



Concentrated Solar Power (CSP) Stations Dispatchable, Baseload & Peaking Solar Thermal Electricity 6th October 2015

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Presentation Outline

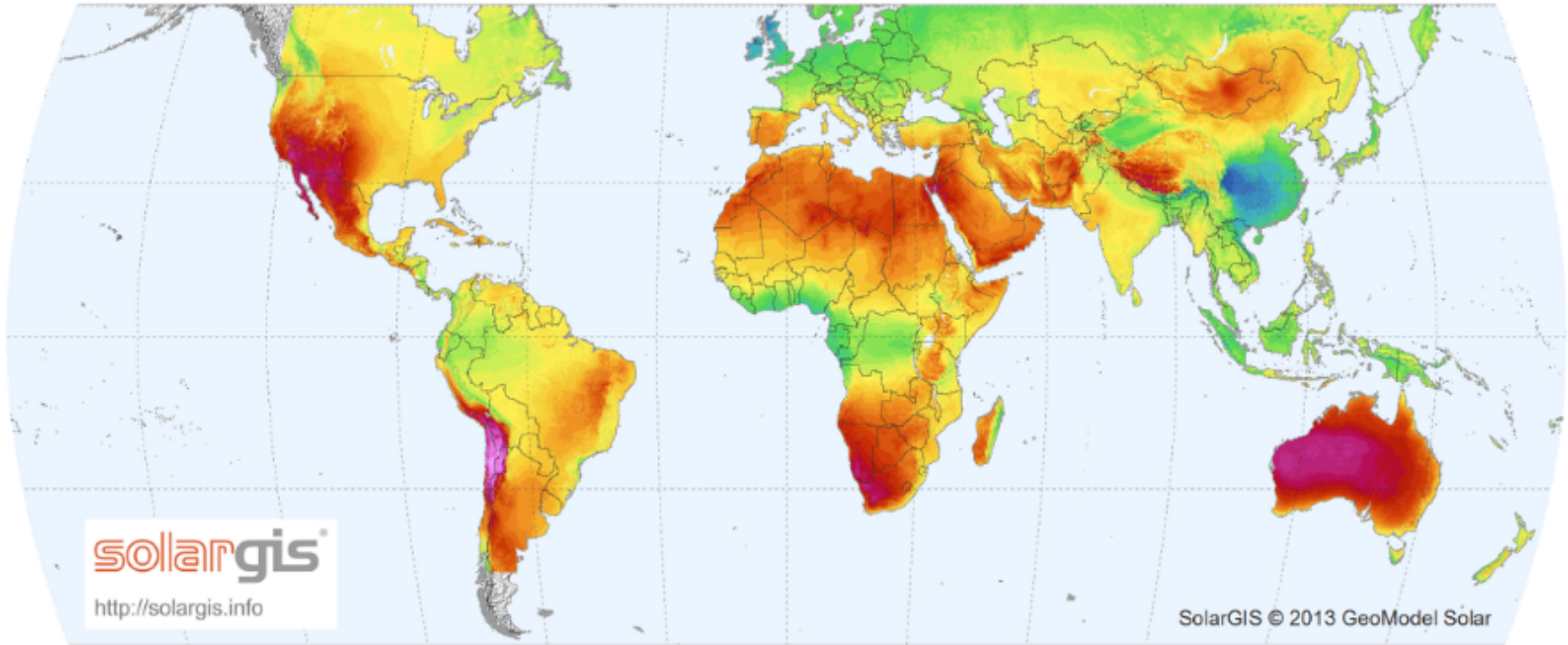


1. Southern Africa's Concentrated Solar Resource (DNI) & Grid Integration
2. Concentrated Solar Power (CSP) – How it works?
3. Debunking the 7 Myths about CSP
4. Southern Africa Solar Thermal Electricity Industrialisation Initiative (SASTEii)
5. Challenge Questions

