Southern Africa Solar Thermal & Electricity Association

IRP 2010 Hearings, 3rd December 2010
Pancho Ndebele, SASTELA Chairman

Presentation Outline

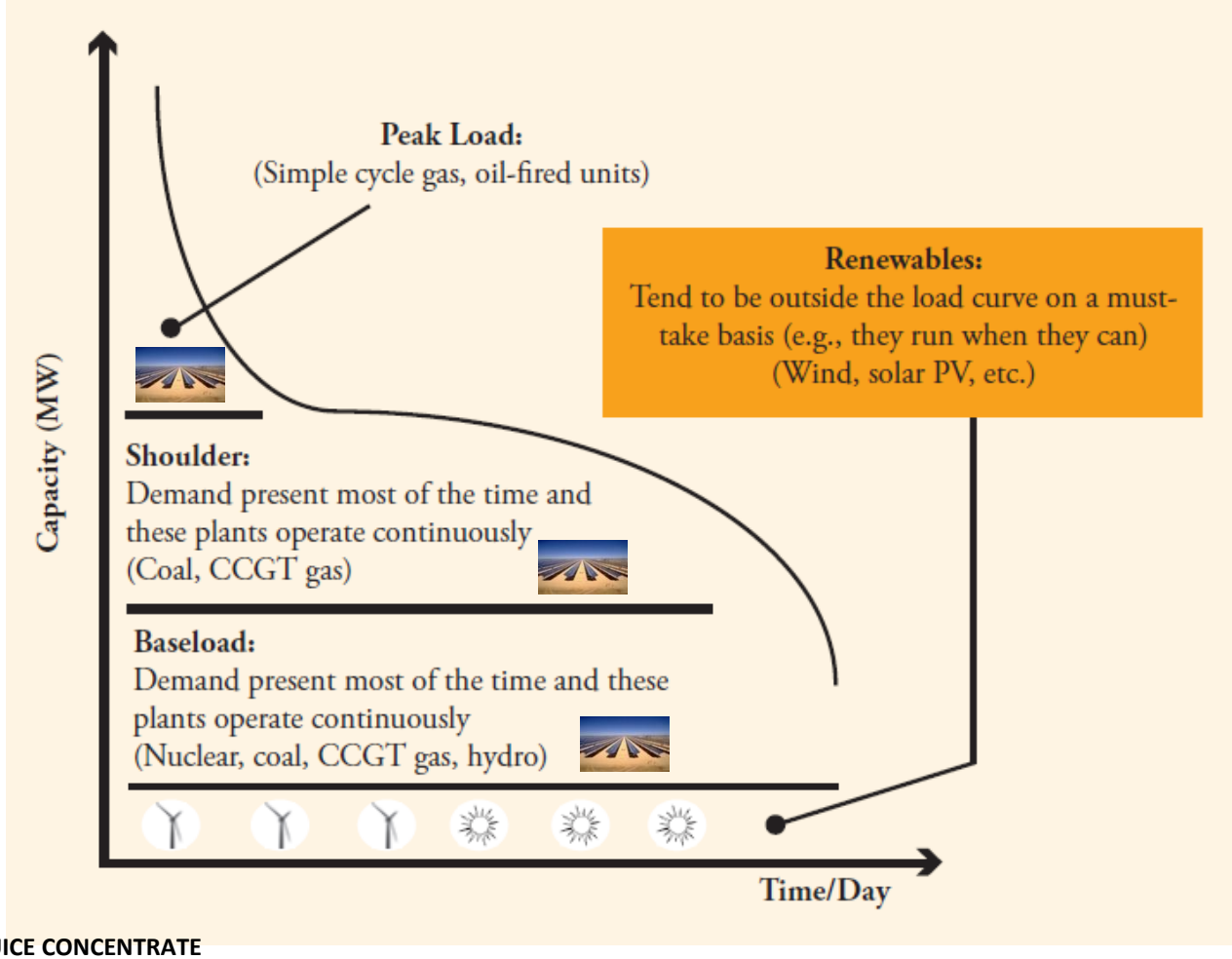
1. SASTELA Introduction
2. South Africa's CSP potential
3. CSP activities under development by industry
4. SASTELA's IRP concerns
5. Declining costs of CSP
6. Recommendations & Economic impact
7. Conclusion

1 : Some of SASTELA's participants

SASTELA

1.2: SASTELA's – 10 Objectives

- Promote the roll out of CSP power plants for the production of sustainable **peak**, **mid merit** (shoulder) and **base load** solar thermal electricity in Southern Africa.



