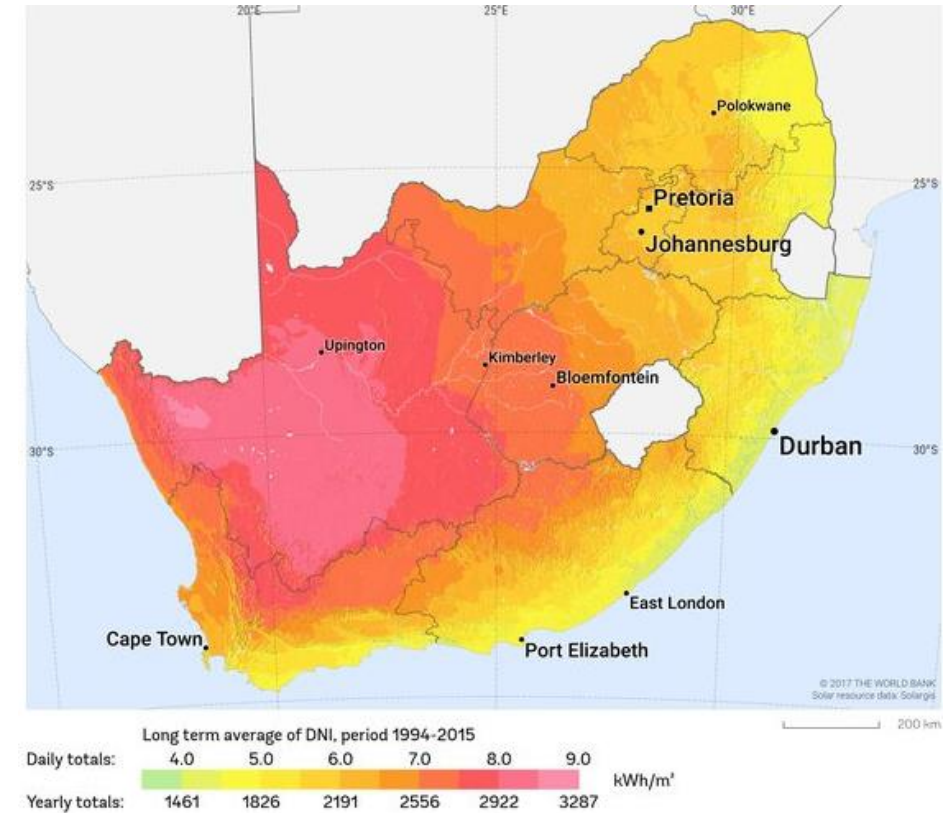


Solar CSP in South Africa: Definition, Status & Opportunities



Speaker

Tony Tiyou – CEO, Renewables in Africa (RiA)

AGENDA

What is Renewables in Africa?

1. What is Solar CSP?
2. Why is Solar CSP important?
3. What is the status for Solar CSP in South Africa?
4. Where are the opportunities in the region?
5. Conclusions

WE ARE ALL IN THIS TOGETHER...

In Memory of all the victims of Coronavirus (COVID-19)
across the World.



What is Renewables in Africa?

1. What is Solar CSP?
2. Why is Solar CSP important?
3. What is the status for Solar CSP in South Africa?
4. Where are the opportunities in the region?
5. Conclusions

WHAT IS RENEWABLES IN AFRICA (RIA)?

A Clean Energy Engineering Company serving
Developers, Investors, Project Owners.

- ✓ **Project Origination Services** to help clients identify right projects
- ✓ **Market insights & business intelligence** to support market entry or market growth.

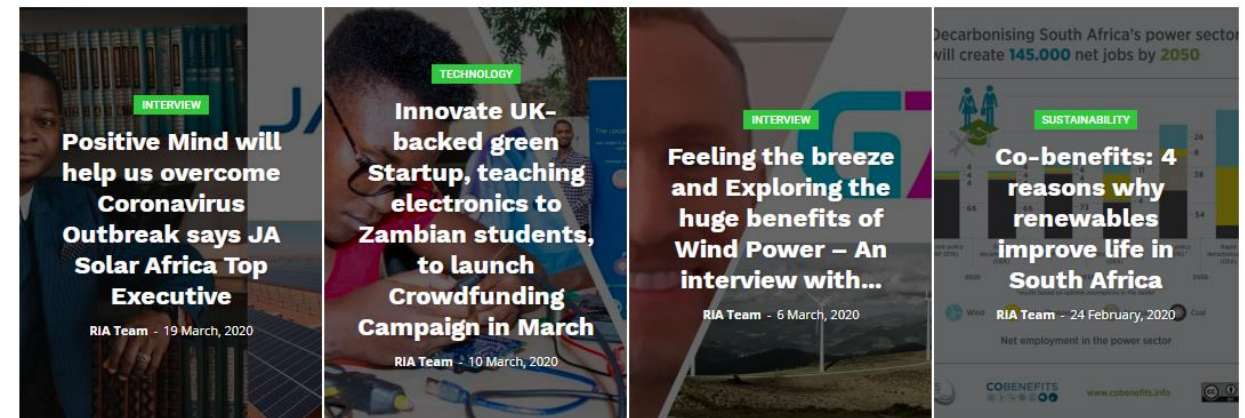
A Media platform, African Clean Energy Champion:

- ✓ **Promotion** and **awareness building** about Renewable Energy to businesses and general public.