1.0: World CSP Resources – Sweet Spots

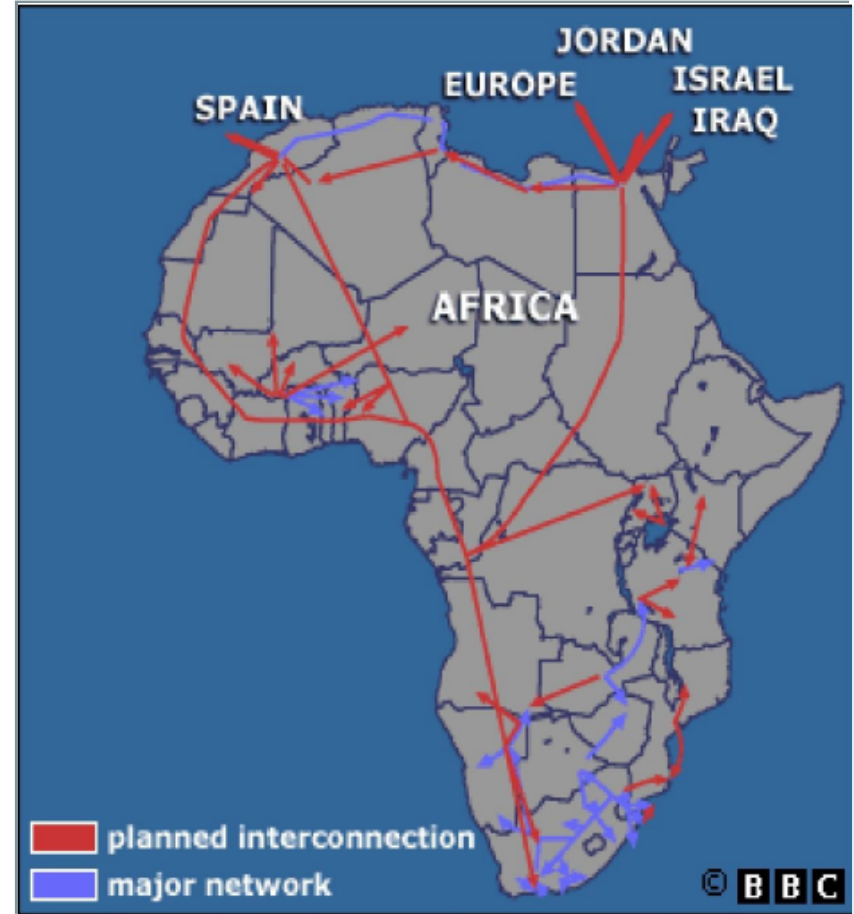
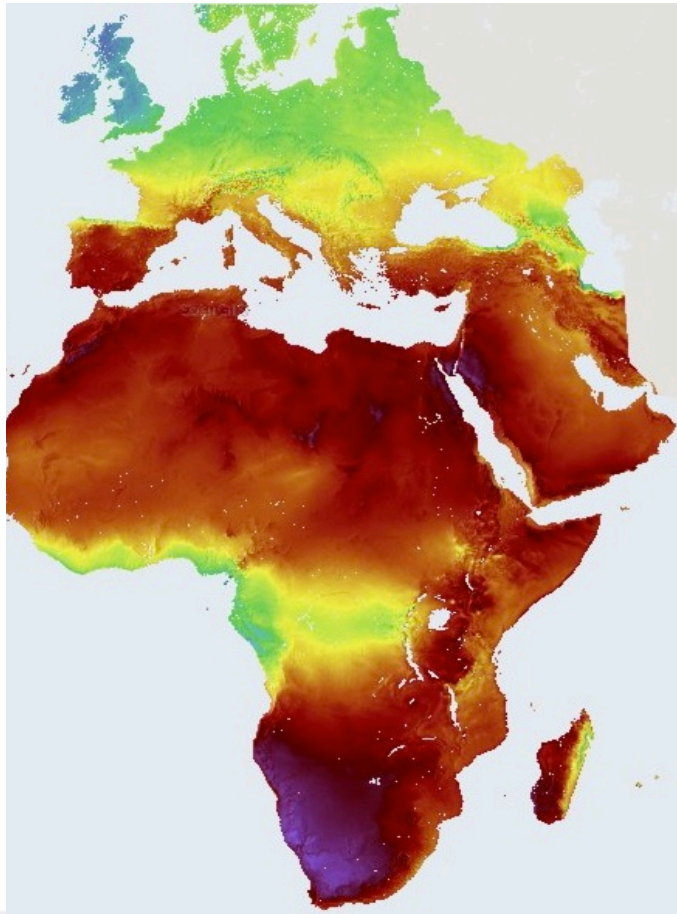
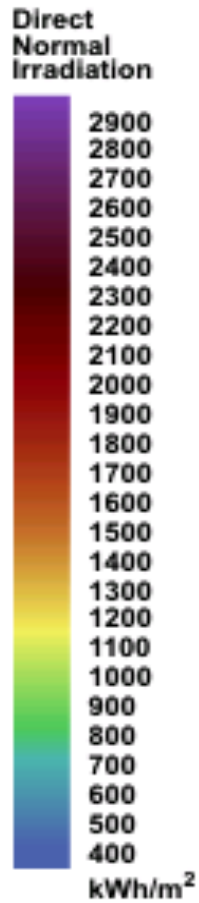
WORLD MAP OF DIRECT NORMAL IRRADIATION

GeoModel
SOLAR

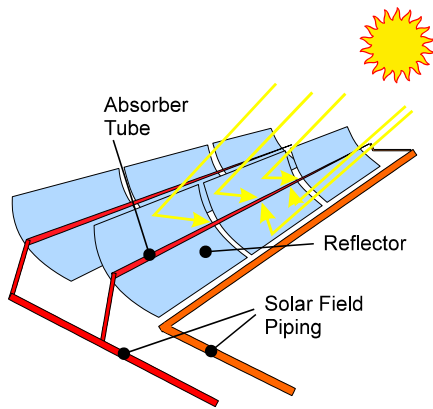


1.1: Southern Africa's CSP Resources & Grid

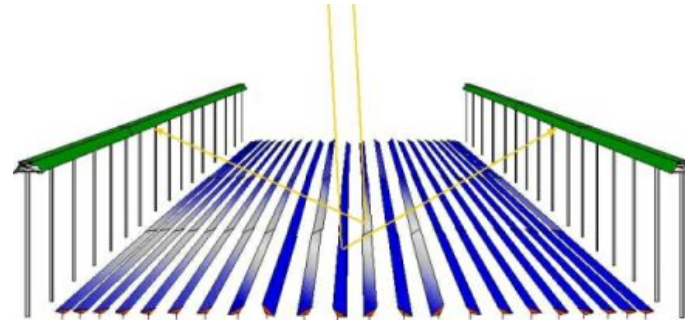
❖ Solar Thermal Fuel - Direct Normal Irradiation (DNI) & Grid Integration