Source: WRI, JUICE CONCENTRATE

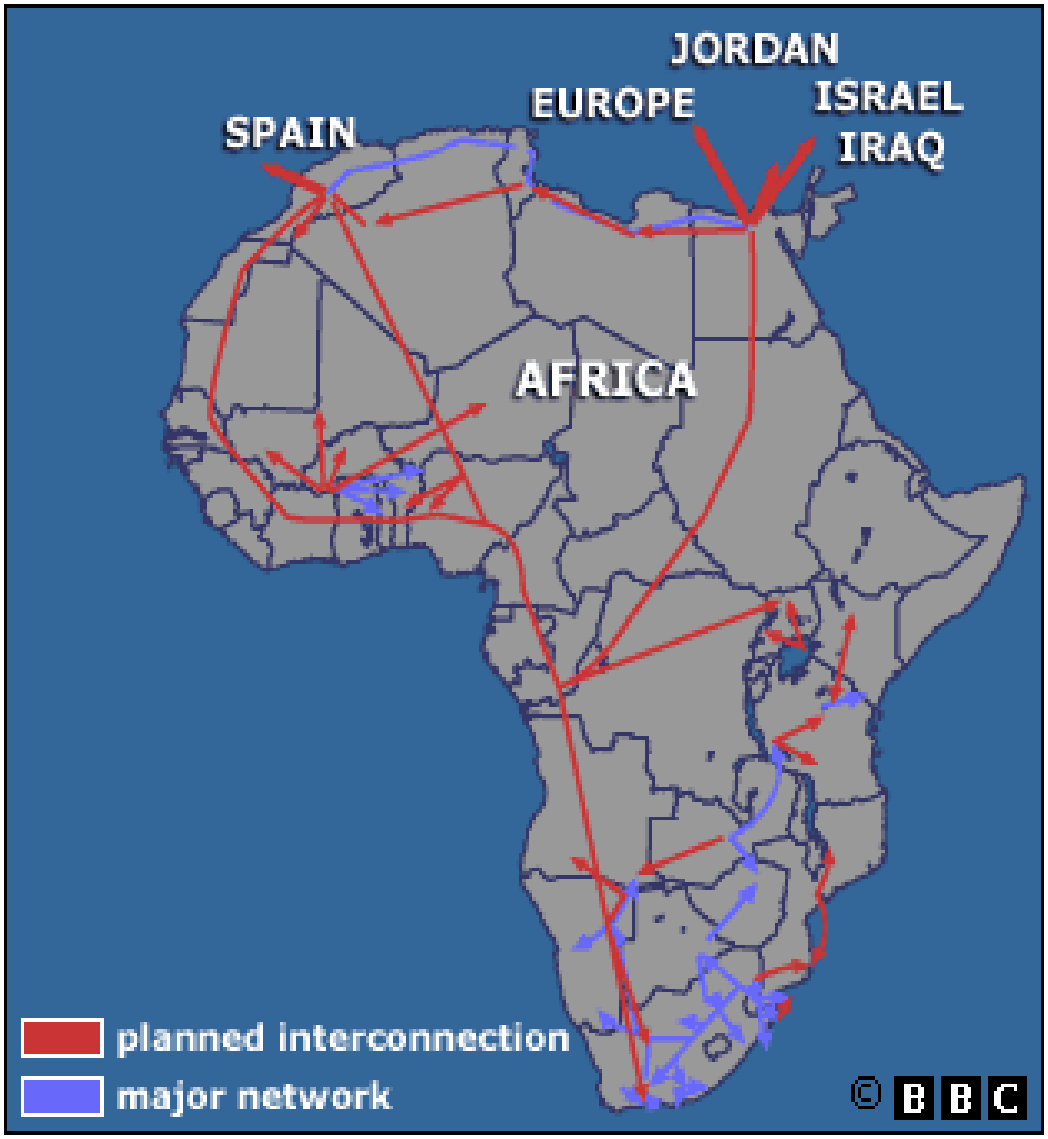
1.3: SASTELA's – 10 Objectives

- Promote the uptake of large scale **industrial solar process heat**.
- Promote CSP in Southern Africa at policy and administrative levels (local, national, regional & international).
- Promote the **manufacture** of **CSP components** in Southern Africa and to explore the **"airbus model",** where SADC **countries** can manufacture different CSP components.
- Promote excellence in the planning, design, construction and operating of CSP plants.
- Support **research** and **innovation**, including **vocational training** and support for **equal opportunities** and **transformation**.