Our Mission: **Bring (Back) Power to Africa**



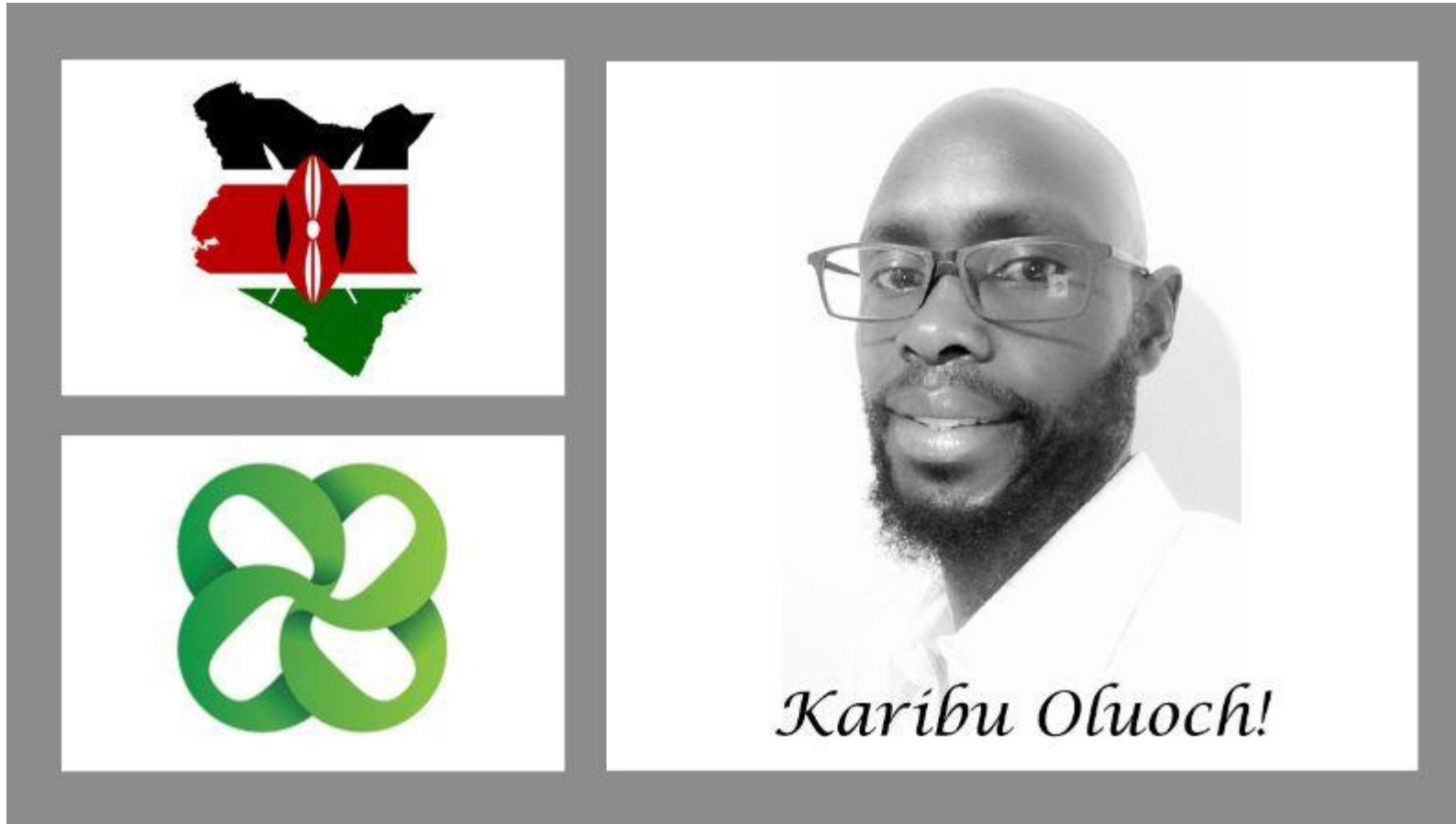
HOME WORKSHOP ABOUT SERVICES UPCOMING EVENTS WIBA GET IN TOUCH



WHAT'S SPECIAL ABOUT US

WHAT IS RENEWABLES IN AFRICA (RIA)?

