Concentrating Solar Thermal Power Stations

Sustainable Green Energy Infrastructure for Peak, Mid-Merit & Base Load Electricity Supply

CESA Young Professionals Sustainability Imbizo
Premier Hotel, OR Tambo
Tuesday, 11 August 2015

Pancho Ndebele : Emvelo Founder

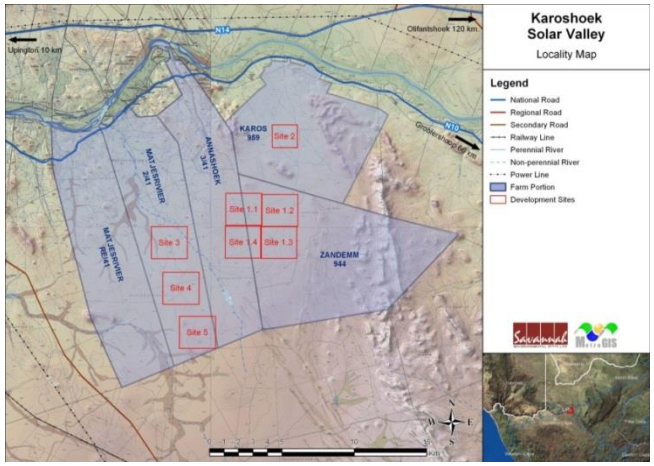
Presentation Outline

1. EMVELO - Introduction
2. Solar Resources for CSP – Global, Africa and South Africa
3. Concentrating Solar Power (CSP) Technologies
4. CSP – Peak, Mid-merit and Baseload
5. CSP Developments in South Africa
6. Localisation & Industrialisation – Regional & National
7. CSP 2030 Regional Strategy
8. CSP Connecting with the NDP & the Green Economy Accord
9. Conclusion

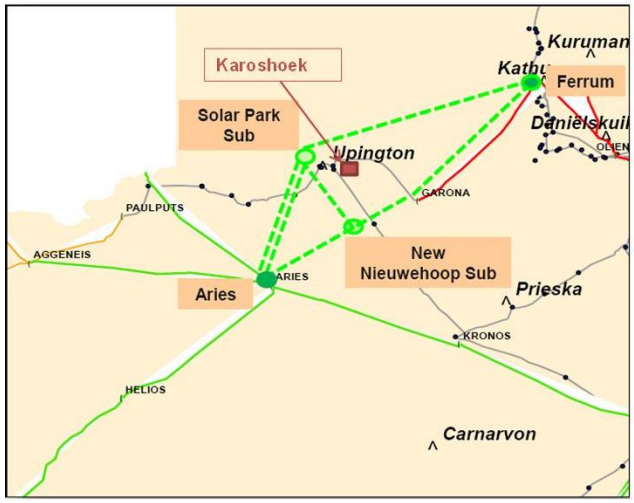
1: Emvelo - Introduction

- ✓ *Emvelo is a South African based company with interests in unlocking Africa's green infrastructure opportunities.*
- ✓ *Emvelo's vision is to be the most admired green infrastructure resources company in South Africa by 2018 and to be amongst the top 5 sustainable green infrastructure companies in Southern Africa by 2020 and in Africa by 2025.*
- ✓ *Emvelo's core purpose is to develop and own utility scale solar thermal power plants*

1.1: Emvelo's Karoshoek 1GW Solar Valley



Project Site



Transmission Network

Located near Upington, Northern Cape and has one of the best solar radiation in the world.

Karoshoek Solar Valley project opportunities:

- Special purpose companies (SPC) will own Solar power facilities at Karoshoek
- Karoshoek site has excellent characteristics
- The vision for Karoshoek Solar Valley Park is to roll out 1 GW of solar projects by 2025

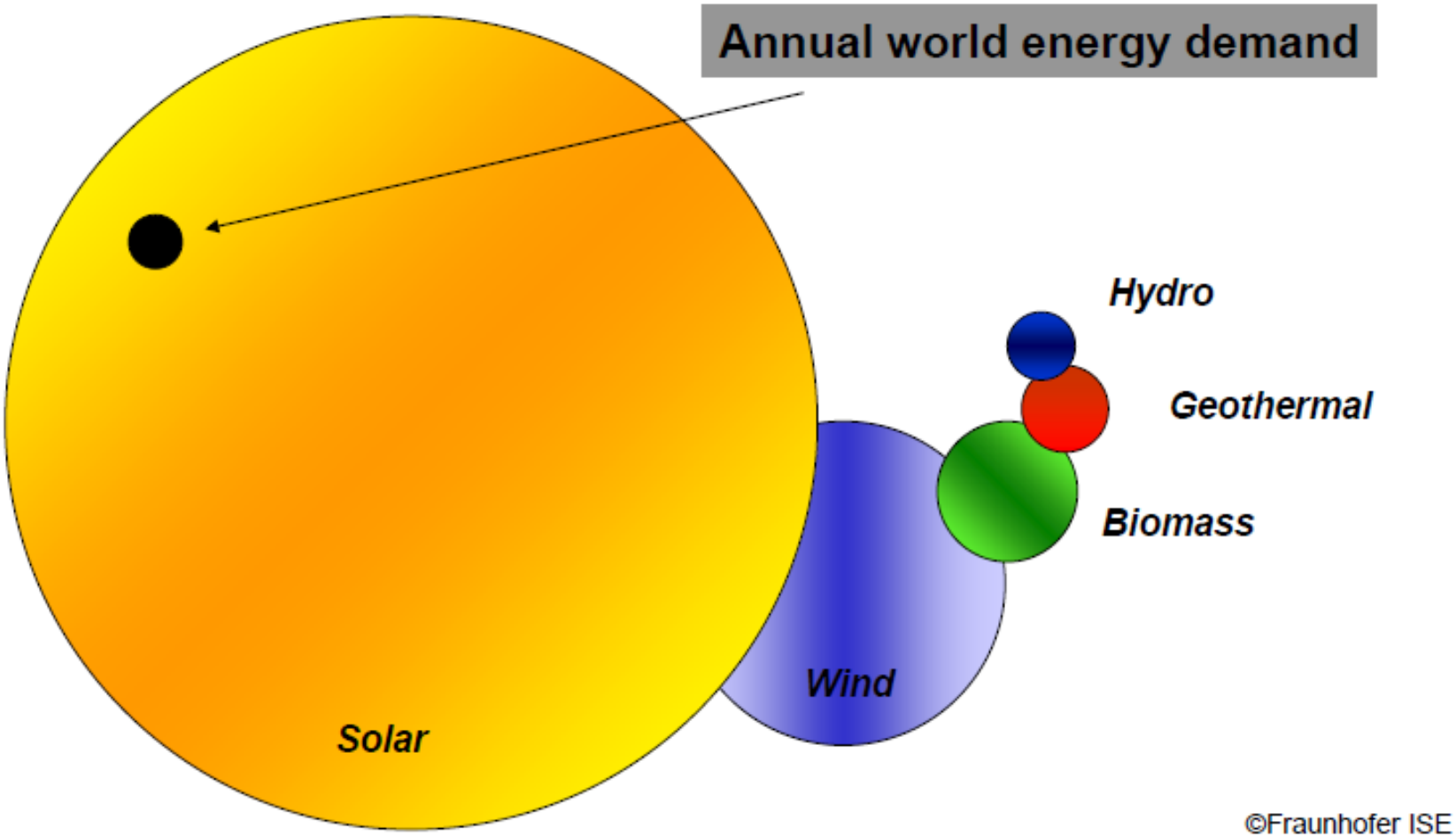
Transmission Infrastructure:

- Karoshoek Solar Valley is located in the middle of the 400kV infrastructure network currently under development (Green lines)
- The 400kV Solar Park Sub will tie into the 132kV Gordonia Sub in Q1 of 2017.
- The first 200-300MW from Karoshoek plants will connect to the 132kV line located on the western side of Karoshoek.