1.4: SASTELA's – 10 Objectives

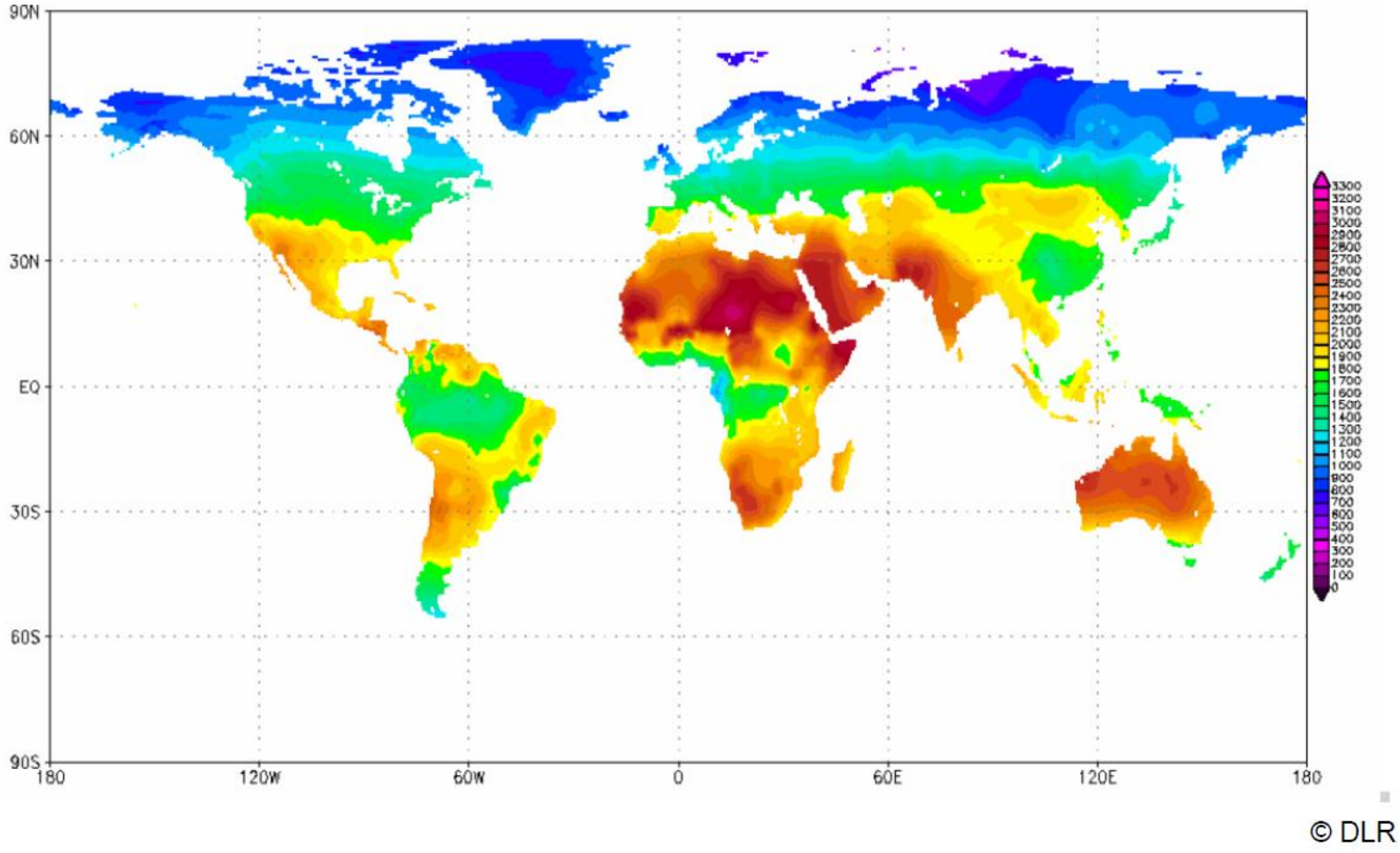
- Participate and **contribute** to combating climate change, promote migration to a **low carbon economy** and **sustainable development**.
- Promote the **creation** of **new sustainable** and **green collar jobs** in Southern Africa.
- Promote the SADC Desertec Concept **(SADCTEC)** and the use of the Southern Africa Power Pool **(SAPP)** for cross border **transmission of solar thermal electricity**.
- To work with NEPAD, the EU and other CSP stakeholders to promote the Africa-Europe grid interconnection concept by 2050.

