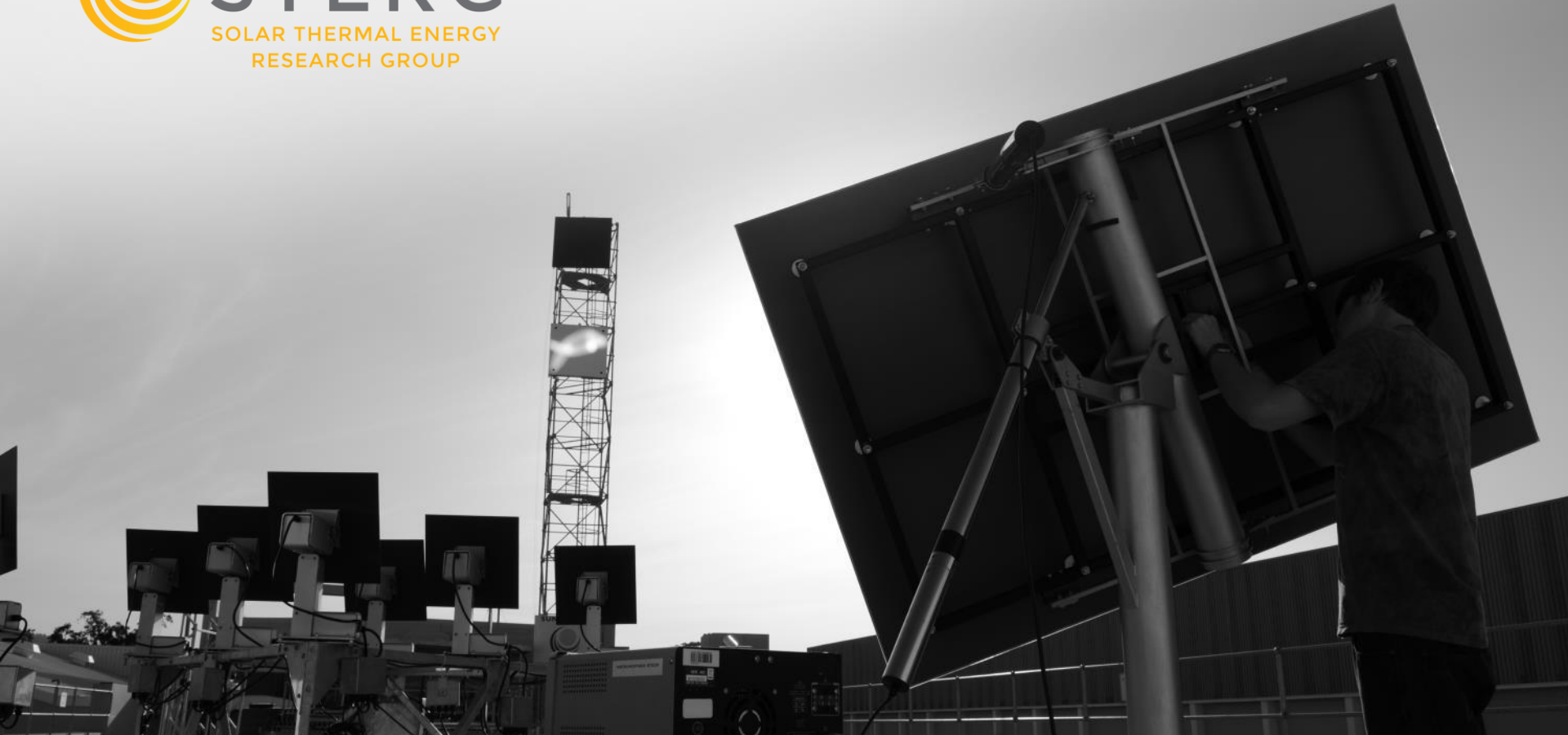




# STERG

SOLAR THERMAL ENERGY  
RESEARCH GROUP



# Sand, Sun and Solar Power: A review of the environmental impacts of Concentrating Solar Power

—  
The South African landscape

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Renewable Energy Postgraduate Symposium