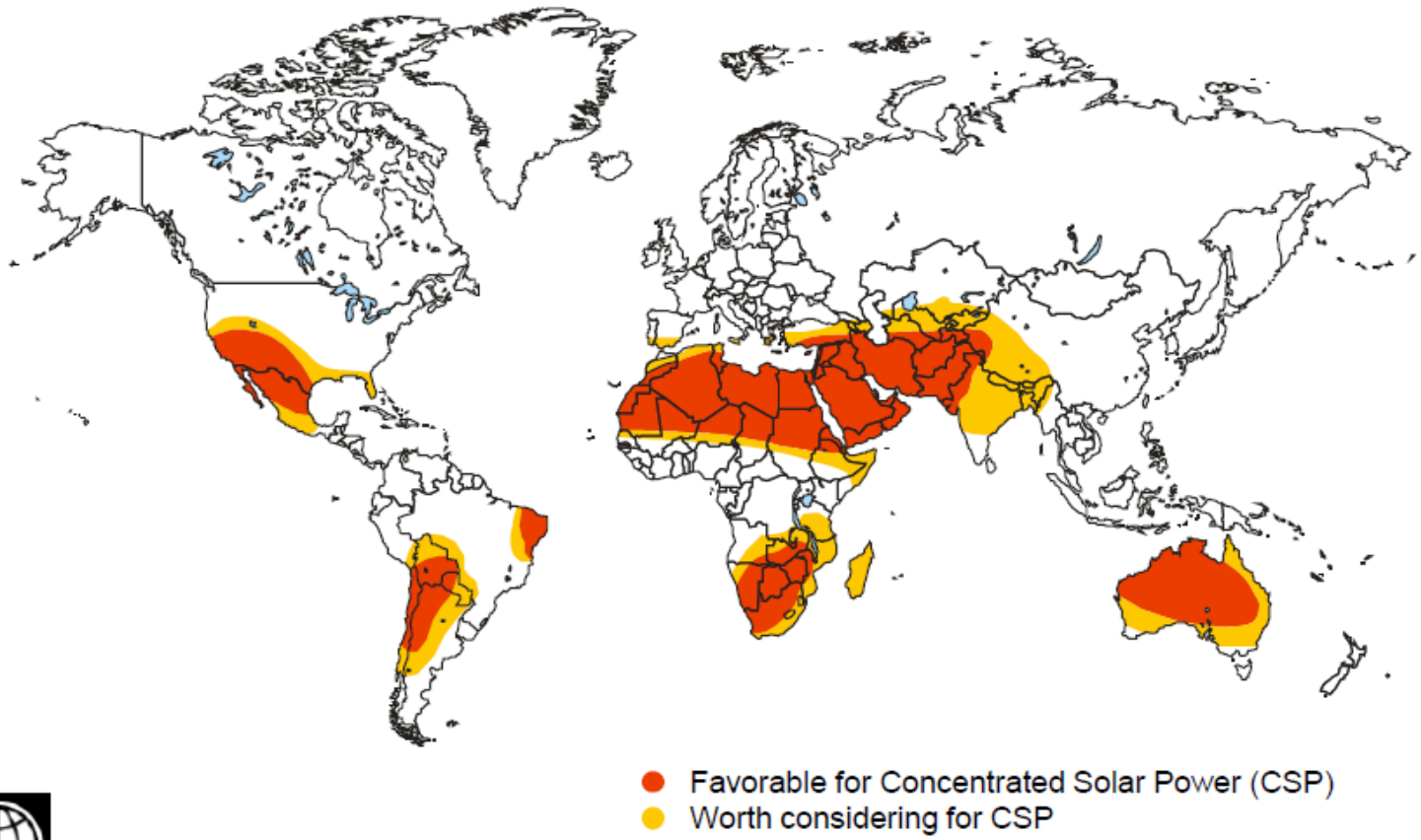
Water Supply:

- The Department of Water Affairs has confirmed that there is water available for the Karoshoek plants (Orange River).
- All the Karoshoek plants will have a lower water footprint as they will utilise dry cooling technology