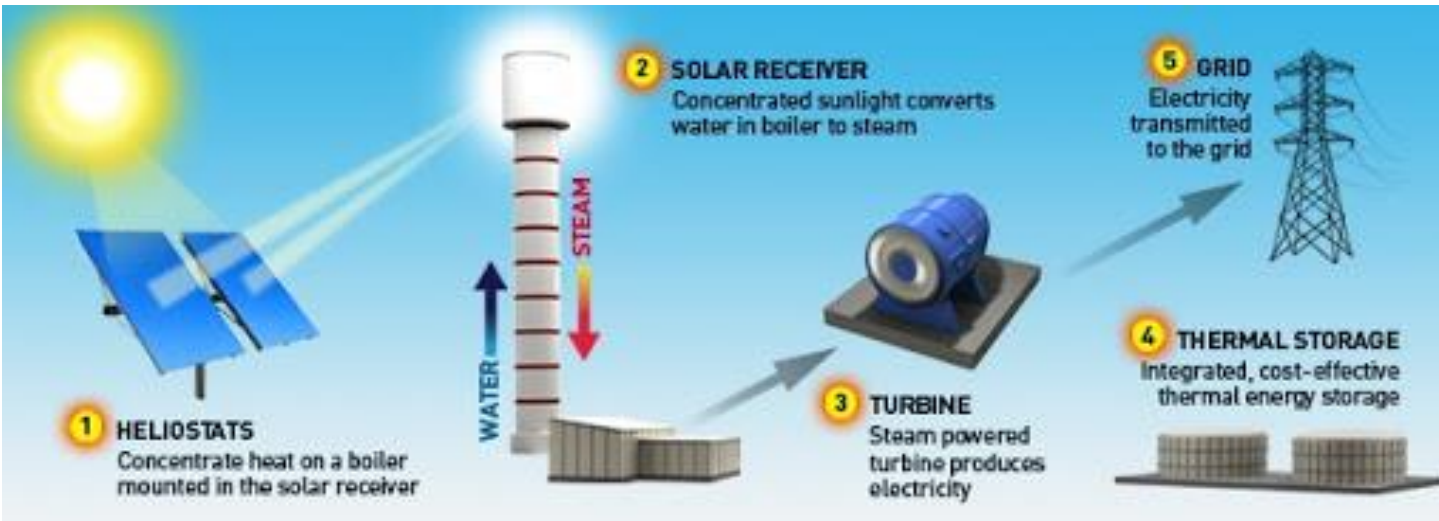
New Appointment: Oluoch Were - Regional Director Kenya & East Africa



What is Renewables in Africa?

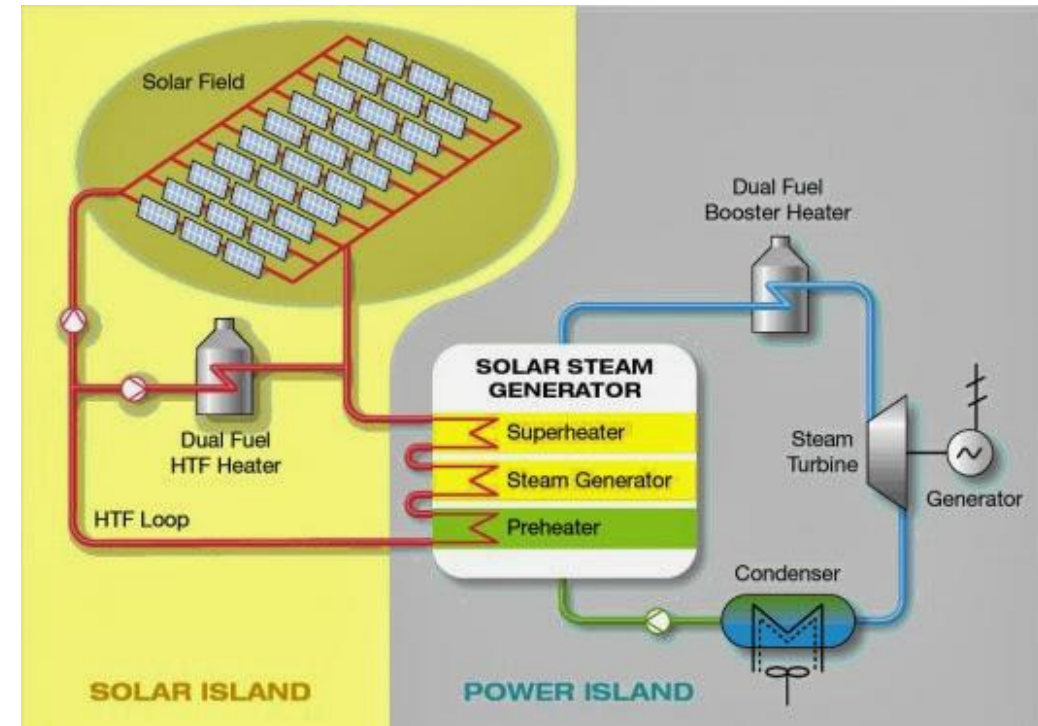
1. What is Solar CSP?
2. Why is Solar CSP important?
3. What is the status for Solar CSP in South Africa?
4. Where are the opportunities in the region?
5. Conclusions

WHAT IS SOLAR CSP?



