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IRP Consultation Workshop

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The essential role of CSP in South Africa´s electricity generation mix

The Euro-mediterranean Solar Thermal Electricity Industry Association (ESTELA) and the Spanish Solar Thermal Electricity Industry Association (Protermosolar) represent the companies, research centers and institutions which have participated in a large majority of CSP Plants installed globally.

ESTELA and Protermosolar consider that CSP has an essential role to play in SA's electrical system in the future, and are thus deeply concerned by the DoE proposal to disregard CSP.

There are important reasons to support CSP´s valuable contribution to SA

1. Technical

CSP is the **only** dispatchable and grid-friendly renewable technology with enough capacity to meet the electricity needs of SA with firmness, and achieve a near carbon free generation system. A wise generation mix of CSP with other renewables technologies will be the right choice (technically and in terms of cost).

2. Local Economic Development

The high local content of CSP plants - and its subsequent **GDP contribution, job creation and regional development** - should be one of the main considered drivers when planning for the new power generation fleet in SA.

3. Affordable cost, with higher value

In terms of "value" CSP plants are **currently competitive** with PV/ Wind + Batteries in responding to the increasing power demands in SA. CSP however, **does not require "investing twice"** as would be the case with other intermittent technologies which require a backup from nuclear, gas or coal.

In terms of cost, CSP plants - which have only 5 GW installed globally as compared with 500 GW of Wind and 300 GW PV - are showing significant cost reductions; reaching the c$10/kWh, with **further decrease expected before 2020**. Can anybody remember the price of PV when there was only 5 GW installed?

Technical reasons

All these characteristics translate into economical value for the electrical system when comparing different alternatives .

- CSP effectively contributes to the grid stability due to the large inertia of the synchronous and massive turbine generation set.
- CSP Plants can support the integration of variable renewable technologies.
- CSP is a dispatchable technology thanks to its large and efficient (almost 100%) storage system.
- CSP Plants can follow the demand without “investing twice” as is the case of non dispatchable technologies.
- Compared to variable renewable technologies, CSP does not require spinning reserve in the system.
- CSP plants can offer a wide range of ancilliary services (secondary and tertiary bands, reactive power, frequency and voltage control).
- CSP Plants do not require further investments as compared with the necessary grid integration infrastructure costs of variable generation technologies.

Reference: Spain with 2,3 GW installed capacity is a successful, demonstrated case of all these technical features.
Some facts and figures from 2016: Hourly CSP contribution record reached 9,4% to the Spanish grid, many hours in summer being above 8%, total monthly contribution in summer months reaching over 4%. The performance is not degradated, and operational experience improves the yield of Plants.

Technical warning to the IRP Base Case

A high share of inflexible generation technologies is not feasible

An IRP base case with 60% of inflexible generation technologies (PV, Wind and Nuclear) **is not feasible both technically and in terms of the investor´s business cases.**

This will result in a completely unbalanced system (between dispatchable and non dispatchable renewables) l**eading to a lot of curtailments, a low capacity factor and the corresponding high costs for backup plants and further investments in frequency and voltage control** – see the example of U.K. – **as well as for spinning reserve, etc.**

Macroeconomic benefits that CSP offers to SA´s economy

Comparison between premiums and returns of a CSP deployment programs

Local Economic Development

+ Industrial development

+ Re-balancing the generation mix

(technically and cost wise)