2: Global Renewable Energy Resources



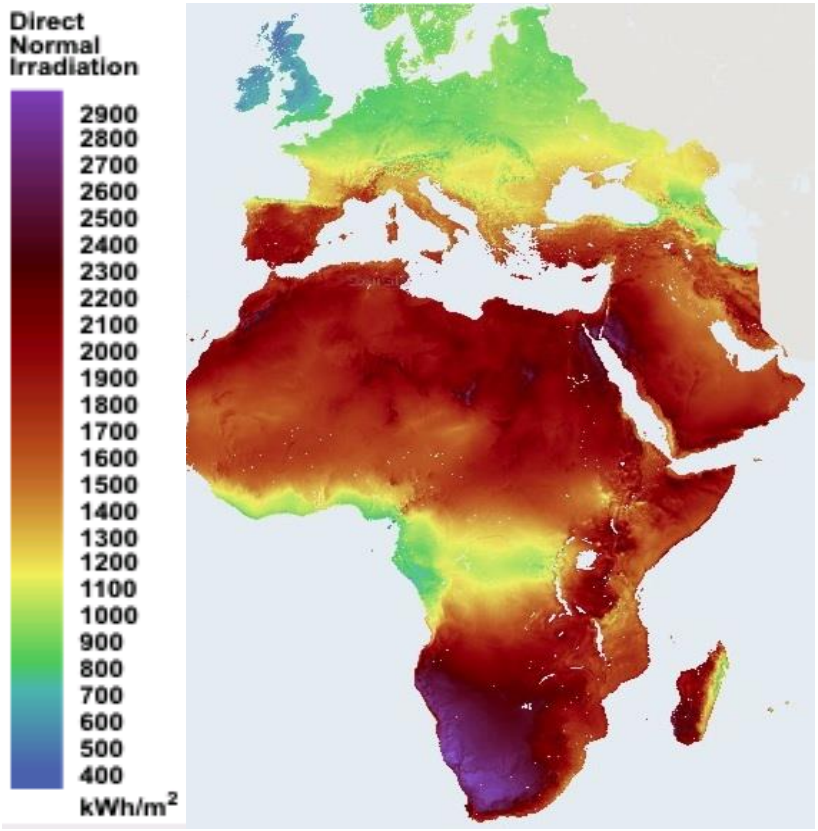
2.1: Global Solar Resources for CSP

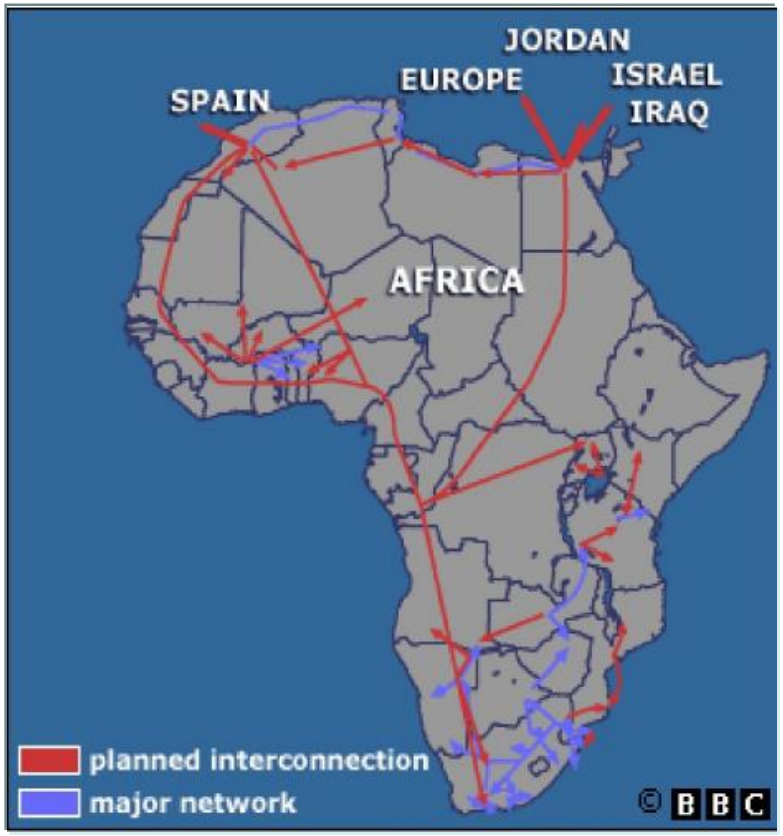


- The SADC & North Africa “sweet spots” for CSP are very large in land area and have the potential to generate multiples of the continent’s electricity needs and possible export to a Europe supportive of reducing global climate change impacts.

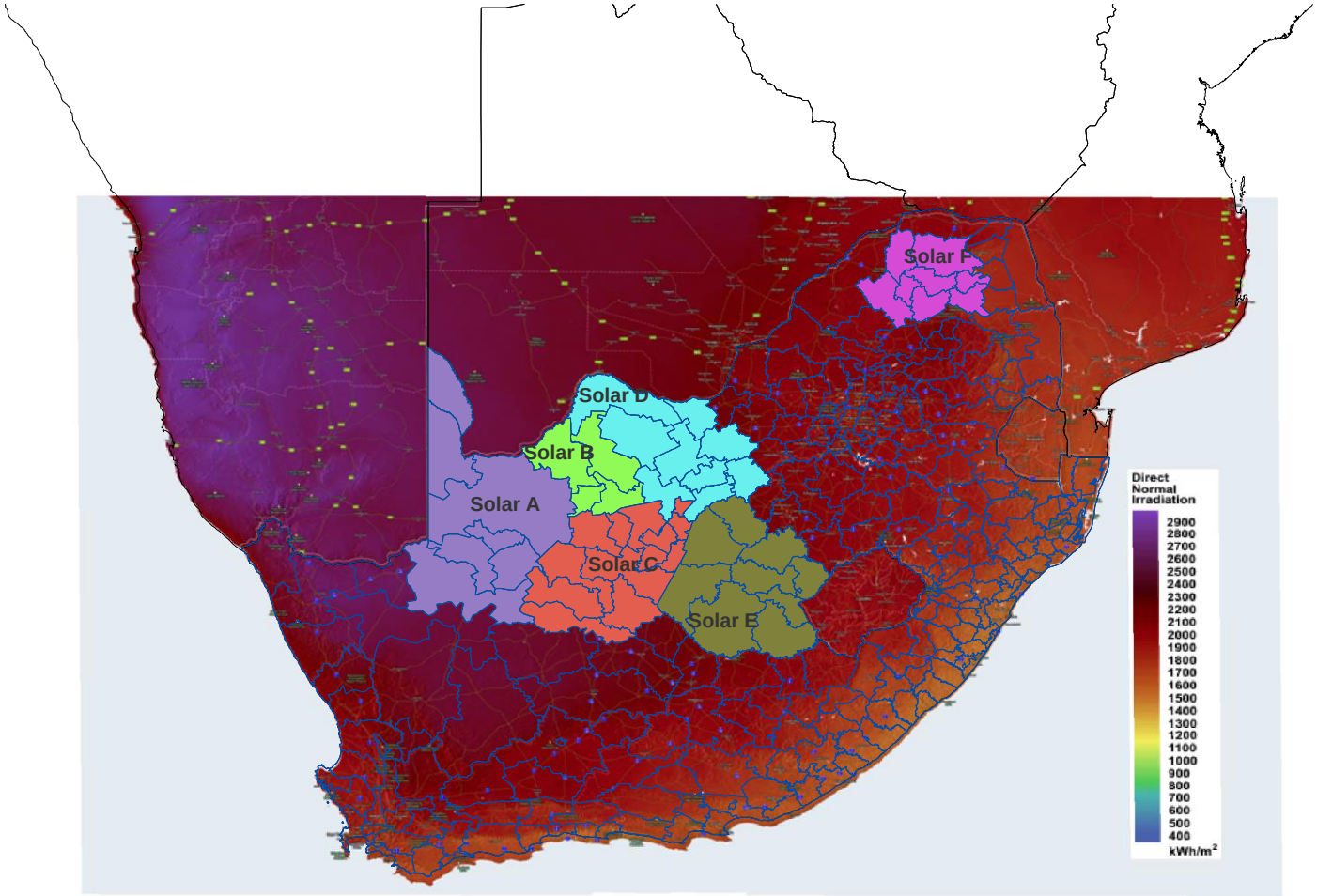
2.2: Africa's Solar Resources for CSP

- Africa'Solar Thermal Fuel (DNI) and Transmission Infrastructure to evacuate power generated by CSP Power Stations