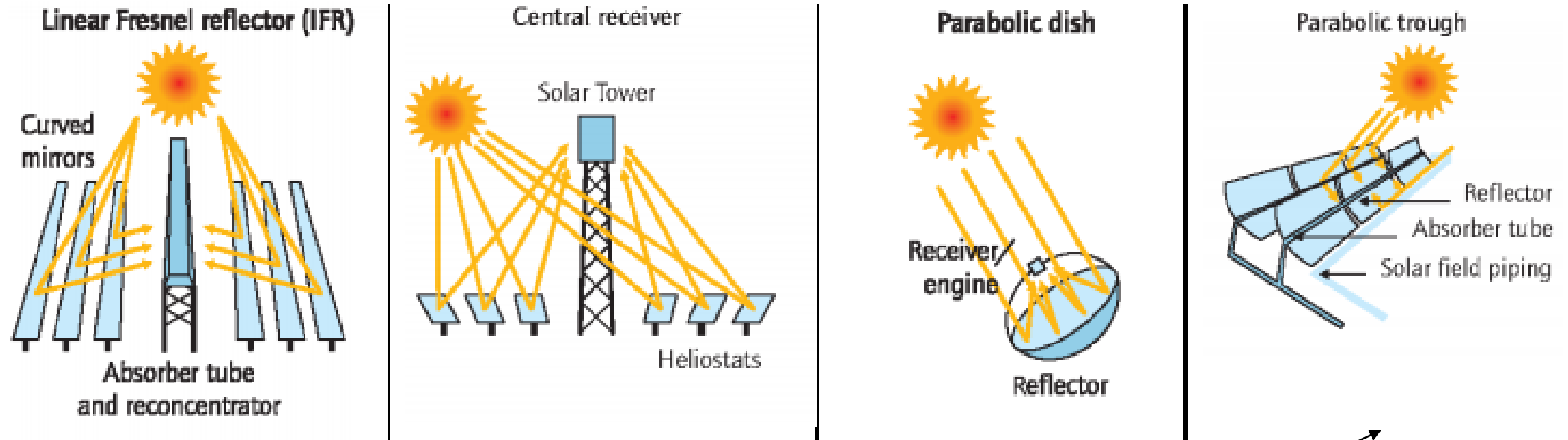
CSP plants generate electric power by using mirrors to concentrate (focus) the sun's energy and convert it into high-temperature heat.

From the power side works like any steam engine, gas turbine!!



DIFFERENT TYPES OF SOLAR CSP

There are four types generally speaking



Source: IEA (2010), *Technology Roadmap: Solar thermal electricity*.

Only these 2 types in South Africa

DIFFERENT TYPES OF SOLAR CSP



Power Tower

Noor plant, Ouarzazate
(Morocco)



Parabolic Trough



Linear Fresnel



Parabolic Dish

What is Renewables in Africa?

1. What is Solar CSP?

2. Why is Solar CSP important?

3. What is the status for Solar CSP in South Africa?

4. Where are the opportunities in the region?

5. Conclusions

WHY IS SOLAR CSP IMPORTANT?

- Solar PV can be deployed everywhere Solar CSP can but not the Opposite (To be economic direct normal irradiance levels (DNI) of **2000 kWh/m²/year** needed).
- PV market is scaling up much more faster than CSP. **Factor of 20** btw annual additions: 575 TWh vs 25 TWh (Source: IEA, ISA).
- PV cost reductions have been rapid and sharp compared to CSP.

So why should we be looking at CSP then?