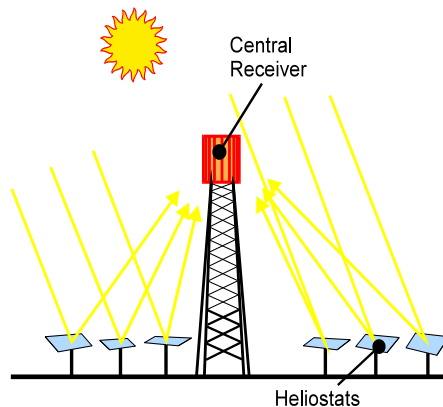
2.0: How it works - CSP Technologies



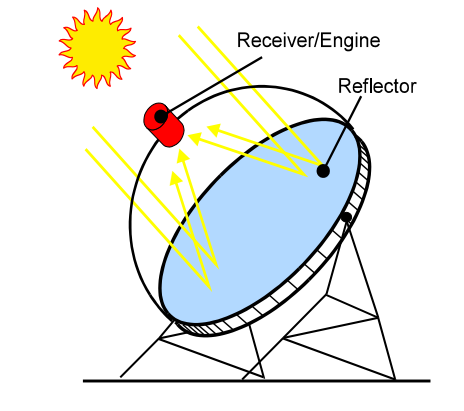
Parabolic troughs



Linear Fresnel Reflectors

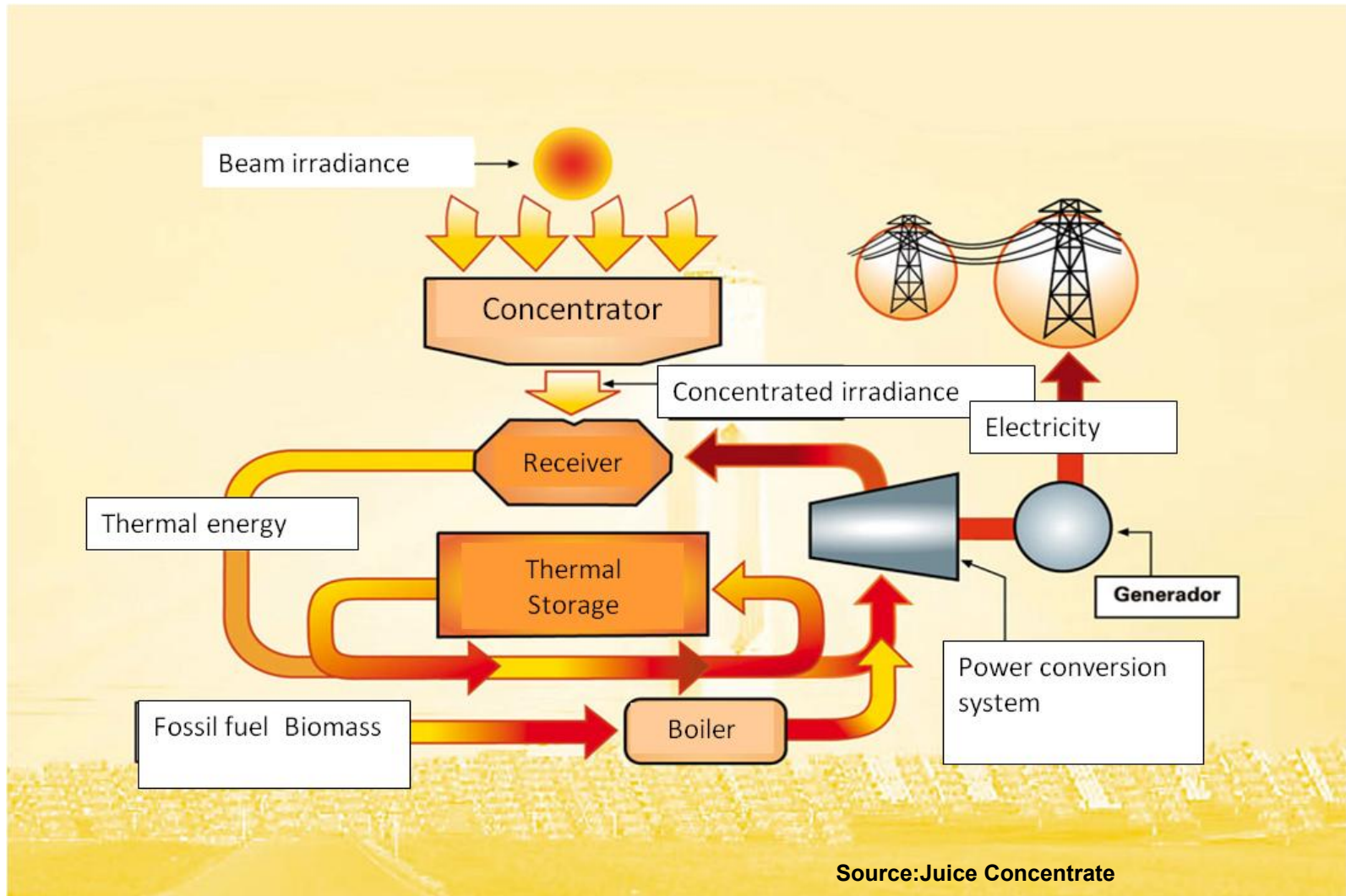


Central Receiver / Heliostats



Parabolic dishes

2.1: How it works – Solar Thermal Electricity Generation

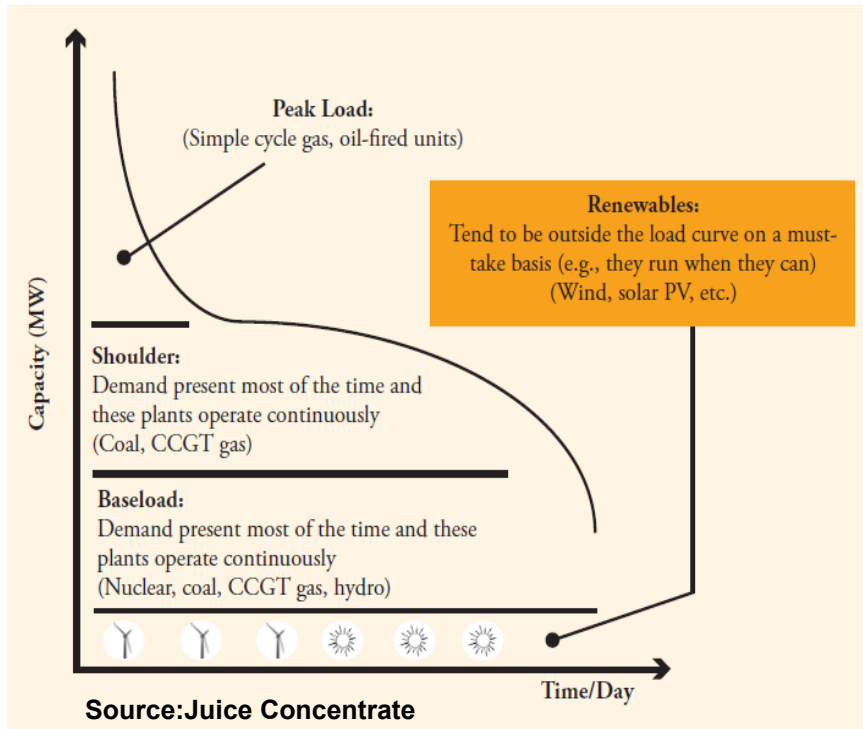


3.0: Debunking the Myths about CSP

❖ ***Myth 1 - CSP like Wind and Solar PV is an intermittent technology and is not dispatchable***

- ✓ Dispatchable generation refers to sources of electricity that can be dispatched at the request of the grid or system operator.
- ✓ These are generating plants that can be turned on or off, or can adjust their power output on demand.
- ✓ CSP Power Stations with Thermal Energy Storage (TES) are capable of delivering electricity on demand without additional cost.
- ✓ CSP allows for integration into the grid of more intermittent renewable sources (Wind and PV) without jeopardising grid stability.

3.1: Debunking the Myths about CSP



❖ **Myth 2 – CSP unlike gas is not capable of providing Peaking Power**

- ✓ South Africa's two CSP Power Stations currently under construction; (**Ilanga CSP1 and Xina**) are designed to meet South Africa's daily evening peak demand which occurs from 4:30pm to 9:30pm.
- ✓ All the CSP's from bid window 3 being deployed in South Africa are designed to operate as semi-Peaking Power Stations.

3.2: Debunking the Myths about CSP

❖ ***Myth 3 – CSP unlike conventional power stations is not capable of providing round the clock baseload power***

- ✓ Baseload refers to power stations that are always on, typically this term refers to coal and nuclear power stations.
- ✓ CSP power stations with a right-sized thermal storage system can provide baseload solar thermal electricity.
- ✓ The 20MW Gemasolar CSP Power Station with 15 hours of TES is a living example of Baseload CSP facility.
- ✓ The 50MW Bokpoort CSP with 9 hours of TES will be able to provide electricity around the clock