1.5: Africa – Europe Grid Interconnection 2050



2: CSP Fuel – Direct Normal Irradiation (DNI)

Africa “sweet spots” for CSP are very large in land area and have the potential to generate multiples of the continent’s electricity needs and possible export to a Europe supportive of reducing global climate change impacts.



2.1: South Africa's CSP Gigawatt potential

PROVINCE	NC	FS	WC	EC	Total
Suitable land area, km^2	14288.0	708.0	294.0	44.0	15334.0
Power generation potential, GW	510.3	25.3	10.5	1.6	547.6
Net energy generation, TWh/a	1734.4	85.9	35.7	5.3	1861.4

6.4 times the total electricity requirement forecast for South Africa for the year 2030 (IRP 2010)

Data Source: Adapted from T Fluri 2009, USB. NC (Northern Cape), FS (Free State), WC (Western Cape), EC (Eastern Cape)

3: CSP Activities under development

- A corridor (red circle) of CSP developments from IPP's (Capacity, up to 1000 MW) has created itself in the Northern Cape as a result of REFIT. The proposed DOE/CCI Solar Park (5GW) initiative is also located within the corridor so is the Eskom 100 MW project.

4: IRP – SASTELA's concerns

- **Least cost** model selects coal generated power ahead of all energies. Anticipated **cost reductions** with **economies of scale** and **technology improvement** in **CSP will compete with coal** well **within the 20 year** IRP 2010 **time frame**.

- **CSP allocation** for the next ten years (2010-2020) is **to little to generate** the **impetus** for SA to become a leader in CSP technology. In ten years time we will be adding more CSP into the energy mix than its currently catered for in the IRP 2010, but we will be importers and followers of the technology.

- Nuclear has a role to play in SA's energy mix but we not sure why there is the imperative to commit unequivocally to nuclear so far in advance. The same commitment should be given to **Dispatchable CSP (Storage & Hybridisation)** so that it has a chance to prove itself.

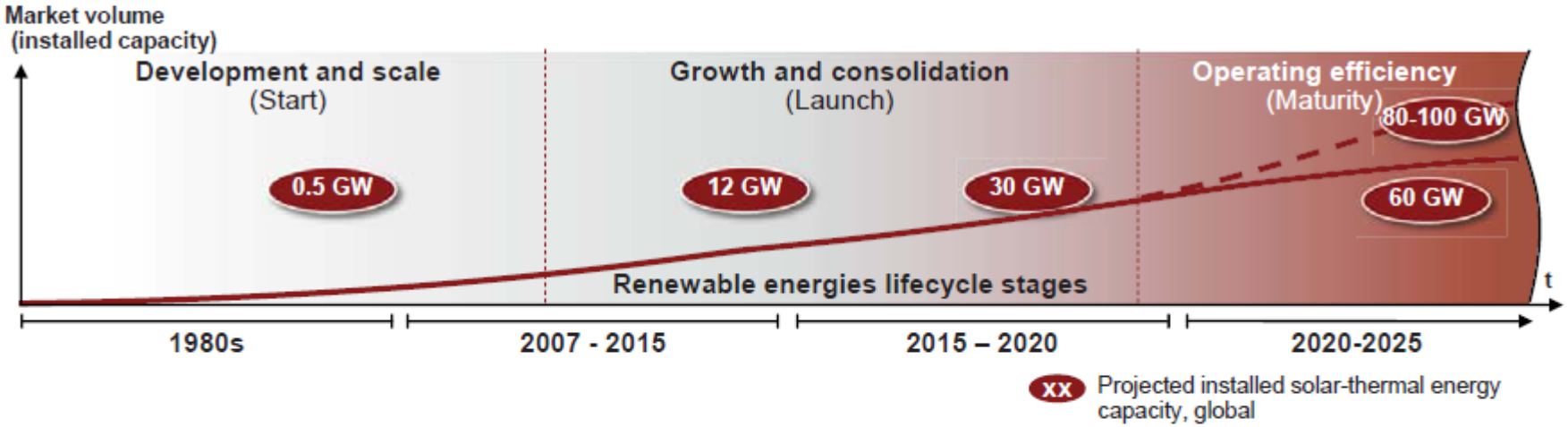
- **Localisation**, whilst wind is catered for,**Scale** is key to unlock South Africa's CSP localisation potential.

