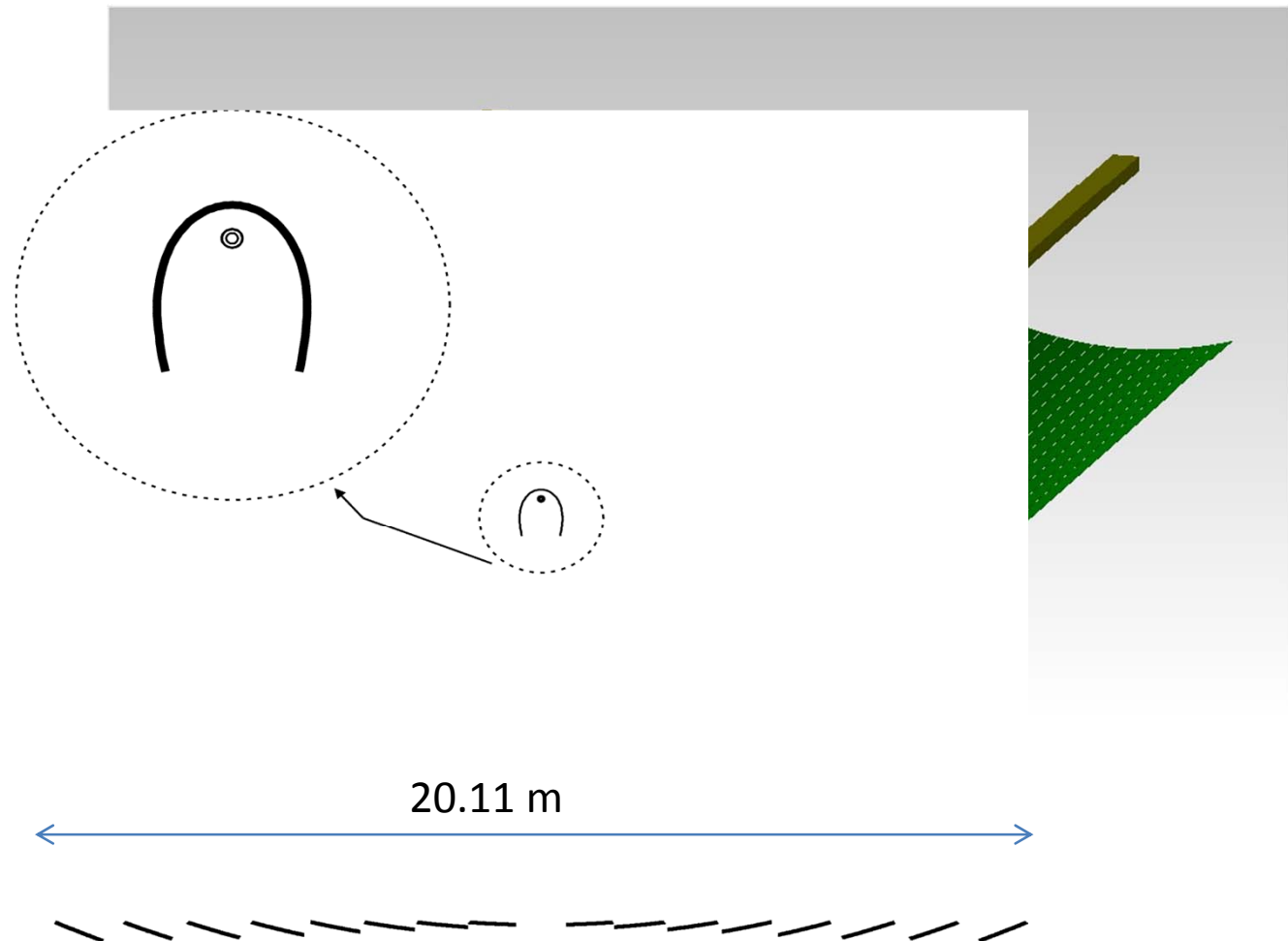
$C=74\times$

$CAP \sim 0.57$

Same 70mm tube

Same acceptance
angle

expected $\eta=14\%$



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PVCROPS- Vanadium Redox Flow Battery; site Herdade da Mitra; BIPV