14 July 2015



# Content



## An initial review of CSP environmental impact in SA

- Introduction
- CSP's value in SA
- Study area
- Impact assessment approaches
- Scope of direct impact assessment
- Conclusion
- Acknowledgements



# Introduction

## Energy in South Africa

- Diversification of SA electricity system needed and being implemented through REIPPPP
- Long term plan- and policy development (2003)
- Integrated Resource Plan (IRP) 2010 & IRP Draft Update 2013
- Release of final IEP and IRP updates unsure



Technology option	IRP 2010 (MW)	Base Case (MW)
Existing Coal	34746	36230
New Coal	6250	2450
CCGT	2370	3550
OCGT / Gas Engines	7330	7680
Hydro Imports	4109	3000
Hydro Domestic	700	690
PS (incl Imports)	2912	2900
Nuclear	11400	6660
PV	9400	9770
CSP	1200	3300
Wind	9200	4300
Other	915	640
<b>TOTAL</b>	<b>89532</b>	<b>81350</b>

# Introduction



## REIPPPP

- Total RE allocation increased to 6525 MW in REIPPPP
- 1.6GW of connected RE capacity had R0.8 billion benefit to the economy (wind & solar)
- Scope for improving social benefits of REIPPPP

Technology	Total (MW)	Allocation remaining (MW)
Wind	2660	660
PV	1938	626
CSP	600	0
Small Hydro	19	116
Biomass	16	19
Biogas	0	60
Landfill	18	7
Total	5037	1488



# Concentrating solar power



## Value in South Africa

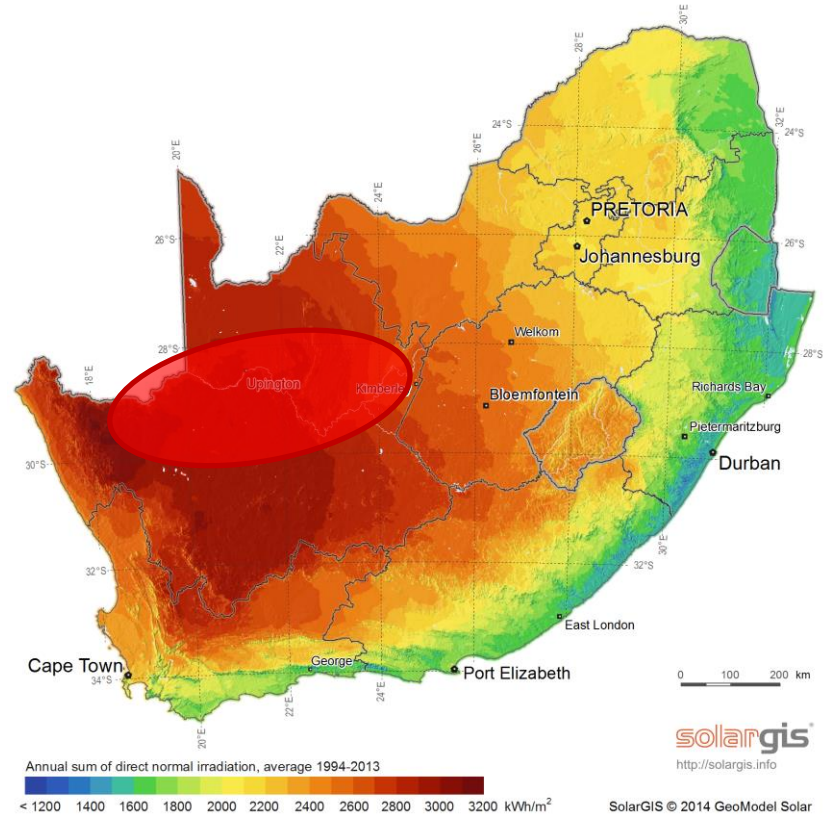
- SA especially good resource (>2900 kWh/m<sup>2</sup>)
- Potential to supply base-load and in peak demand
- Roughly only a fifth of CSP capacity allocated in IRP Update has been committed
- Only 100 MW in operation



