STERG Symposium

14th/15th July 2016

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Eskom Chair in CSP

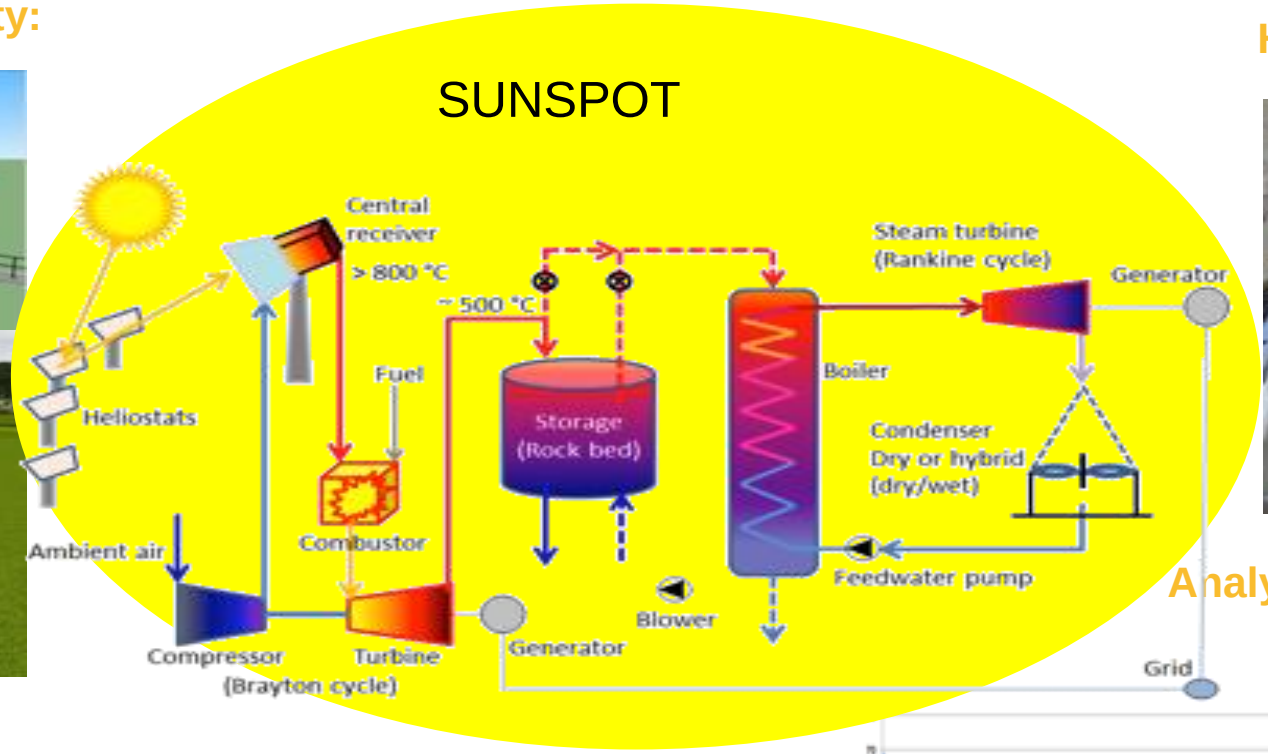
Solar Thermal Energy Research Group (STERG)

Stellenbosch University

STERG current research priorities

Overview

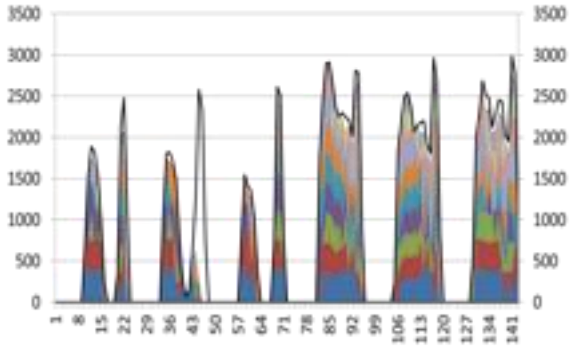
Optics and receiver test facility:



HTF and Storage:

Thermodynamics:

Analysis and optimization



STERG Solar Thermal Energy Research Group

UNIVERSITEIT STELLENBOSCH UNIVERSITY

3º Simpósio IPES: A Concentração Solar e o Futuro
Universidade de Évora (Auditório Nobre do Colégio do Espírito Santo), 01/02/2016 e 02/02/2016

Vision of the Solar Thermal Electricity Industry

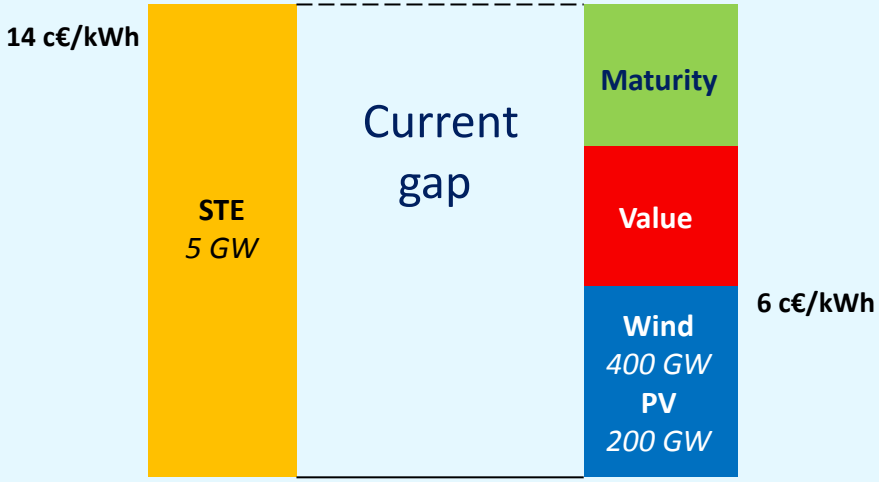
Dr. Luis Crespo
President of ESTELA
General Secretary of Protermosolar

Evora February the 1st, 2016

The big question mark:

On Shore Wind and PV have reached already competitive cost levels.

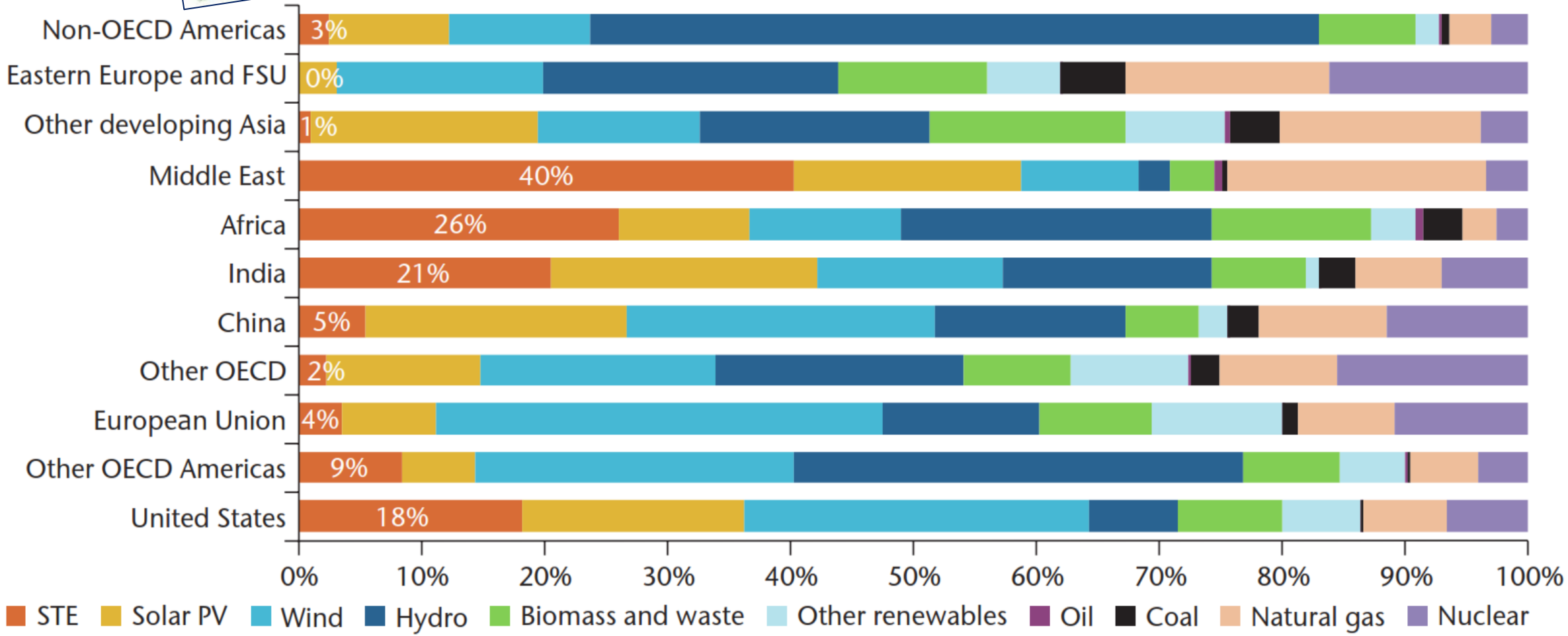
Thus, is it still worth continuing to support STE technology?