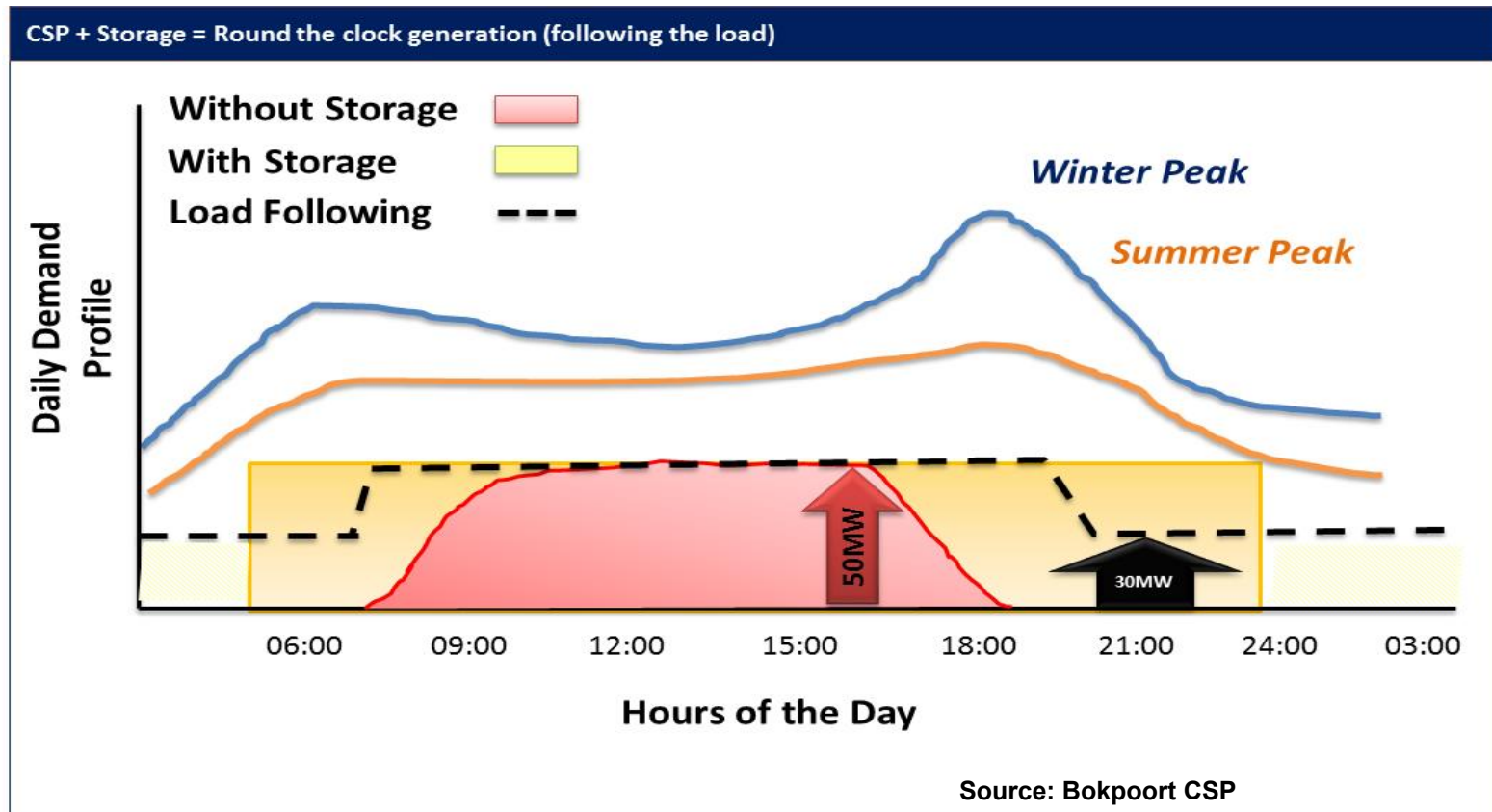
3.3: Debunking the Myths about CSP

- ❖ **Myth 3 – CSP unlike conventional power stations is not capable of providing round the clock baseload power: *Gemasolar CSP Power Station***