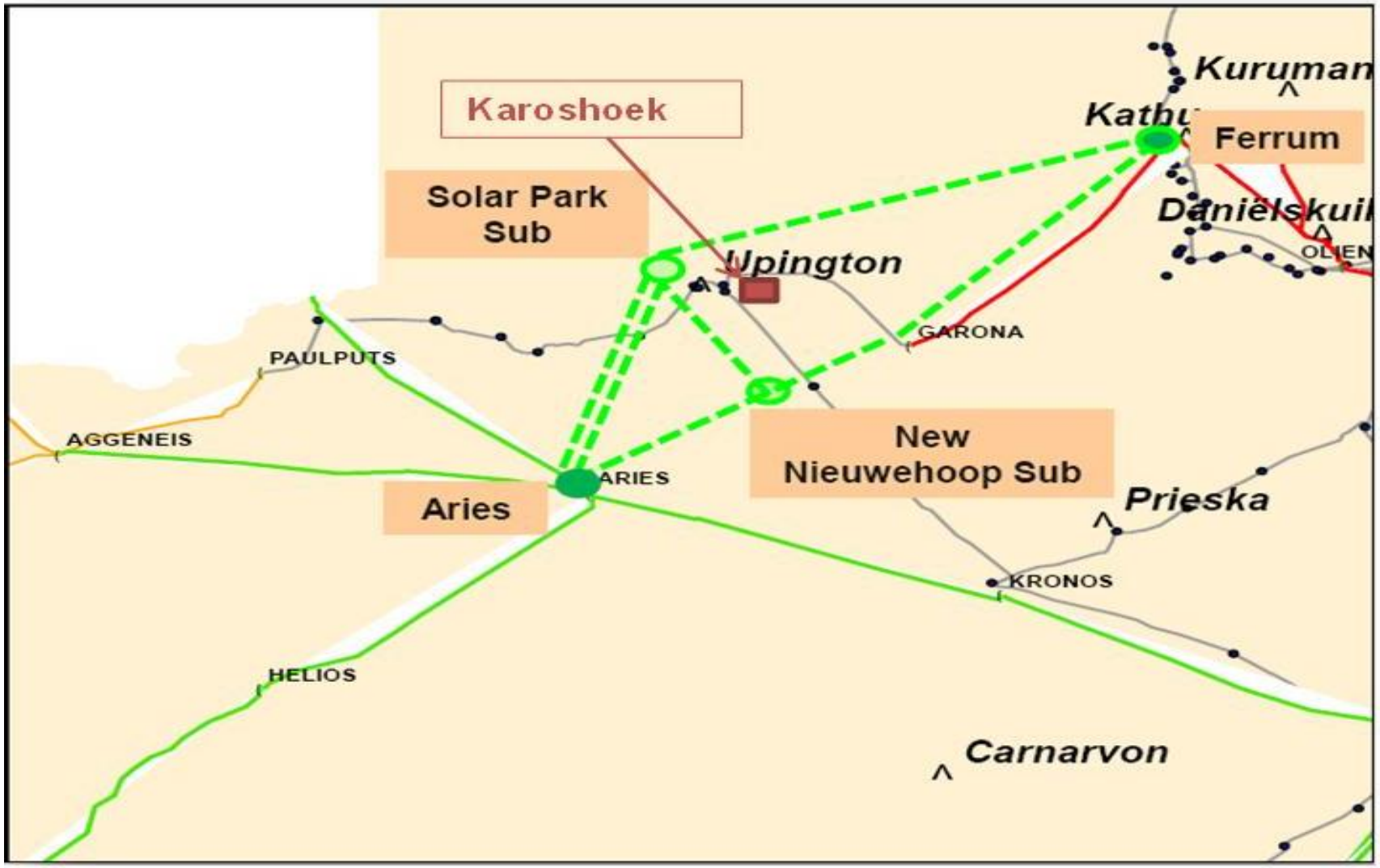


2.3: South Africa's CSP 'Sweetspots'



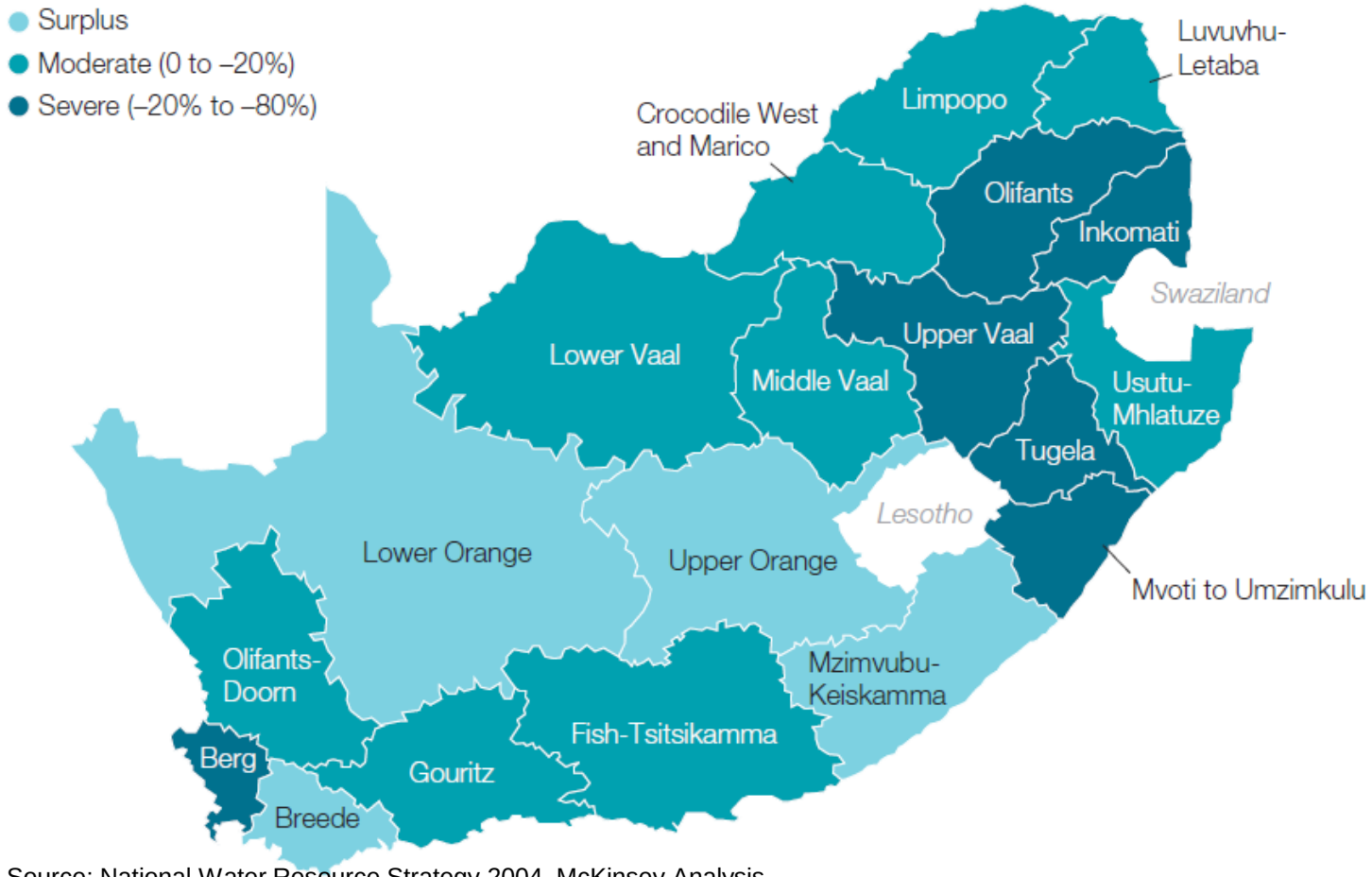
- No limitations on DNI in South Africa and the rest of Africa