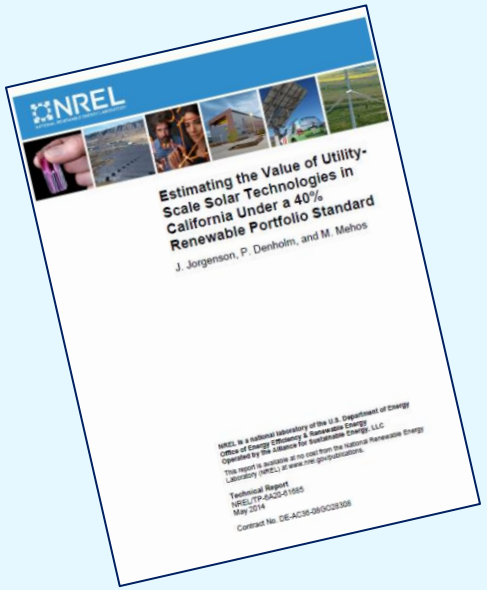


- ✓ The PPAs for the two recently awarded STE plants in Morocco Noor 2 & 3 (200 MW PT & 150 MW T) were 15% lower than the previous one for Noor 1 awarded 2 years ago.
- ✓ A 110 MW STE plant with 17,5 hours of storage, partly hybridized with PV, was recently selected in Chile with a PPA of $110/MWh, in competition with all other generation technologies including Gas Combined Cycle.
- ✓ The tariff for the current “Expedited round” in South Africa is close to 20% less than the previous one for Round 3 established 18 months ago.

IEA STE Roadmap

STE plants will be the dominant technology in the future for Middle East and African countries and they will play a significate role in other regions





Value of solar power according to RE penetration share

Example for 33% and 40% RE shares in California (NREL, May 2014)

Value component	33% renewables		40% renewables	
	STE with storage value (USD/MWh)	PV Value (USD/MWh)	STE with storage value (USD/MWh)	PV Value (USD/MWh)
Operational	46.6	31.9	46.2	29.8
Capacity	47.9-60.8	15.2-26.3	49.8-63.1	2.4-17.6
Total	94.6-107	47.1-58.2	96.0-109	32.2-47.4

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- **What does operational value means:**

Operational value represents the avoided costs of conventional generation at their respective dispatching times along with related ancillary services costs, such as operating reserve requirements. Savings on emission costs are also accounted

- **What does capacity value means:**

Capacity value reflects the ability to avoid the costs of building new conventional generation in response to growing energy demands or plant retirements

"Flexibility products" for different kind of services - as requested by the electrical system - need to be properly defined to reflect this added value.

Such "flexibility products" will be more an more important as the share of renewables increases.

The reasons for a brilliant STE future

1. Technical

STE is the only dispatch-able and grid-friendly renewable technology with potential enough to firmly meet the electricity needs worldwide in order to achieve an almost carbon free generation system.
A wise mix with other R.E. technologies will be the right choice.

2. Local Economic Development

Local content of STE plants - and conversely its GDP contribution - should be one of the main drivers behind the coming supporting policies in most countries of the Sunbelt.