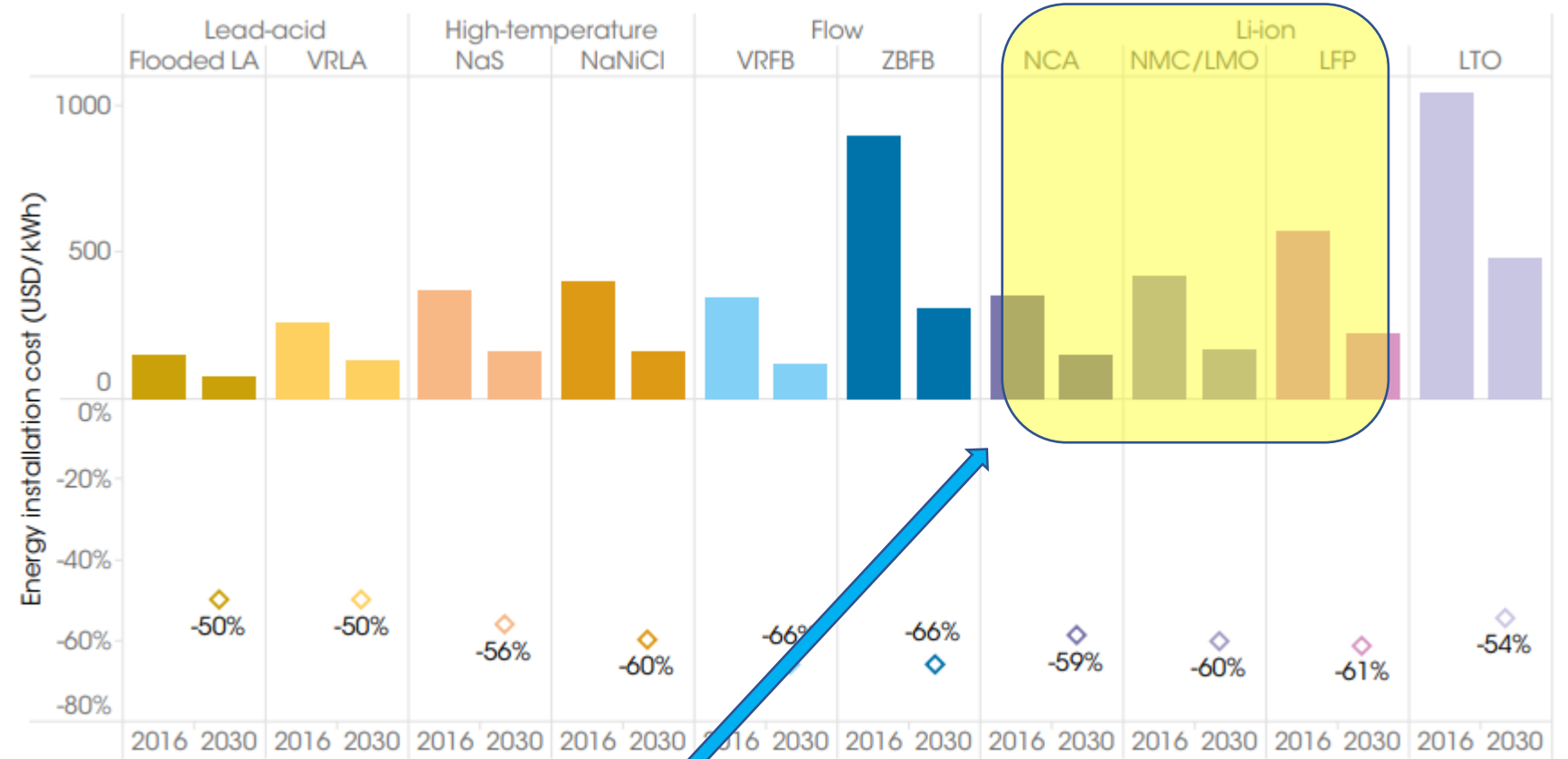


2 key words: **Thermal Storage**

STORAGE IMPLICATION

- 100 MW plant with 12 h of storage max. capacity stores 1200 MWh.
- The largest battery storage of 100 MW only delivers 129 MWh of energy.

The critical issue? → **The cost per kWh of storage.**



Note: LA = lead-acid; VRLA = valve-regulated lead-acid; NaS = sodium sulphur; NaNiCl = sodium nickel chloride; VRFB = vanadium redox flow battery; ZBFB = zinc bromine flow battery; NCA = nickel cobalt aluminium; NMC/LMO = nickel manganese cobalt oxide/lithium manganese oxide; LFP = lithium iron phosphate; LTO = lithium titanate.

Source: Irena, Electricity Storage and Renewables, 2017

Current Li-ion Batteries costs range: **USD 220 – 300 per kWh**

What is Renewables in Africa?

1. What is Solar CSP?

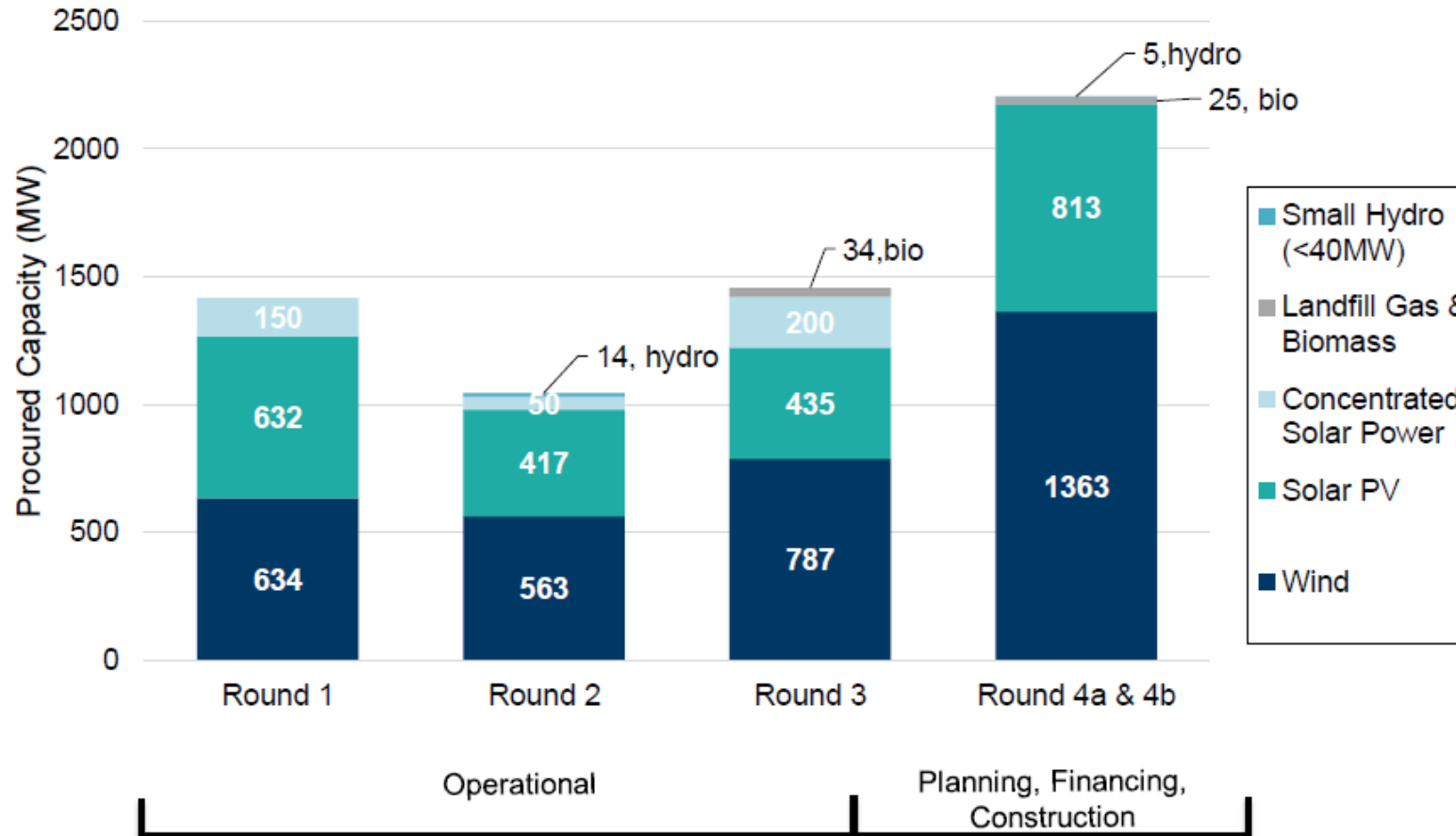
2. Why is Solar CSP important?