6.2 kW PV system on roof of building

5kW battery

60KWh storage capacity



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PV CROPS: advanced Li-Ion batteries

- 5KW 32kWh storage capacity



DNI measurement in Alentejo;

Universidade de Évora +
AREANATEJO

and IPES associates :

Lógica

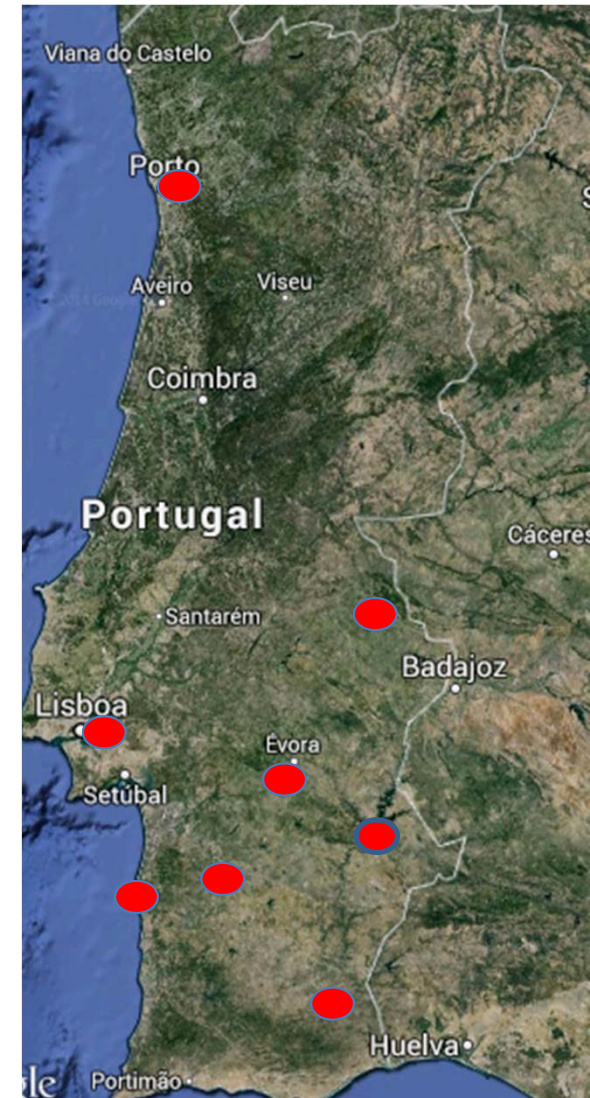
Enercoutim

Integrum Solar

Inegi

+

LNEG, Generg



Creation of IPES, a not for profit association (Instituto Português de Energia Solar (2012)), integrating the R&D institutions, Energy Agencies, the finance sector and some of the main companies interested in Solar Thermal Electricity and PV in Portugal. **IPES aims at being a catalyst for R,D&D+I in Solar Energy in Portugal, promoting technology transfer to its associates and among them, actively supporting the definition and the promotion of adequate energy policies for the sector**



NOVO BANCO
CREDITE

OPEN RENEWABLES
Dreen - De VIRIS

TÜV Rheinland PORTUGAL

SCHREDER Lighting

RAUL César FERREIRA
INTEGRUM Energia
(Grupo SONAE)

MARTIFER Solar
ENERCOUTIM

UEVORA

ADENE

INEGI

AREANATEJO

ISQ

ENERGYIN

LÓGICA

SUN AID

PCTE

EXOSUN

SUNOK

EFACEC

GENERG

EDPi



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In conclusion

U. Evora: **Renewable Energies Chair**

It is a work in progress

Jointly with LNEG, creation of the Research Infrastructure **INIESC:** to be the leading institution for solar concentrating technologies in Portugal

Establishing an essential network with the most active and important European R&D Institutions in the Solar field

Setting itself up to work with top European (Portuguese) companies in this field