# Study area

## Resource distribution

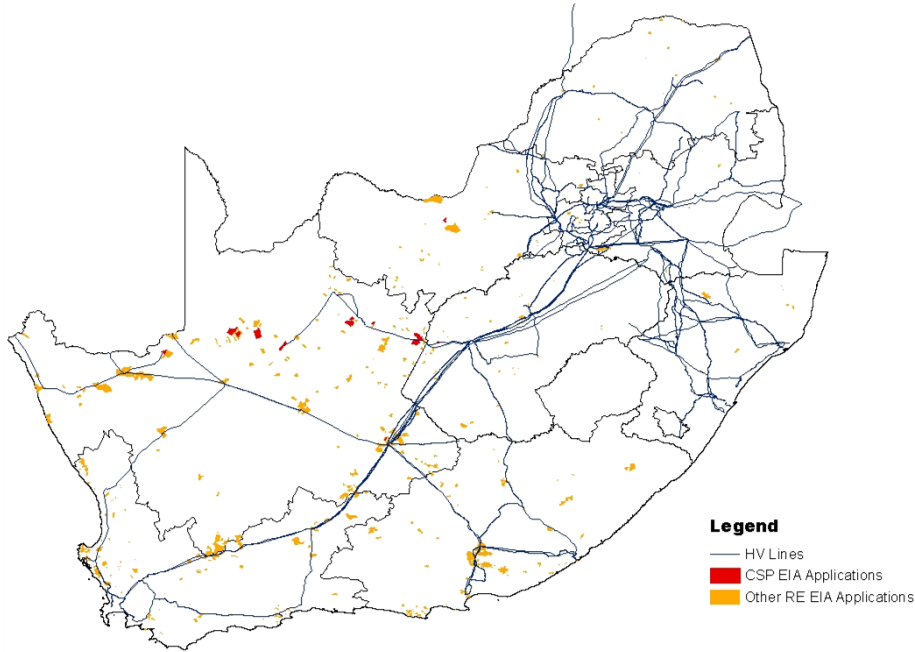
- 3300 MW can have footprint of: 6666 – 435 138 ha
- Location of transmission infrastructure and water resources also limitation
- Thus have impact on land: direct, indirect, beneficial & adverse



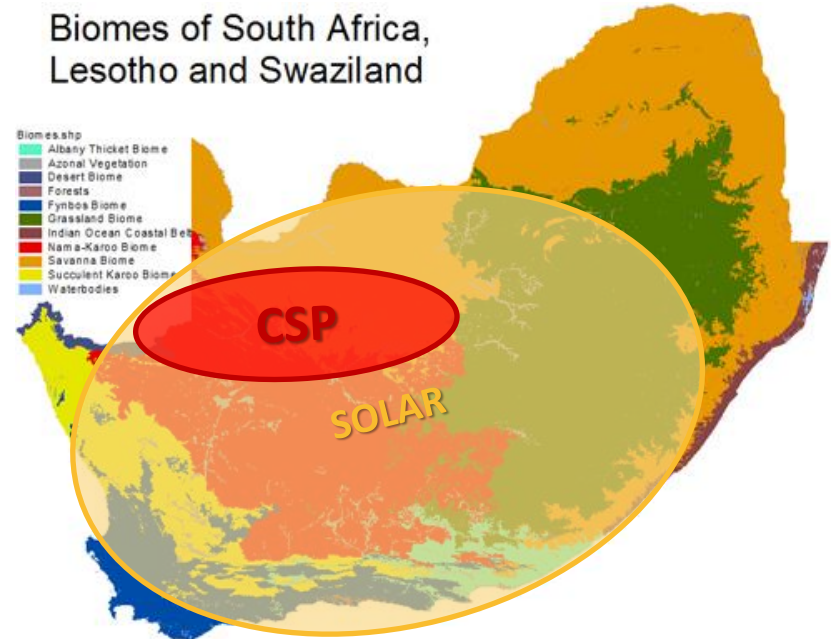
# Study area

## Impacts

Impact: *“The effective action of one thing or person upon another; the effect of such action; influence; impression.”*