3.4: Debunking the Myths about CSP

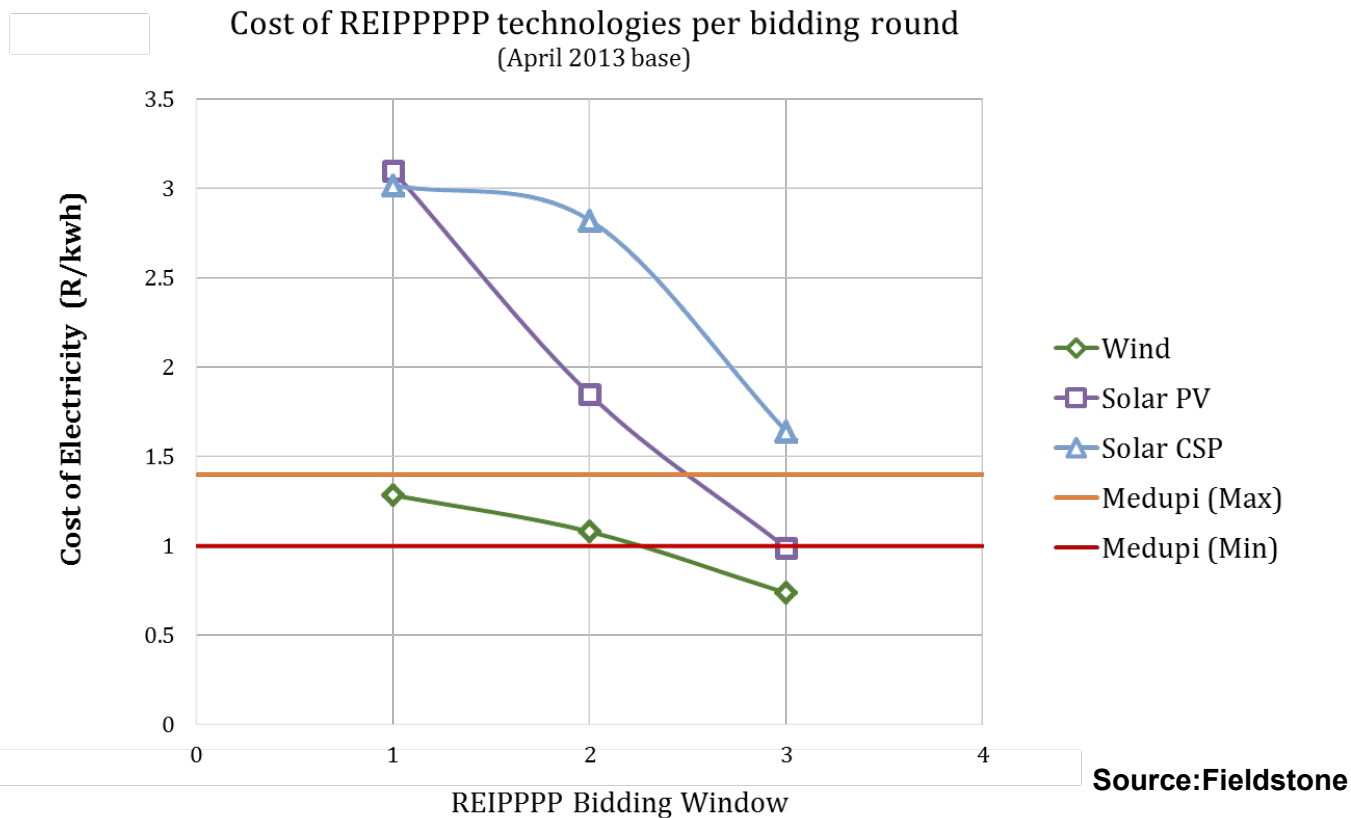
- ❖ **Myth 3 – CSP unlike conventional power stations is not capable of providing round the clock baseload power: *Bokpoort CSP Power Station***



3.5: Debunking the Myths about CSP

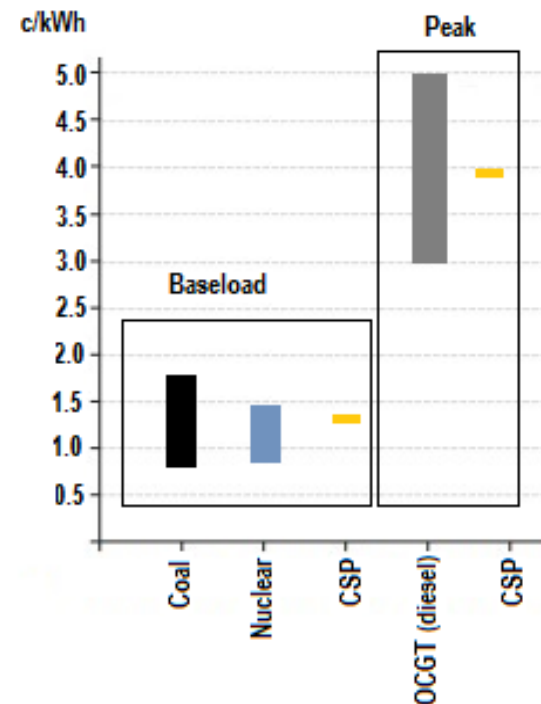
❖ Myth 4 – CSP is too expensive and it always will be ...

- ✓ The tariff for Solar CSP dropped in Round 3.5 to R1.46/kWh
- ✓ The CSP tariff cap for the Expedited Bid Window is R1.37/kWh