3. What is the status for Solar CSP in South Africa?

4. Where are the opportunities in the region?

5. Conclusions

POWER CAPACITY DEVELOPMENT



Source: Blue Horizon, 2018

Since launch of REIPPPP, South Africa has procured > 6.4 GW from more than 90 utility-scale RE IPPs. Mostly wind (55%), solar PV (38%) and **300 MW of Solar CSP**.

SOLAR CSP PROJECTS IN SOUTH AFRICA

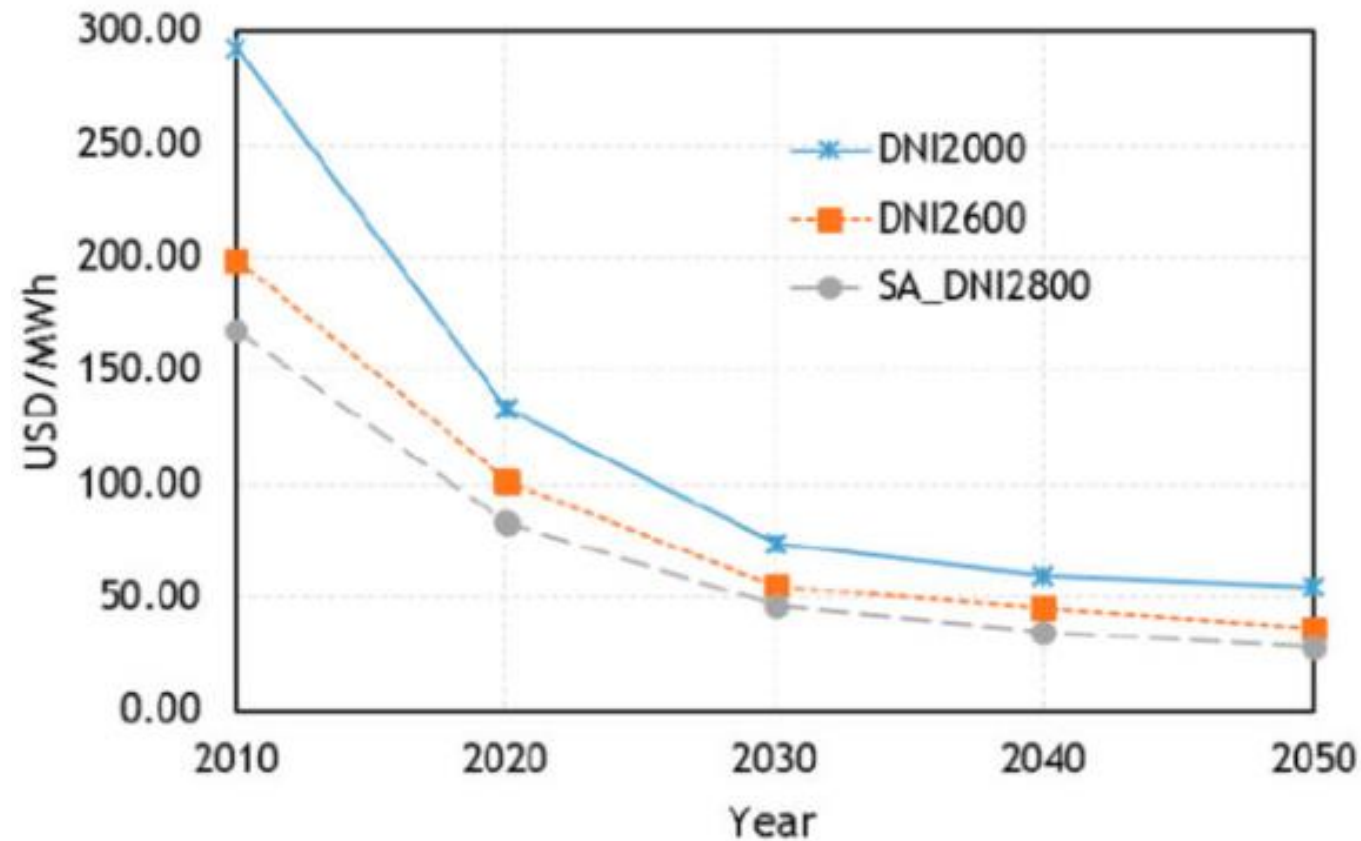
Project name	Technology	Capacity (MW)	REIPPPP Window	Nearest town	Status
Bokpoort CSP	Parabolic trough	50	2	Groblershoop	Operational
Eskom CSP	Tower	100	other	Upington	Construction
Ilanga CSP 1	Parabolic trough	100	3	Kimberley	Construction
Kathu Solar Park	Parabolic trough	100	3	Kuruman	Operational
Kaxu solar 1	Parabolic trough	100	1	Pofadder	Operational
Khi solar 1	Tower	50	1	Upington	Operational
Redstone CSP	Tower	100	3	Postmasburg	Planning
Xina CSP	Parabolic trough	100	3	Pofadder	Operational
Totals	8	700			