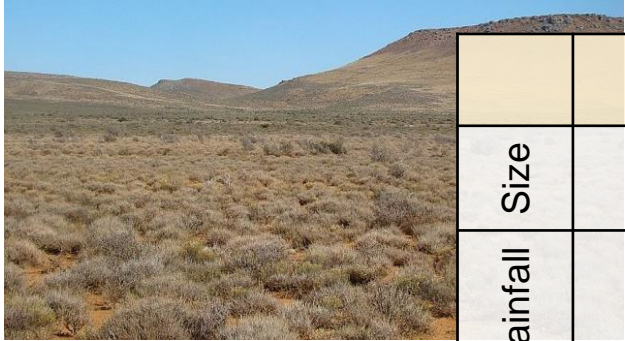
Biomes of South Africa, Lesotho and Swaziland





# Study area

## Description



	Nama-Karoo	Savanna (Kalahari)
Size	20% of SA	33% of SA
Rainfall	100-520 mm/annum	235-1000 mm/annum (92.7-150.6mm)
Vegetation	Grassy, dwarf shrubland	C4 grasses & Shrub-tree layer (Desert shrubland)
Status	0.6% protected 4% transformed	8.8% protected 23% transformed



© Aubrey Kemp 2012



# Impact assessment



## Where/what is the impact on?

Land	Biodiversity		Air		Water	
Soil loss	Displacement	Mortality	Abiotic changes	Biodiversity	Surface water	Groundwater
Changes in land use	Avifauna	Avifauna	GHG emissions	Birds	Usage	Usage
Changes in land cover	Invasion	Flora	Changes in albedo	Insects	Run-off	Salinization
HTF spill risk			Light & noise pollution		Biodiversity	Contamination
			Dust			
Ecosystems						
Species communities		Resilience		Gene flow		Nutrient cycling

*“Impact assessment can be broadly defined as the prediction or estimation of the consequences of a current or proposed action.”*



# Impact assessment



Where/what is the impact on?



*“Impact assessment can be broadly defined as the prediction or estimation of the consequences of a current or proposed action.”*



# Impact assessment



## Current approach

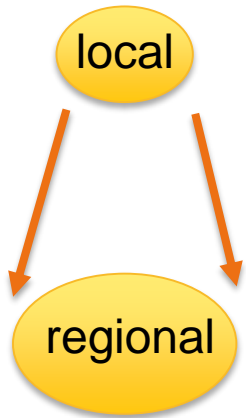
- Legislation (EIA regulations in National Environmental Management Act (Act no. 107 of 1998))
- Mandatory EIAs at project level
- SEA for RE deployment (RE Development Zones)
- EIAs also only tool to evaluate socio-eco impacts
- ‘New’ research field
- Extrapolation to other RE technologies and time scales