3.6: Debunking the Myths about CSP

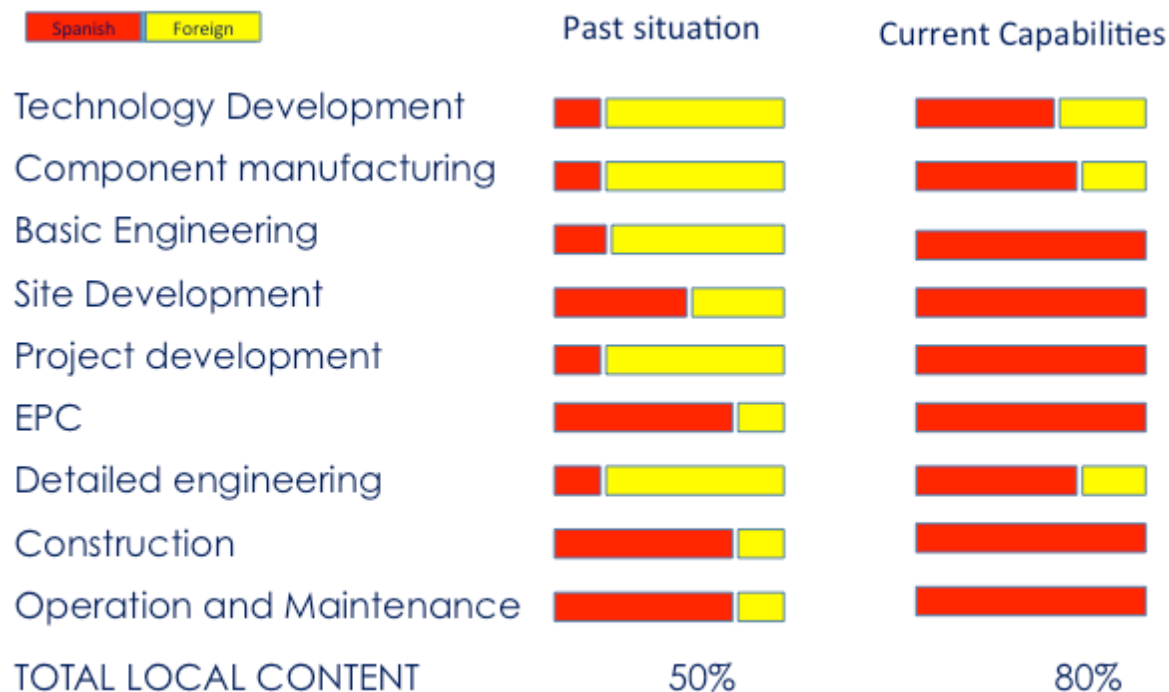
		Generation cost - new, greenfield units	
		Low price (c/kWh)	High price (c/kWh)
Technology			
Baseload	Coal*	0.77*	1.72*
	Nuclear*	0.91	1.47
	CSP (R3.5)		1.46
Peak	OCGT (diesel)**	3	5
	CSP (R3.5)		3.942
Ref:	* World Energy Council - World Energy Perspective (2013)		
	• Priced in Aus, UK and USA		
	**EcoPower Africa		



1. Comparing the Round 3.5 CSP tariff with LEC numbers for other conventional technologies shows that CSP is cost competitive with conventional options, if CSP is viewed as an integrated generation option – providing both Baseload and Peak power.
2. Leveling the playing field between CSP and conventional options by increasing the plant size and lengthening the PPA term will further enhance CSP as a competitive technology.

3.7: Debunking the Myths about CSP

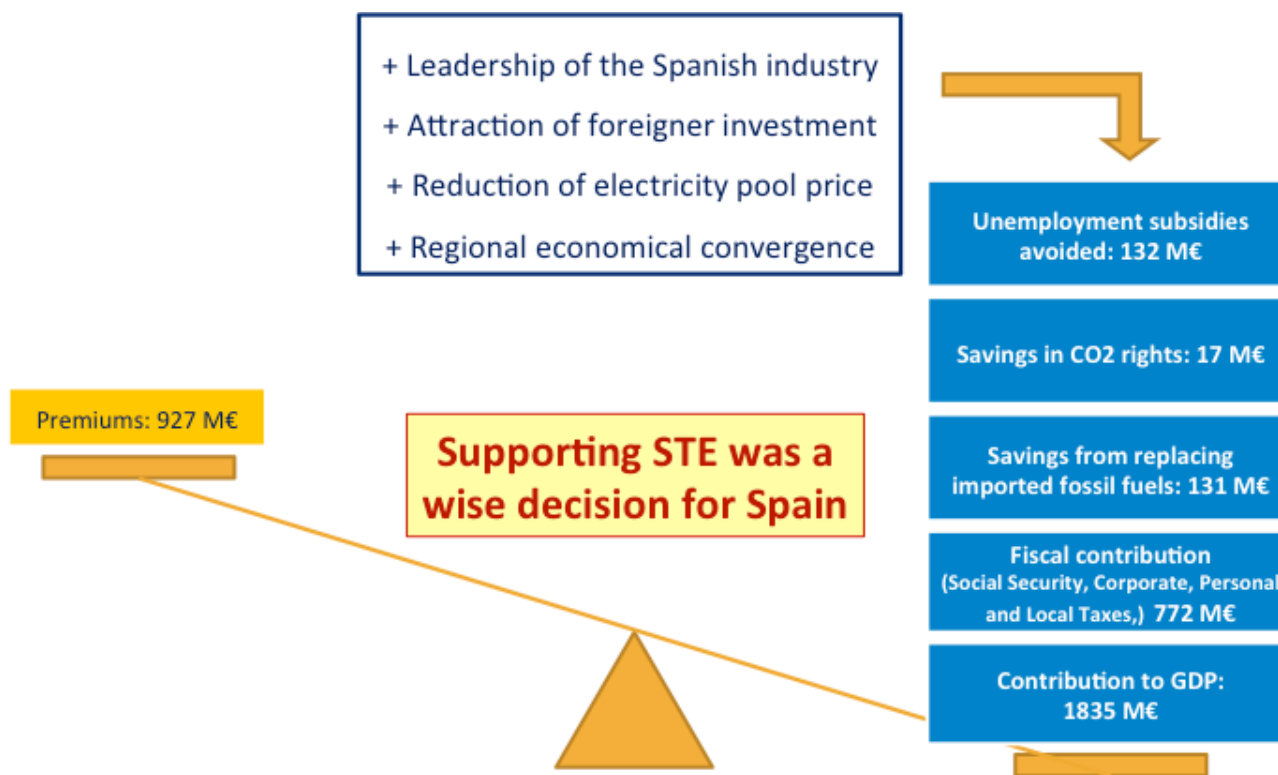
- ❖ **Myth 5 – CSP does not provide much localisation for industrialisation and it may be better for countries starting a CSP programme later (after 2020 or so...)**
- ❖ **Spanish experience from start of program in 2008 (Past Situation) to around 2012 (Current Capabilities)**