3. Affordable cost

STE plants are currently a cost competitive choice to supply the increasing
power demand of emerging countries compared with “investing twice” as
it would be the case regarding other fluent R.E. technologies + CC

Comparison between premiums and returns to the ~~Economy of a STE deployment~~ program

+ Industrial development

+ Equilibrating the mix

+ Reinforcement of the grid

+ Attraction of foreigner investment

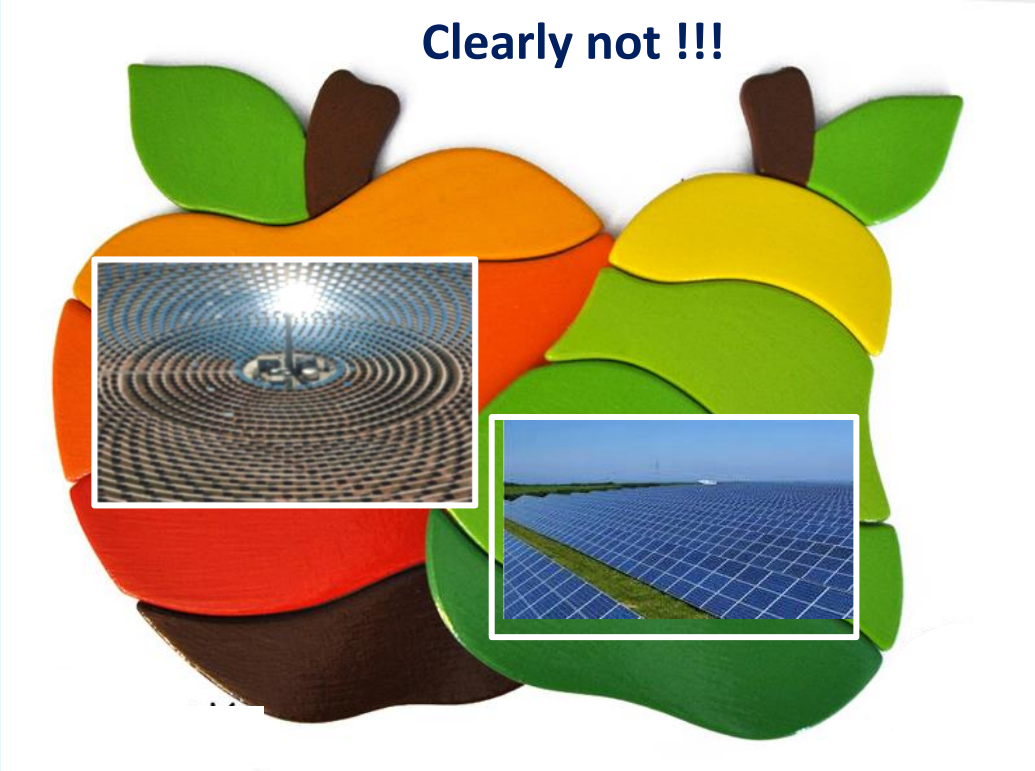
+ Regional economical convergence

Supports

Supporting STE was a wise decision for Spain and it will be so in all countries

- **Unemployment subsidies**
- **Savings in CO2 rights**
- **Savings from replacing imported fossil fuels**
- **Fiscal contribution** (Social Security, Corporate, Personal and Local Taxes,)
- **Contribution to GDP**

Are we comparing apples to apples?



Cost/kW is not the right indicator. Comparisons must be made in terms of investment for the same yearly production.

Cost/kWh is not the right indicator neither. When talking at system level what matters **is not "cost" but "value"**.

Apart from **dispatchability and grid integration** issues, which provide a clear and accountable "plus" to STE and **macroeconomic** impacts, which policy makers should take into account, there are other aspects which are usually disregarded such as:

Life of components, Performance degradation, Impact of temperature on performance, Losses in charging and discharging batteries or pumping stations, etc.

Time has come when it is not enough global goals established on the share of RE by 2030 or 2050. **Including the necessary high contribution of dispatchable generation technologies within these goals is already a must**. Otherwise a CO_2 free generation system will not be feasible and the business cases for RE investments will not be sustainable any longer.

- ✓ **STE is** - and will continue to be - the **necessary choice** when planning addition of new capacity in sunny countries.
- ✓ **STE would be** also the **preferred choice** for policy makers when all the impacts - technical and economical - are duly taken into account

Thank you for Luis Crespo!

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Thank you !

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