# Impact assessment



## Determining direct impact of CSP



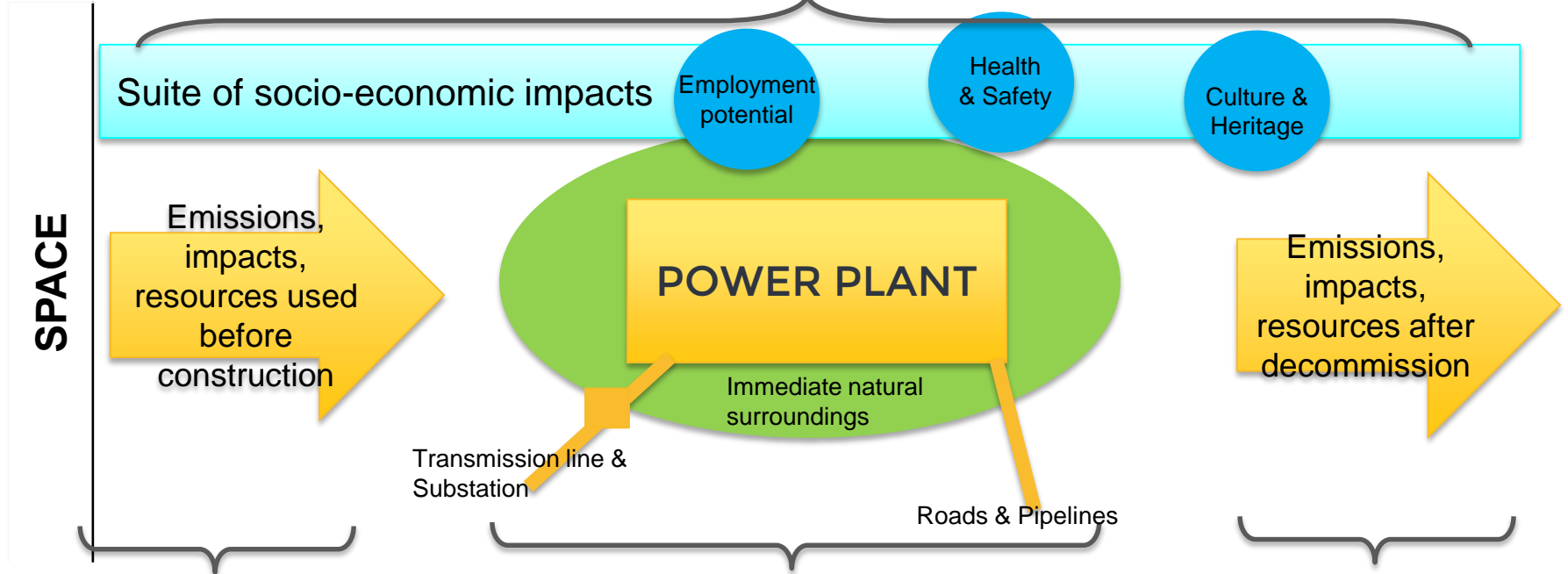
- **Power plant parameters:** Spatial footprint & soil loss, water usage, mortality impact, emissions, spillage, EIA
- **Field-data collection:** To be explored
- **GIS:** National biodiversity, Hydrology layers, Land cover & ecosystem services, Protected areas
- *i.e. investigating impact using a synthesis approach*