2.4: South Africa – Transmission Infrastructure



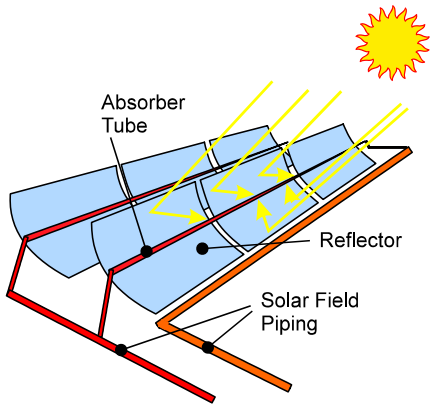
2.5: Water Availability

Gap between existing supply and projected[1] demand in 2030,
% of 2030 demand

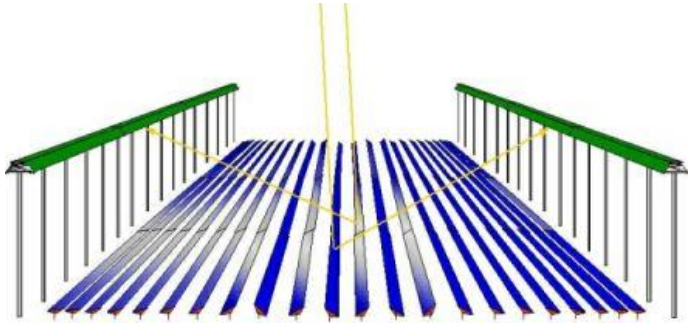


Source: National Water Resource Strategy 2004, McKinsey Analysis

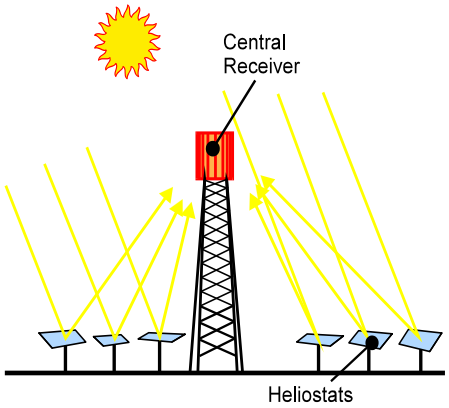
3: CSP Technologies that we use to mine the sun?