+ Reinforcement of the grid

+ Attraction of foreign investment

+ Regional economical convergence

Premiums

Savings on unemployment subsidies

Savings in CO2 rights

Savings from replacing imported fossil fuels

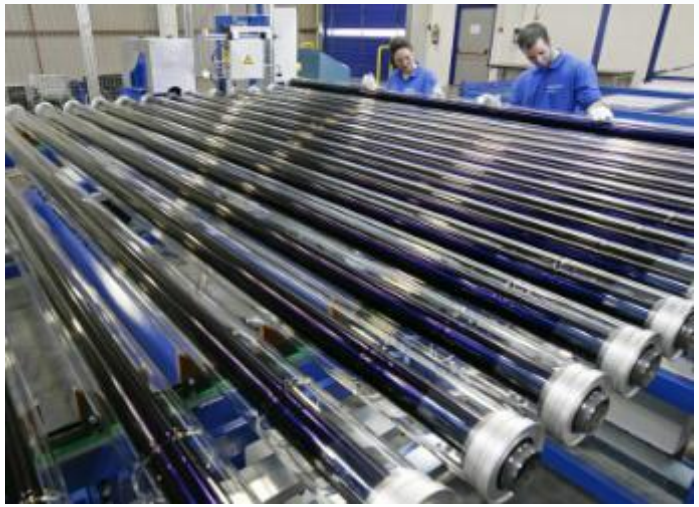
Fiscal contribution (Social Security, Corporate, Personal and Local Taxes,)

Contribution to GDP

The positive macroeconomic benefits have immediate impact (from the begining of plant development) - and last forever -, whilst the premiums for CSP generation only start to be payed 3 years after the initial development.

Example of Industry localization for solar field components

Absorber tubes - Spain



Curved mirrors - Rioglass factory Upington

Pre-requisite:
Stable program of some few hundred MW per year

Collector structure - Spain

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Other direct effects on Industry

Reorientation of other mature industries:

- Construction, civil works
- Engineering of conventional power plants
- Electricity Transmission Infrastructures
- Galvanizers, …

Reinforcement of certain industry sectors:

- Piping and tanks
- Heat exchangers
- Boilers
- Cabling
- Telecommunication and control

Huge impact in auxiliary sectors

- Cleaning, environmental, labs, …
- Road transport,
- Training, …

+ Reinforcement of supplier's subsidiaries in the country:
Promotion, Maintenance, Spare parts, …

Affordable cost with higher value

Some recent examples demonstrating that prices in CSP Plants are fast decreasing:

- ✓ The PPAs for the two recently awarded CSP 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, CSP won in competition with all other generation technologies including Gas Combined Cycle. **$64/MWh has been offered by a CSP plant in the most recent auction in Chile.**

- ✓ A tender process is currently being undertaken in Dubai. After announcing a goal of $80/MWh for a 200 MW CSP Plants 30 promoters have presented their expressions of interest. Several have been already prequalified.

In SA the CSP price has seen reductions from BW 1 to the 2015 expedite round of up to 17%, or 30% if ZAR exchange rate impact is considered.

Understanding the value of solar power according to the renewable electricity penetration share

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

http://www.nrel.gov/docs/fy14osti/61685.pdf

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

Conclusion:

It is equivalent - for the total cost of the system- to pay 50 USD/MWh for PV or 100 USD/MWh for STE with storage. This difference increases further with greater RES penetration.

- **What does operational value mean:**

  Operational value represents the avoided costs of conventional generation (at their respective dispatching times), as well as related ancillary services costs, such as spinning reserve, etc. Savings on emission costs are also accounted for.

- **What does capacity value mean:**

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

Additionally required integration costs of variable renewables must be taken into account.

Conclusions: proposal to the IRP draft

- At the very least, revise the IRP calculations **considering more realistic and updated costs for CSP Plants** (current offers in Dubai and Morocco with the corresponding DNI rate could provide accurate current cost levels) and – very importantly – **consider specially a more realistic cost reduction curve** where the effects of the concurrence and market growth will soon be evident, as was the case with the PV sector. (Figures of c$ 6 – 8 / kWh could be realistic for CSP in 2022).
- Over and above this update, to arrive at the most efficient generation mix and plan for the best generation fleet for SA, **revise the calculation model and consider not only the cost, but the value approach** or, at least, **consider the necessary system firmness and the integration costs of variable renewables.**
- Think of the - real - possibility that the expected nuclear program will not be completed, will be delayed or will run into extra costs (as has been the case in other countries).
- Keep in mind that **CSP has a unique value in driving real economic development in SA, particularly in the NCP**.

Don't close the door to CSP! as a significant percentage of CSP in the renewables generation mix will reduce the need for further investments in conventional technologies -> and lead to a more sustainable - and cheaper - system than the current base case in the IRP draft proposal.

Thanks for your attention.

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