- **Job creation potential**, CSP can create **more jobs per MW** across the value chain in comparison to other renewables and conventional fuels and this should be taken into account.

- **Low carbon scenarios** with a more sensible incremental increase in CSP to allow for learning and scale cost reductions, increased utilisation efficiencies will contribute to climate mitigation.

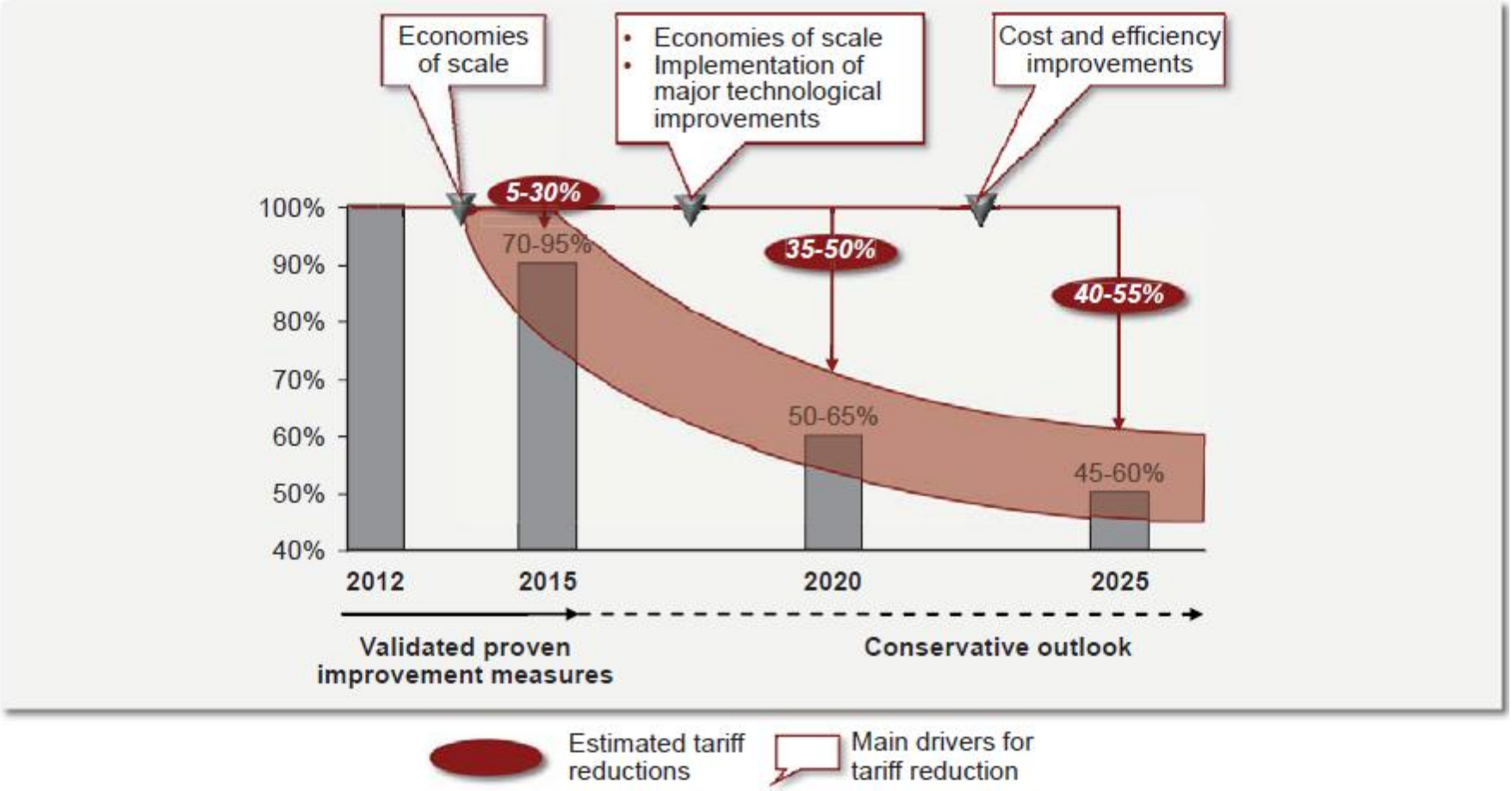
5: Declining costs of CSP

Pioneer phase	Commercial ramp-up	Major technology improvement	Large scale deployment
• Plant sizes 1 to 80 megawatts • Tariffs: greater than c€30	• Plant sizes 50 to 100 megawatts • Tariffs: c€27 to c€31	• Plant sizes 100 to 250 megawatts • Tariffs: c€10 to c€18	• Plant sizes greater than 250 megawatts • Tariffs: greater than c€10