CSP cost of electricity
(Round 3):
R1.69/kWh≈\$0.09/kWh)

CSP Projects in South Africa

NB: Additional information in RiA Solar Tracker

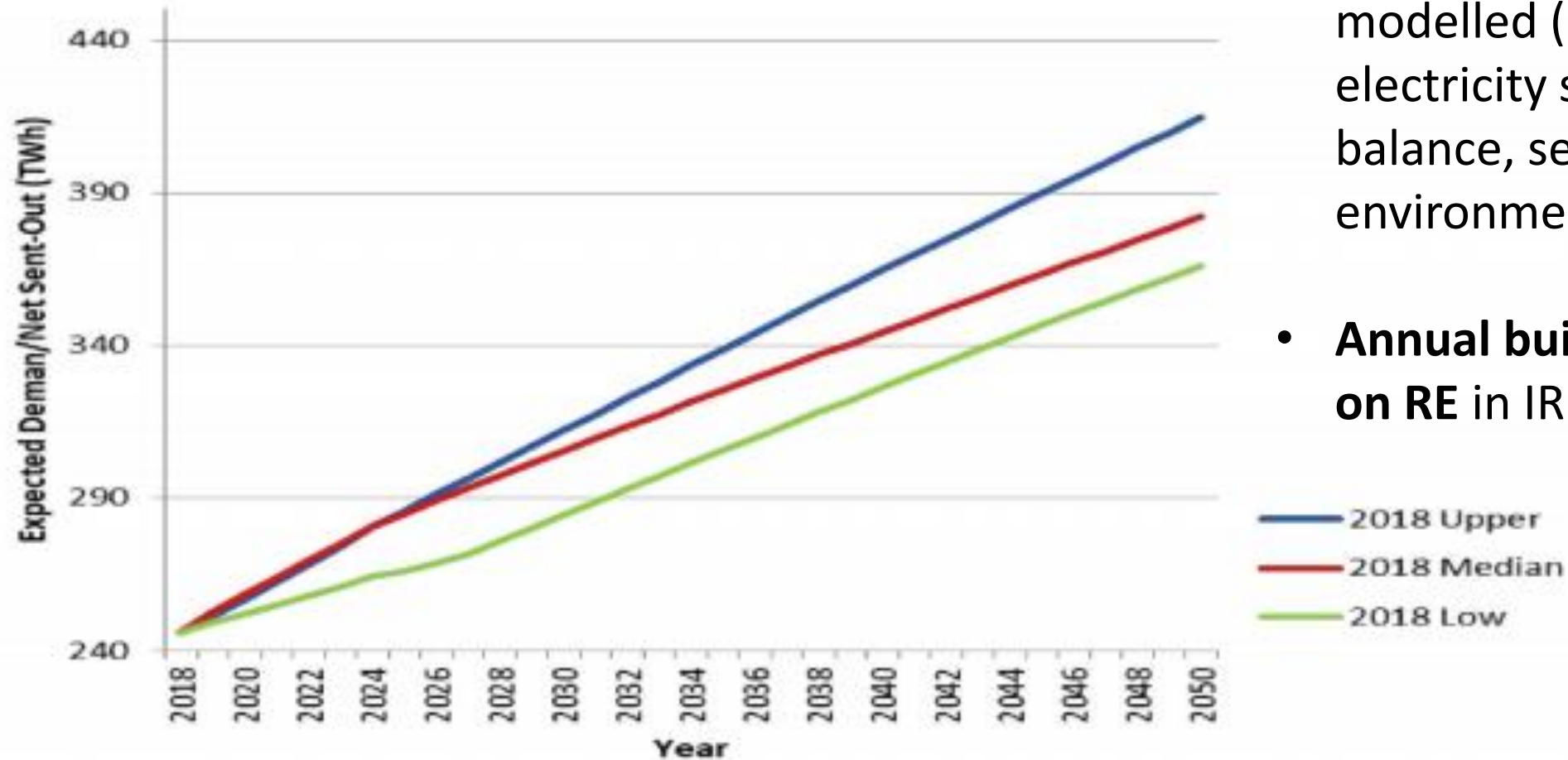
SOLAR CSP PRICE PROJECTIONS



Predicted price path for CSP

South African studies have forecasted that prices would drop by **50%** or even lower by 2030

IRP DEMAND FORECAST IN 2018



- A number of scenarios were modelled (e.g. least-cost electricity supply, demand balance, security of supply, environment).
- **Annual build limits placed on RE in IRP.**