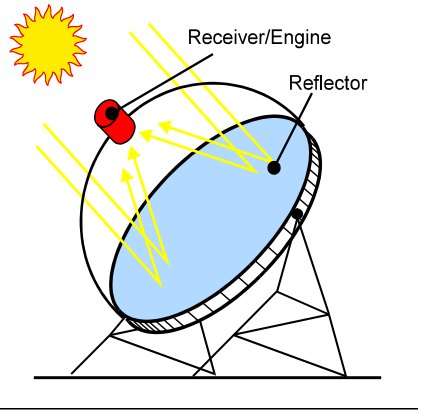
Parabolic troughs



Linear Fresnel Reflectors

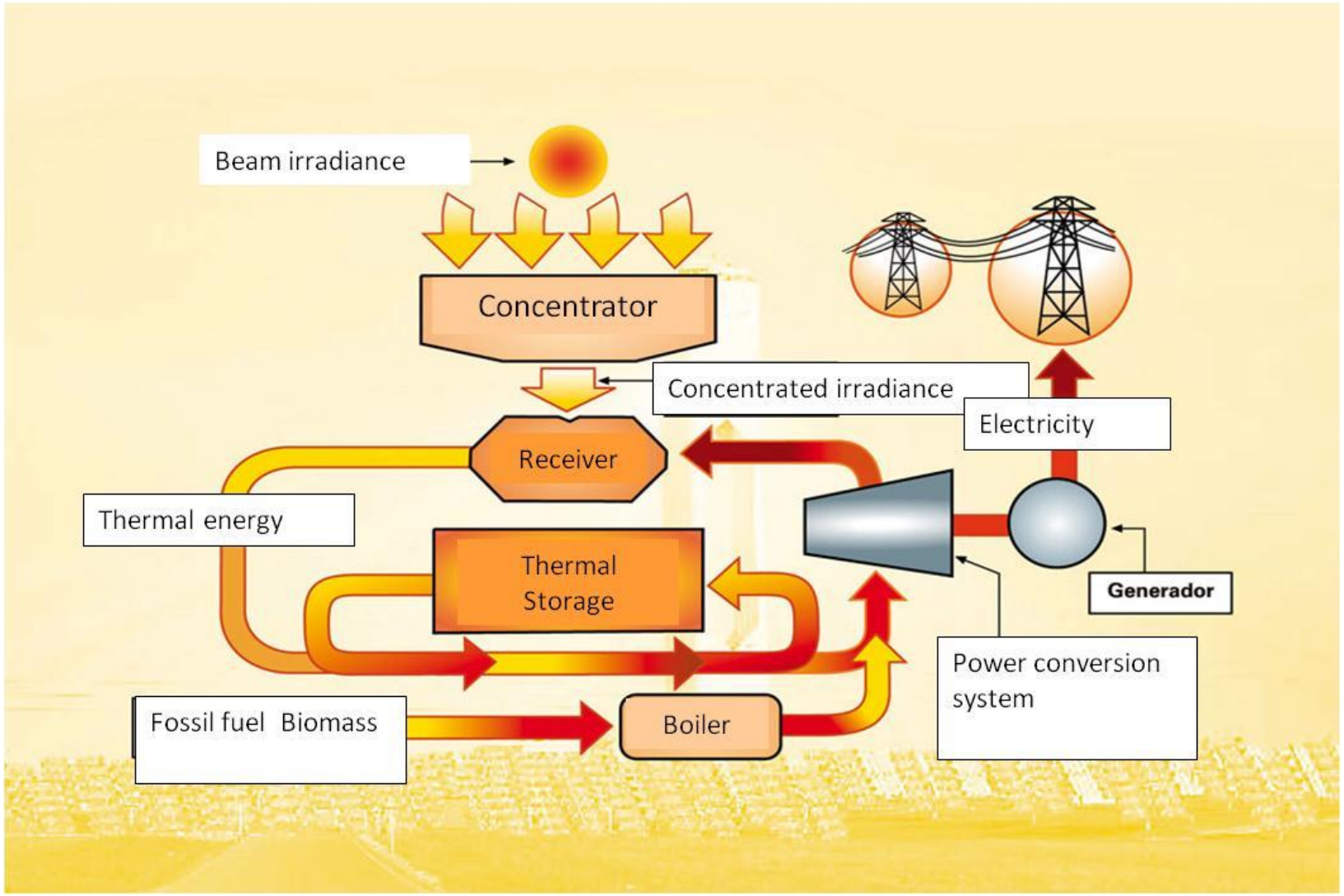


Central Receiver / Heliostats



Parabolic dishes

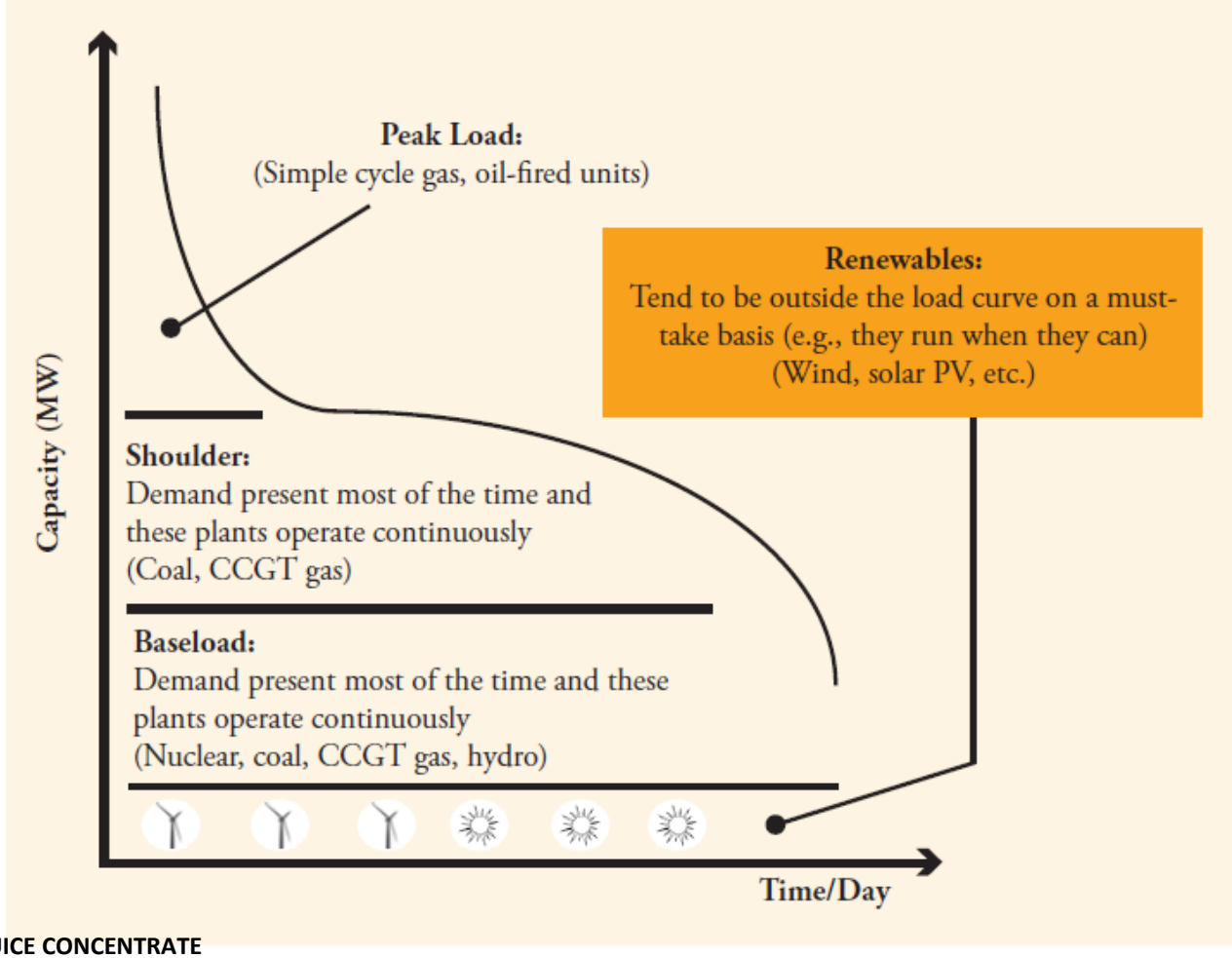
3.1: Concetrated Solar Power – How it works?



Source: LEORNADO ENERGY

4: Peak, Mid merit & Baseload Capabilities

- **CSP Power Stations** for the production of sustainable **peak**, **mid merit** (shoulder) and **base load** solar thermal electricity in Southern Africa.



Source: WRI, JUICE CONCENTRATE

4.1 : CSP Power Stations with Storage

ANDASOL 1 – 7.5 HOURS STORAGE

GEMASOLAR – 15 HOURS STORAGE

5: Renewable Energy – REIPPPP CSP Projects to date

Impact of the R1 and R2 CSP projects

Investment: *SA's first 3 CSP projects will attract investment of R15,8bn, of which R4,0bn will be spent on local content, as per an analysis conducted by the DOE*

Jobs: *the DOE analysis further indicated that the 3 projects will create 1,827 construction and 120 operations and maintenance jobs*

- Round 1 Preferred Bidders:

KaXu Solar One	1.2
State/Region	Bokpoort
Gross Capacity	100MW
Developers	Abengoa Industrial Development Corporation
EPC Group	Abener
Technology	Parabolic Trough
Cooling Technology	Dry
Storage (Hours)	3.00

Khi Solar One	1.3
State/Region	Upington
Gross Capacity	50MW
Developers	Abengoa Industrial Development Corporation
EPC Group	Abener
Technology	Tower
Cooling Technology	Dry
Storage (Hours)	2.00

- Round 2 Preferred Bidders:

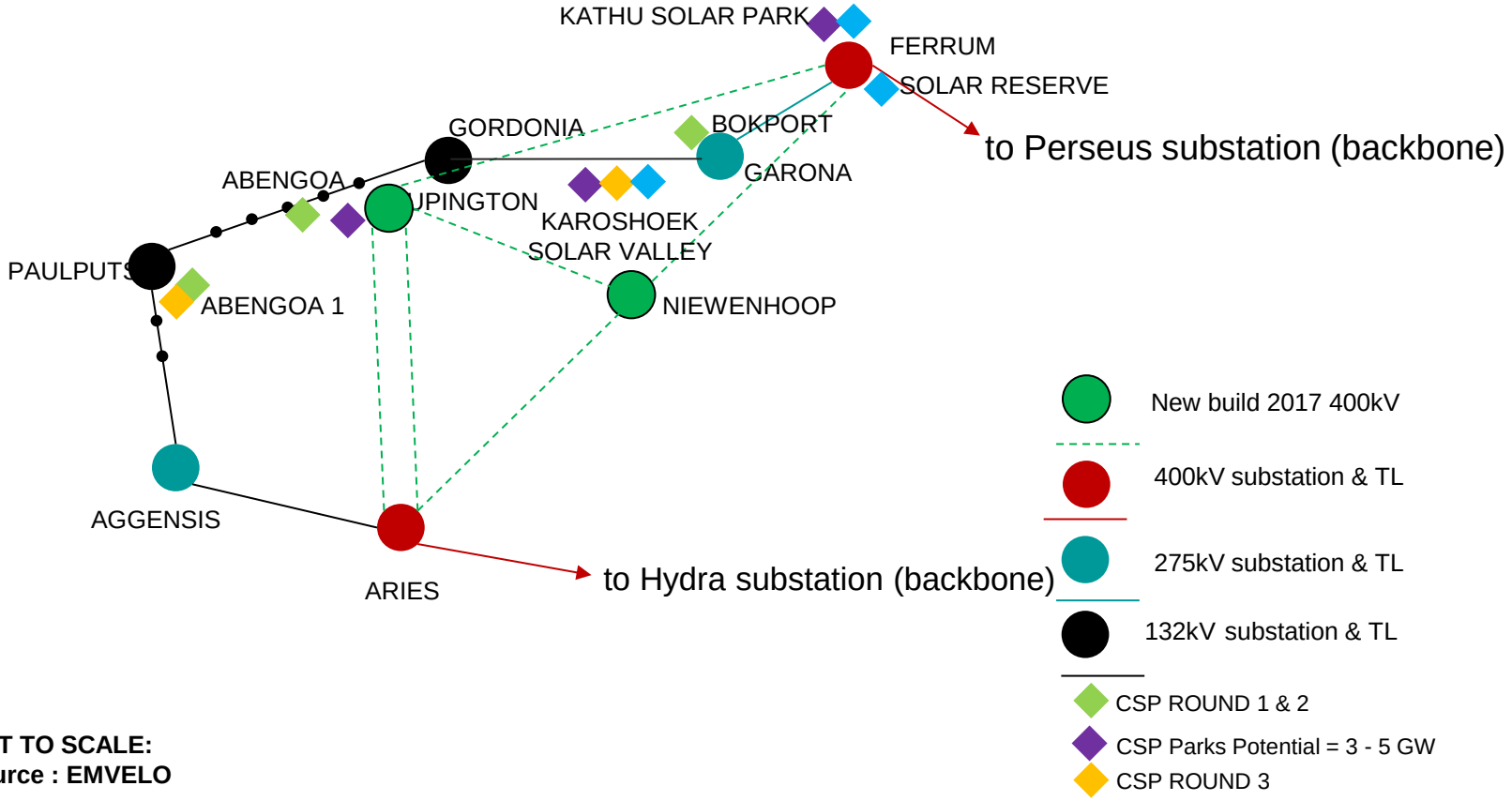
Bokpoort Solar Facility	2.2
State/Region	Northern Cape Province
Gross Capacity	50MW
Developers	ACWA, Solafrica Thermal Energy
EPC Group	A consortium made up of Sener, Acciona, TSK and Crowie will form the EPC consortium responsible for the construction works, commissioning and start-up of the power plant
Technology	Parabolic Trough
Cooling Technology	Dry
Storage (Hours)	9.00

- In Round 3, 2 CSP projects, each of 100MW gross capacity, were awarded as Preferred Bidders – these projects were submitted by the Abengoa and Emvelo/Ilanga 1 consortiums and are currently working towards reaching Financial Close

- In Round 3.5, 3 CSP projects, each of 100MW, we submitted by ACWA, Emvelo / Ilanga 2 and GDF Suez consortiums. The 2 preferred bidders will be announced in August 2014

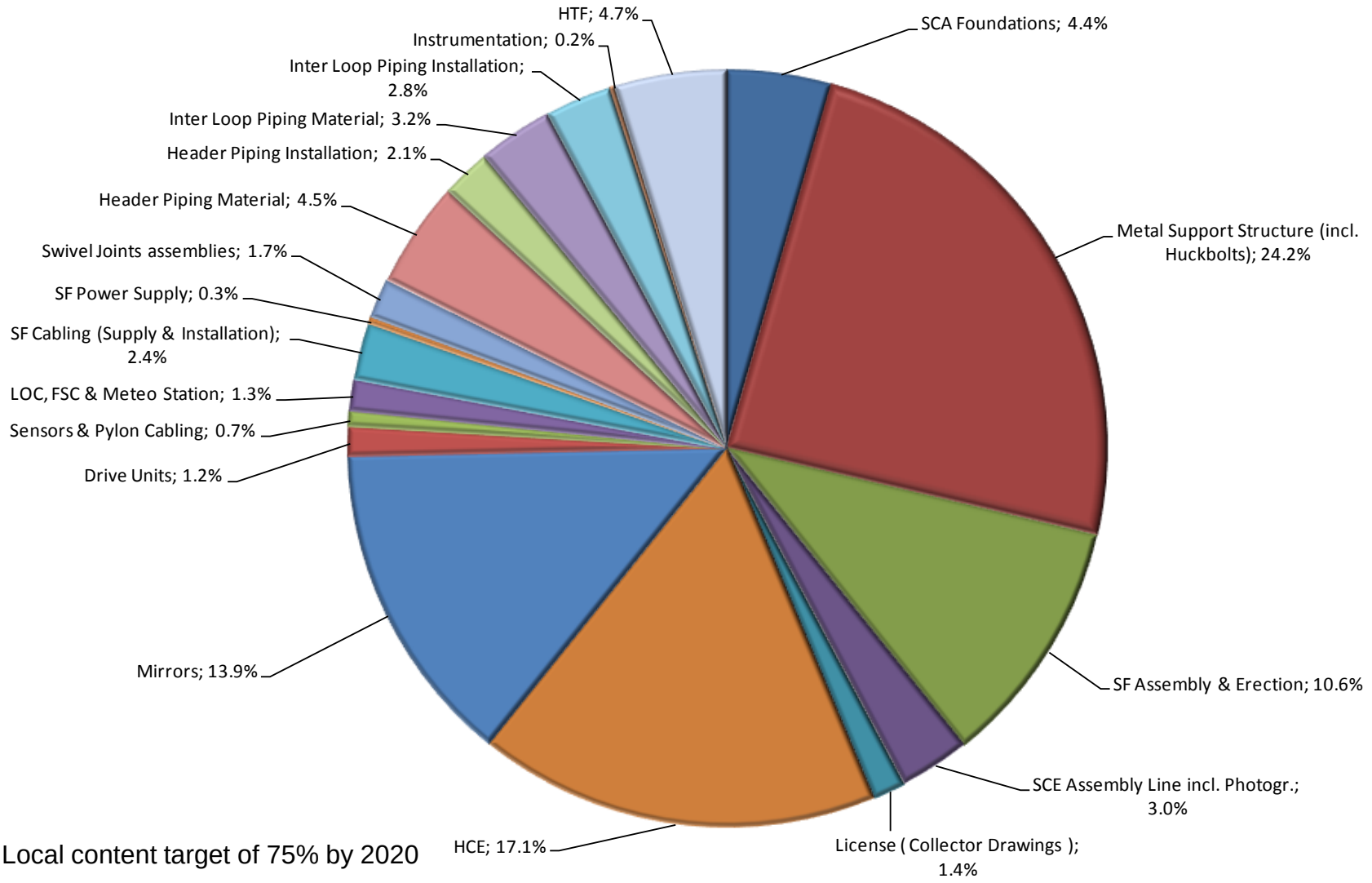
5.1 : CSP Projects in construction & development

- Round 1 and Round 2 Projects under construction (200 MW) -
- Round 3 Projects under construction (200 MW)
- Round 3.5 projects in finsncisl close (200 MW)