Note: Tariffs are in euro cent per kilowatt hour, and equal to the minimum required tariff to ensure project break-even. Considers tariff decrease of 4.5 percent, with an increase of direct normal irradiance by 100 kilowatt hours per square meter area referent to Spanish base case
Source: ESTELA project team; A.T. Kearney analysis

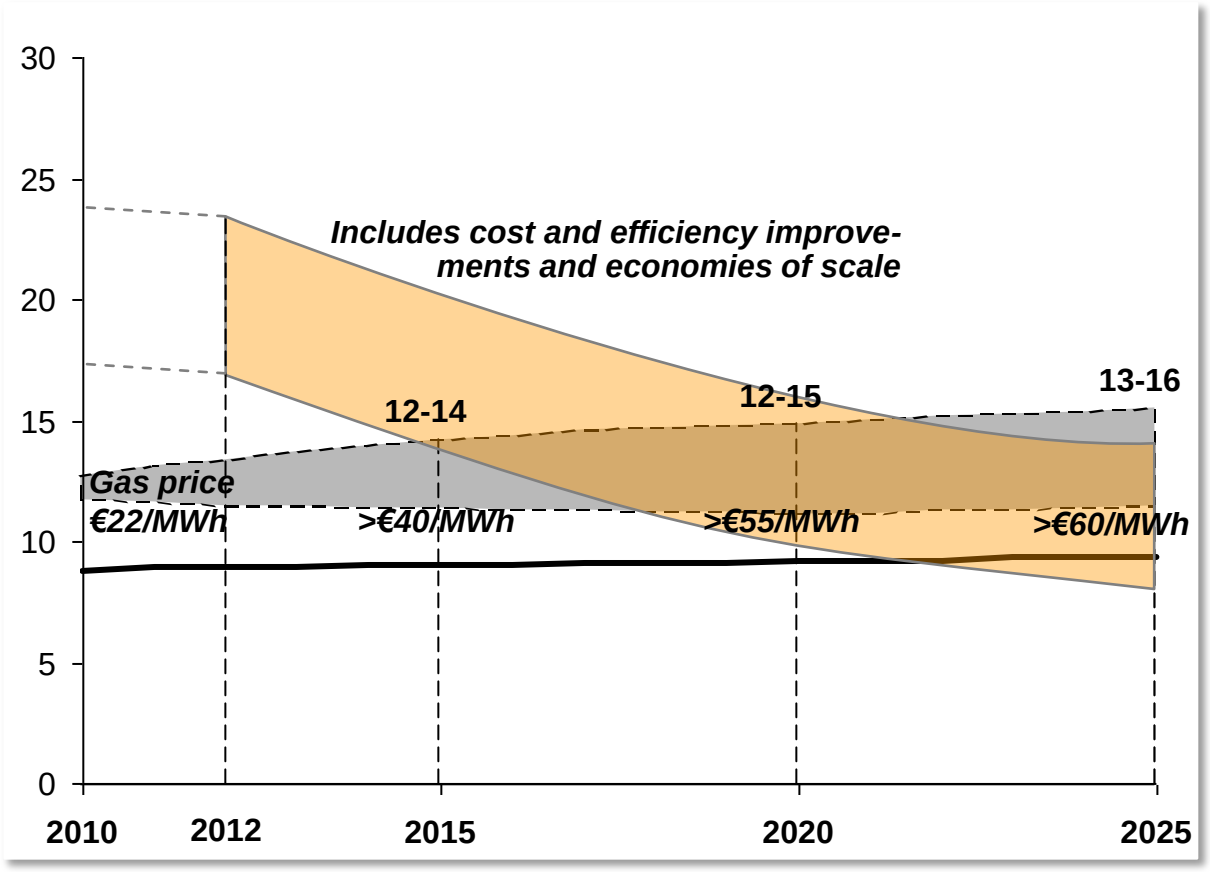
5.1: Expected tariff reductions from 2012 to 2025



Notes: Tariffs equal the minimum required tariff, and are compared to 2012 tariffs
Source: A.T. Kearney analysis