INTEGRATED RESOURCE PLAN 2019

	Coal	Coal (Decommissioning)	Nuclear	Hydro	Storage	PV	Wind	CSP	Gas & Diesel	Other (Distributed Generation, CoGen, Biomass, Landfill)
Current Base	37 149		1 860	2 100	2 912	1 474	1 980	300	3 830	499
2019	2 155	-2373					244	300		Allocation to the extent of the short term capacity and energy gap.
2020	1 433	-557				114	300			
2021	1 433	-1403				300	818			
2022	711	-844			513	400	1000	1600		
2023	750	-555				1000	1600			
2024			1860				1600		1000	500
2025						1000	1600			500
2026		-1219					1600			500
2027	750	-847					1 600		2000	500
2028		-475				1000	1 600			500
2029		-1694			1575	1000	1 600			500
2030		-1050		2 500		1 000	1 600			500
TOTAL INSTALLED CAPACITY by 2030 (MW)	33364		1860	4600	5000	8288	17742	600	6380	
% Total Installed Capacity (% of MW)	43		2.36	5.84	6.35	10.52	22.53	0.76	8.1	
% Annual Energy Contribution (% of MWh)	58.8		4.5	8.4	1.2*	6.3	17.8	0.6	1.3	

	Installed Capacity
	Committed / Already Contracted Capacity
	Capacity Decommissioned
	New Additional Capacity
	Extension of Koeberg Plant Design Life
	Includes Distributed Generation Capacity for own use

- 2030 Coal Installed Capacity is less capacity decommissioned between years 2020 and 2030
- Koeberg power station rated / installed capacity will revert to 1926 MW (original design capacity) following design life extension work.
- Other / Distributed generation includes all generation facilities in circumstances in which the facility is operated solely to supply electricity to an end-use customer within the same property with the facility
- Short term capacity gap is estimated at 2000 MW

New additions by 2030!!!

- 6 GW of Solar PV
- 14.4 GW of wind

No new CSP until 2030!!!

So where are the new opportunities?

What is Renewables in Africa?

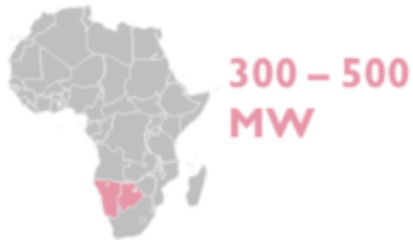
1. What is Solar CSP?
2. Why is Solar CSP important?
3. What is the status for Solar CSP in South Africa?
4. Where are the opportunities in the region?
5. Conclusions

SOLAR INITIATIVE IN SOUTHERN AFRICA

5,000 MW Mega-solar project (CSP and PV) developed by **Botswana and Namibia**, supported by World Bank, IFC, AfDB, Irena, Power Africa.

Phase 1: Domestic

Procure capacity to cover future domestic demand only

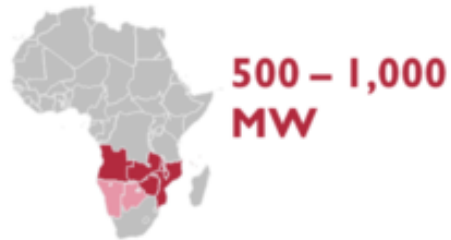


Market Conditions

- Upgrade domestic transmission networks
- Risk premiums as developers get to know program

Phase 2: Regional

Procure capacity to cover demand in SAPP or through bilateral agreements

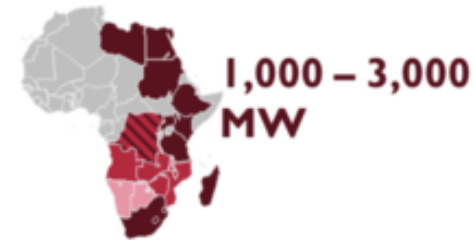


Market Conditions

- Reduced risk premiums as parties get to know program better
- Upgrade interconnection points to allow cross-border power trade
- SAPP trading opportunities increase

Phase 3: Power Pools

Procure large amount of capacity to meet demand in SAPP and EAPP



Market Conditions

- Bid prices very low as risk premiums reduce further
- ZTK connects the EAPP and the SAPP, allowing cross-continent power sales
- SAPP trading remains robust

WHAT ABOUT SMALL SOLAR CSP?

There are other opportunities:

- Existing solutions are designed for developing countries, especially in offgrid locations.
- RiA is currently discussing with start-up developing micro CSP plants (10x+ smaller) to be piloted in southern Africa.



Example of small CSP solutions in Morocco

CONCLUSIONS

1. In an era where industry is looking to mitigate the variability and intermittency of RE sources, CSP with thermal storage provides a suitable answer.
2. South Africa has already built 300 MW of CSP and that are operational and about 350 MW are in the pipeline.
3. IRP 2019 plan does not include CSP in the mix however Botswana and Namibia could offer opportunities to developers and investors.
4. Small CSP are promising solutions that will allow the industry to expand beyond utility-scale market.
5. **Covid-19 is shaking and re-shaping society, economies, and industries. STAY ALERT for unforeseen opportunities.**

NGUE PELO (THANK YOU) !!

Get in touch: tony@renewablesinafrica.com



RenewablesInAfrica



@Renewablesafri



(+44).1277 231 552

www.renewablesinafrica.com