Source: Protemosolar

3.8: Debunking the Myths about CSP

- ❖ **Myth 6 – CSP deployment is expensive and inefficient for the economy of the countries**
- ❖ **A 100MW CSP in SA will create about 1000 construction jobs and about 100 permanent jobs during the operational phase**



Source: Protemosolar

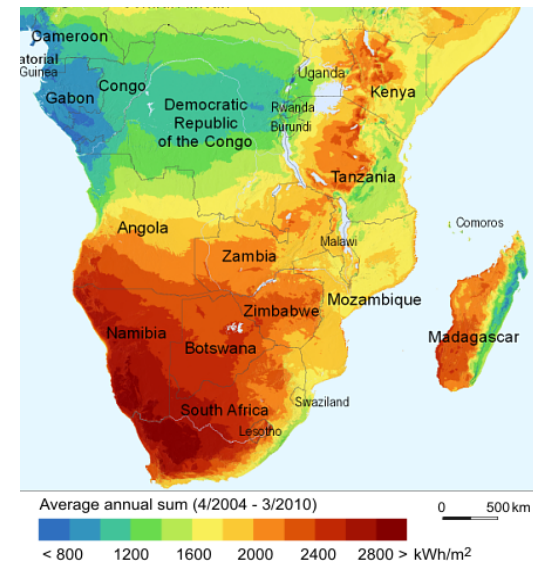
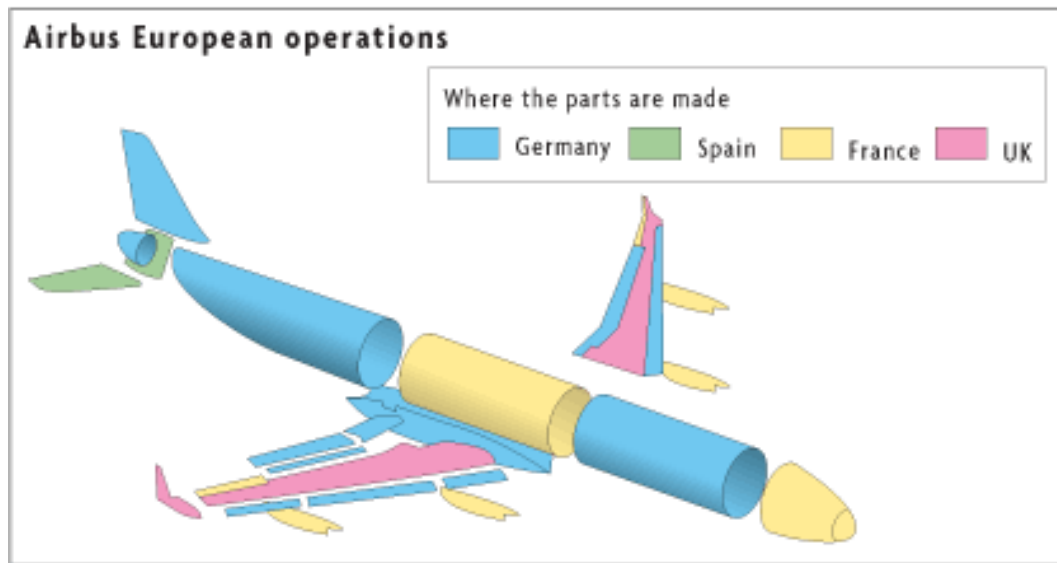
3.9: Debunking the Myths about CSP

❖ ***Myth 7 - CSP does not contribute much to the environment as it uses much water and endangers birds***

- ✓ CSP uses the sun as the fuel source, there are no CO₂ emissions that are generated and the technology is ideal for addressing the global climate change challenge.
- ✓ CSP power stations and other conventional thermal power stations have a lower water footprint, as they require less water per hectare in comparison to agricultural activities.
- ✓ South Africa's CSP projects with the exception of Bokpoort all use dry cooling, which uses 90% less water in comparison to wet cooling.

4.0: SADC CSP Initiative

- ❖ *Southern Africa Solar Thermal Electricity Industrialisation Initiative (SASTEii) – creating a framework for the deployment of CSP Power Stations, the **manufacture and industrialisation of CSP components** in Southern Africa and to explore the **“airbus model”**, where SADC **countries** can manufacture different CSP components for Solar Thermal Power Stations. (SASTEii will be launched in 2016 as a PPP)*



5.0: Challenge Questions

1. Since CSP power stations have the ability to provide, dispatchable, peaking and baseload solar power. What measures need to be put in place for SADC to become the global hub for the deployment and manufacturing of CSP components for the regional and international markets?
2. For CSP power stations to become more competitive from a tariff standpoint what type of procurement framework needs to be put in place to drive down costs of CSP?
3. Would an airbus model of industrialisation and manufacturing of CSP components in the SADC region where different countries manufacture certain components be a sound framework for the uptake of CSP across the region?