5.2: LCOE of Dispatchable CSP vs Convional Sources

Cost comparison of dispatchable CSP against conventional (Spain, LCOE, in €c/kWh)



- **Dispatchable CSP** technologies are expected to compete **against CCGT and hard coal as peak to mid load provider**
- On the long run, **CSP** can **substitute CCGT** as peak to mid load provider
- Further **hybridization** can support **cost competitive dispatchability**
- Introduction of **additional CO2-penalties** would **further drive competiveness of CSP**

Hard coal
CCGT
CSP – dispatchable

Assumptions: DNI 2,084 kWh/m²a; inflation included (CPI -0.5%); storage 5-20hrs
Plant sizes increase according to projected ramp-up; CCGT – 25 years, Hard coal 40 years plant runtime
Source: ESTELA project team; A.T. Kearney analysis; EPIA

6: Recommendations & Economic Impact

- The IRP modellers should use the AT. Kearney and Clinton Climate Initiative figures in the modelling and compare these to EPRI.
- The modelling should **focus** more on **dispatchable CSP** instead on non dispatchable CSP.
- A **minimum of at least 2GW of CSP by 2020** should be allocated, this will stimulate South Africa's solar thermal industry.
- **8GW of CSP** should be allocated from **2021 – 2030** bringing the total allocation for CSP by **2030** to 10GW.
- The IRP should look at both short term and longterm trade offs in relation to costs and socio economic development.

6.1: Economic Impact of a minimum 2GW CSP by 2020

Direct Jobs from deployment of 2GW of CSP by 2020

- 16,000 - 20,000 Construction Jobs
- 1,600 - 2,000 Operation and Maintenance Jobs
- 600 -1,000 Manufacturing Jobs for 2*200 MW capacity CSP local manufacturing factories.

SOURCE: DLR, GREENPEACE

Indirect Jobs from Deployment of 2GW of CSP by 2020

- 168,000 Indirect jobs

SOURCE: SOLAR RESERVE, IDC

Potential carbon Emissions Reductions by 2020

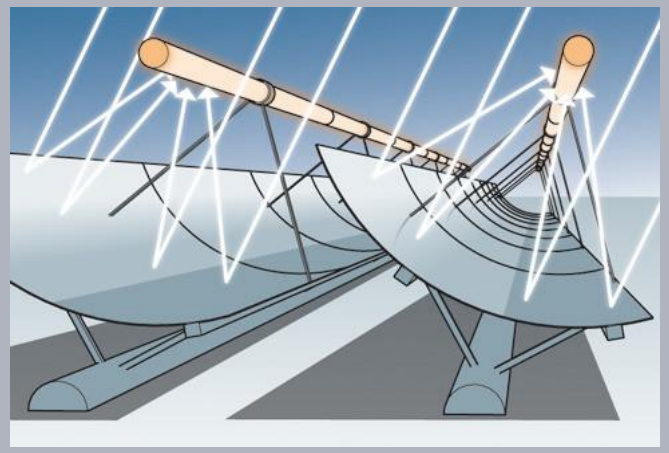
- 6,080,000 tCO^2e

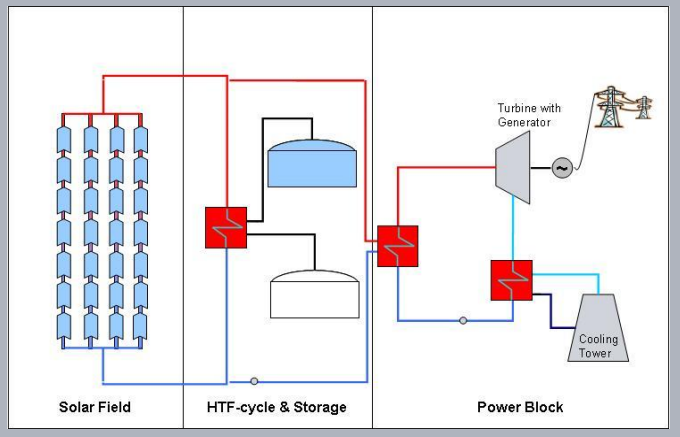
SOURCE: EMVELO

Raw Materials Required and Environmental Benefits

- 400,000 tons of Steel
- 240,000 tons of Glass
- 400,000 m^3 of Concrete

SOURCE: DLR





IMAGES: SIEMENS

- A deployment of 2GW of CSP by 2020 has the potential to contribute 191,000 Direct & Indirect green collar jobs to the new growth path target of 300,000 jobs by 2020.