# Direct impacts



## Scope summary



SPACE

EXCLUDED

Suite of socio-economic impacts

Employment potential

Health & Safety

Culture & Heritage

POWER PLANT

Immediate natural surroundings

Transmission line & Substation

Roads & Pipelines

Emissions, impacts, resources used before construction

Emissions, impacts, resources after decommissionion

EXCLUDED

INCLUDED

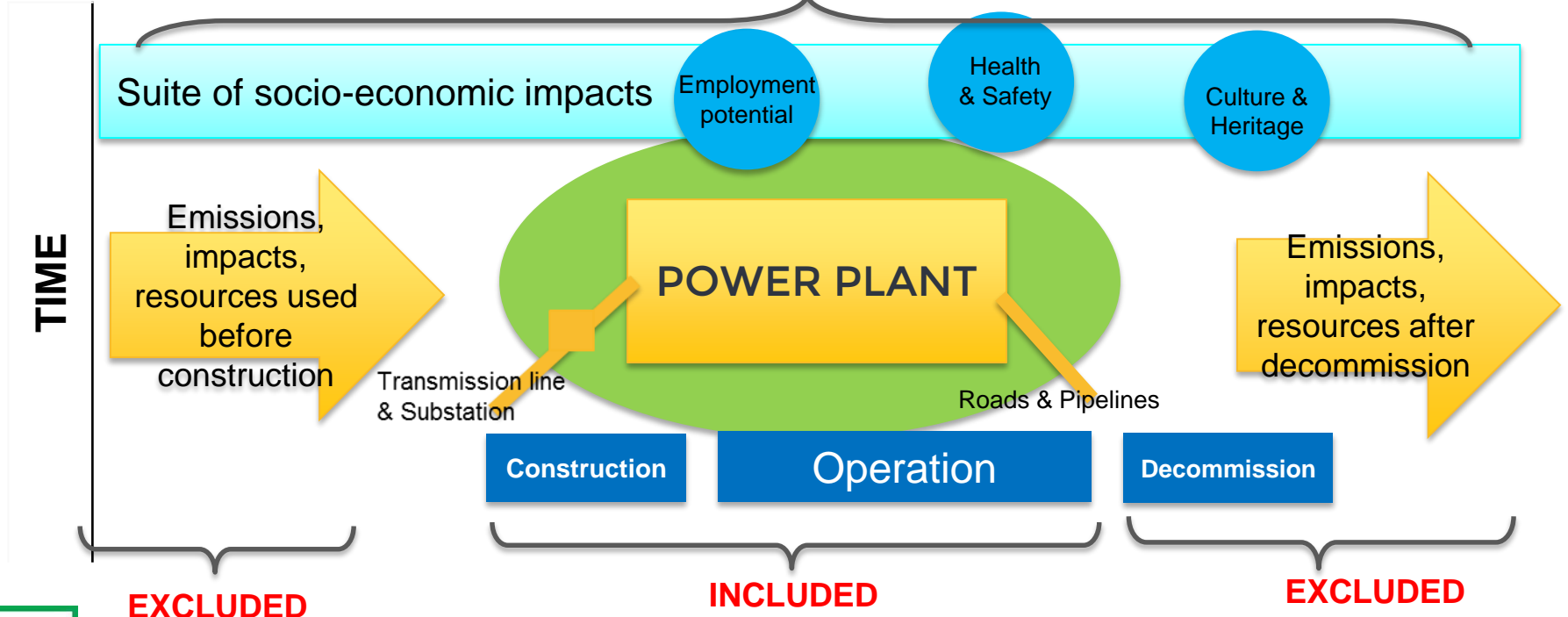
EXCLUDED



# Direct impacts



## Scope summary

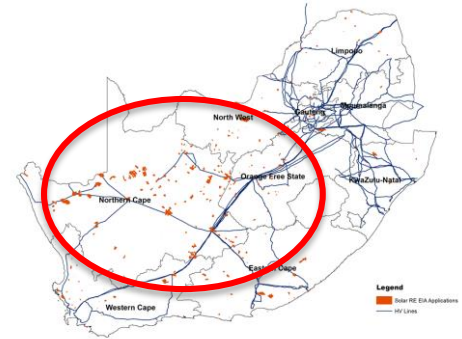


# Conclusion



Into the future, CSP is likely to:

- Have an **increased footprint within the Kalahari** and bordering bioregions
- Impacting on **biodiversity** in general, **vegetation** types, **land-use, water** resources and associated **ecological processes**

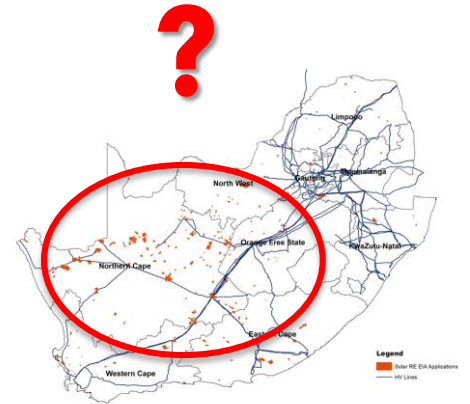




# Conclusion

It is thus necessary to:

- Make use of this **early opportunity**
- Determine & monitor the **direct impacts** of CSP on the **natural environment** in the Kalahari on a **local scale**
- Provide an outlook on what this impact is on a **regional scale** and **into the future**

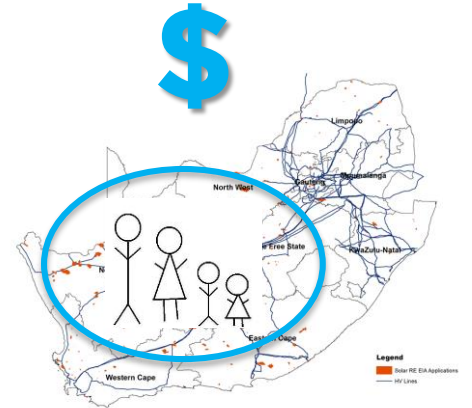


# Future studies & investigations



## Peripheral research

- Determining optimal power plant construction methods for minimal impact
- CSP project impact on local communities
- Land-use efficiency of CSP in South Africa
- Co-benefits of RE and ecosystem services
- Impact of CSP and/or PV projects on carbon balance of ecosystem



2015      2030      2050



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# Thank you

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