NOT TO SCALE:
Source : EMVELO

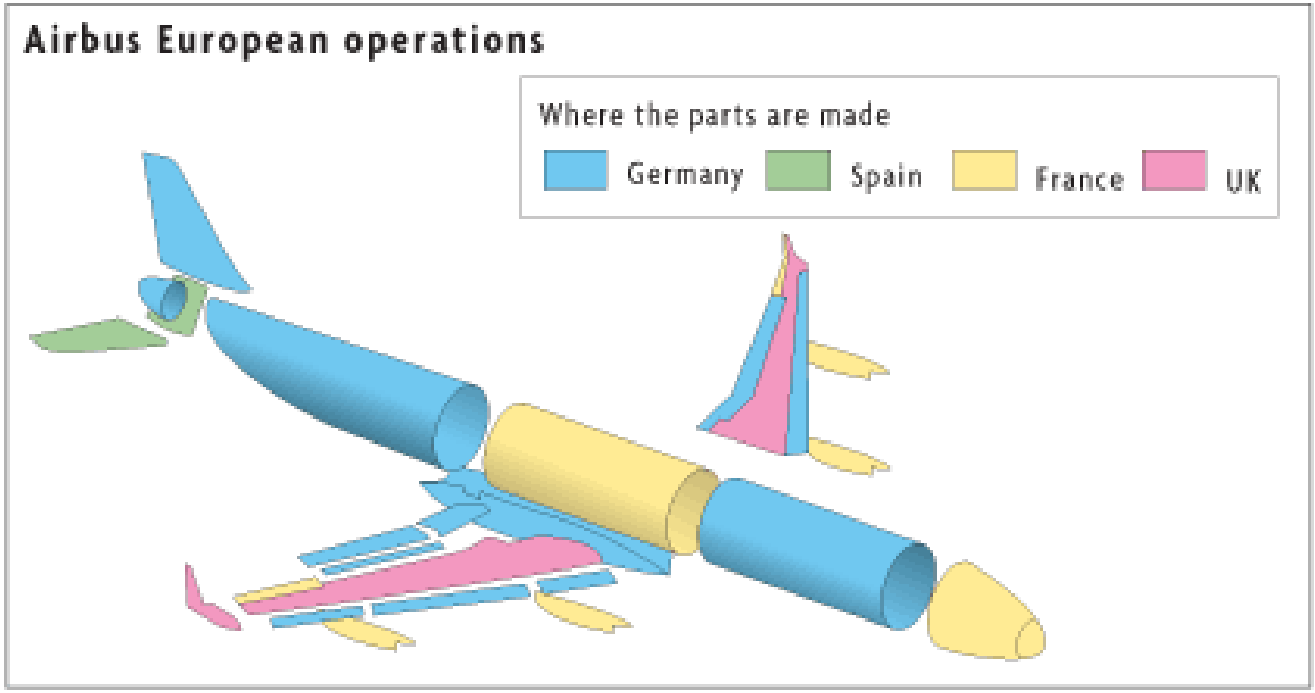
6: Localisation & Industrialisation - CSP Components



Local content target of 75% by 2020

6.1 : CSP - Regional Airbus Manufacturing Model

- We can create a regional industry that **manufactures CSP components** in Southern Africa by adopting the **'airbus model',** where SADC **countries** can manufacture different CSP components for Regional Solar Thermal Power Stations.



7 : CSP 2030 Strategy & Action Plan

SASTELA

the dti
Department:
Trade and Industry
REPUBLIC OF SOUTH AFRICA

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Assessment of the localisation, industrialisation and job creation potential of CSP infrastructure projects in South Africa - 2030 Strategy & Action Plan

enolcon

ERNST & YOUNG

7.1 : 2030 CSP Strategy & Action Plan

- ***Scenario A*** - ***IRP 2010 Scenario:*** deployment of the 1GW of CSP in the IRP 2010 by 2020 instead of 2025*;*

- ***Scenario B*** - ***Northern Cape Solar Corridor (NOCASCO) Scenario****:* this scenario is in line with the 5 GW solar park/corridor under investigation by the DoE

- ***Scenario C – 60% CSP*****:** this scenario assumes that the Conventional Energy Options (Nuclear) in the IRP 2010 are not deployed and are replaced by 60% of CSP with storage alongside gas power; and

- ***Scenario D*** - ***SADC Scenario***: as per Scenario C, plus an additional deployment of 10GW of CSP power stations across (SADC)

Scenario	Total (GW)	By 2020	By 2025	By 2025 for export	By 2030	By 2040
Scenario A	**1GW**	1GW				
Scenario B	**6GW**		5GW	1GW		
Scenario C	**12GW**				10GW 2GW hybridisation	
Scenario D	**22GW**				10GW 2GW hybridisation	10GW SADC

7.2 : CSP 2030 Strategy – Economic Contribution

	Total (GW)	Contribution to GDP [1]	Full time jobs created in peak year[2]	Job years [3]	Net CSP foreign trade balance[4]
Scenario A	1GW	R24bn	3,500	60,000	(R19bn)
Scenario B	6GW	R108bn	17,000	320,000	(R37bn)
Scenario C	12GW	R205bn	35,000	750,000	(R88bn)
Scenario D	22GW	R251bn	37,000	790,000	R34bn[4]

Source: EY analysis

8 : Connecting with the NDP

- **CHAPTER 3 : ECONOMY & EMPLOYMENT**
  - ✓ CSP can play a key role in helping drive down the unemployment rate from 24.9% to 14% by 2020
- **CHAPTER 4 : ECONOMIC INFRASTRUCTURE**
  - CSP can help achieve the following objectives and actions:
  - ✓ The proportion of people with access to the electricity grid should rise to at least 90% by 2030, with non grid available for the rest.
  - ✓ The country would need an additional 29 000MW of electricity by 2030. About 10 900MW of existing capacity is to be retired implying new build of more than 40 000MW
  - ✓ At least 20 000MW of this capacity should come from renewable sources.
  - ✓ Move to less carbon intensive electricity production through procuring at least 20 000MW of renewable energy, increased hydro imports etc..

8.1 : Connecting with the NDP

- **CHAPTER 5 : ENVIRONMENTAL SUSTAINABILITY & RESILIENCE**
  - ✓ At least 20 000MW of renewable energy should be contracted by 2030

9: Conclusion

- **CSP lifetime**, unlike other renewables (PV & Wind) has a **35+ year lifetime** which is **close to** other **convetional options (coal & nuclear).**
- A CSP roll out will **position South Africa** and **the region to challenge Saudi Arabia (25 GW by 2030**) for the race to become a **global leader in the industrialisation, manufacturing, deployment of CSP and export of CSP components.**
- CSP can contribute immensely to localisation & Job Creation and will fulfill the objectives of the following interventions
  - **New Development Plan.**
  - **The National Climate Change Response Policy.**
  - **The New Growth Path and the Industrial Policy Action Plan.**
  - **The Green Economy Accord**

Contact Details

THANK YOU

pancho@emvelo.co.za
+27 10 003 5070