6.2: Economic Impact of 10GW CSP by 2030

Direct Jobs from deployment of 10GW of CSP by 2025

- 80,000 – 100,000 Construction Jobs
- 8,000 – 10,000 Operation and Maintenance Jobs
- 3,000 -5,000 Manufacturing Jobs for 5*200 MW capacity CSP local manufacturing factories.

SOURCE: DLR, GREENPEACE

Indirect Jobs from Deployment of 10GW of CSP by 2025

- 840,000 Indirect jobs

SOURCE: SOLAR RESERVE, IDC

Potential carbon Emissions Reductions by 2025

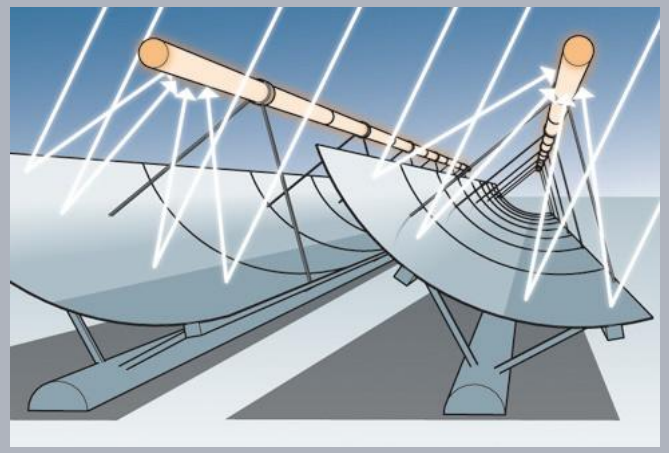
- 30,400,000 tCO^2e

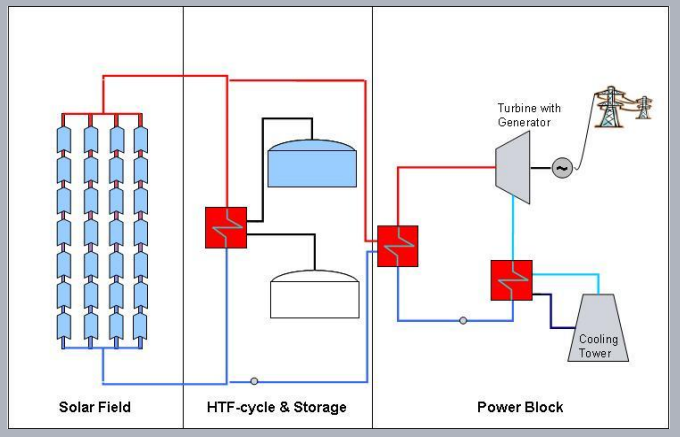
SOURCE: EMVELO

Raw Materials Required and Environmental Benefits

- 2,000,000 tons of Steel
- 1,20,000 tons of Glass
- 2,000,000 m^3 of Concrete

SOURCE: DLR





IMAGES: SIEMENS

- A deployment of 10GW of CSP by 2025 has the potential to contribute 932,000 Direct & Indirect green collar jobs to the new growth path target of well over 400,000 jobs by 2030.

7: Conclusion

- "Our role as Africans in the industrial revolution was mainly as slave labourers and observers to the plundering of our natural resources. During the **IT revolution we missed the boat** because our economies were not geared to seize the opportunity as Taiwan and Korea were able to do in LCD technology and India in IT Software" Ms. Dipou Peters, Minister of Energy.

- "We believe that in **stimulating investment** in **green industry** we will be able to contribute to the creation of **decent jobs**", President Jacob Zuma.

- "There are big challenges that we face in **creating enough jobs for South Africans** willing and able to work... this has led government to create **a new growth path** that seeks to be **more labour absorbing**, **less carbon intensive**" Ebrahim Patel, Minister of Economic Development.

- The new growth path projects a jobs potential of 300,000 jobs by 2020 to green the economy, with 80,000 in manufacturing and the rest in construction, O&M. The **new growth path** provides the **basis for coordinated policies** and **programmes** across the state.

- "South Africa is **very fortunate to have the capacity** and **the potential to export CSP technology and energy** to less fortunate parts of the world" Jose Alfonso Nebrera, President of the European Solar Thermal Electricity Association (ESTELA)"

SASTELA

Thank You

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