The System and Marginal Value of CSP in the SA IRP Time Horizon: The WWF SA Scenarios and NamPower Macroeconomic Study

CENTRE FOR RENEWABLE AND SUSTAINABLE ENERGY STUDIES

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REPUBLIC OF SOUTH AFRICA

NRF National Research Foundation

Eskom

sasol reaching new frontiers

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Outline

- Spatiotemporal approach
- Example: WWF 2030
- Example: NamPower

Resolving space

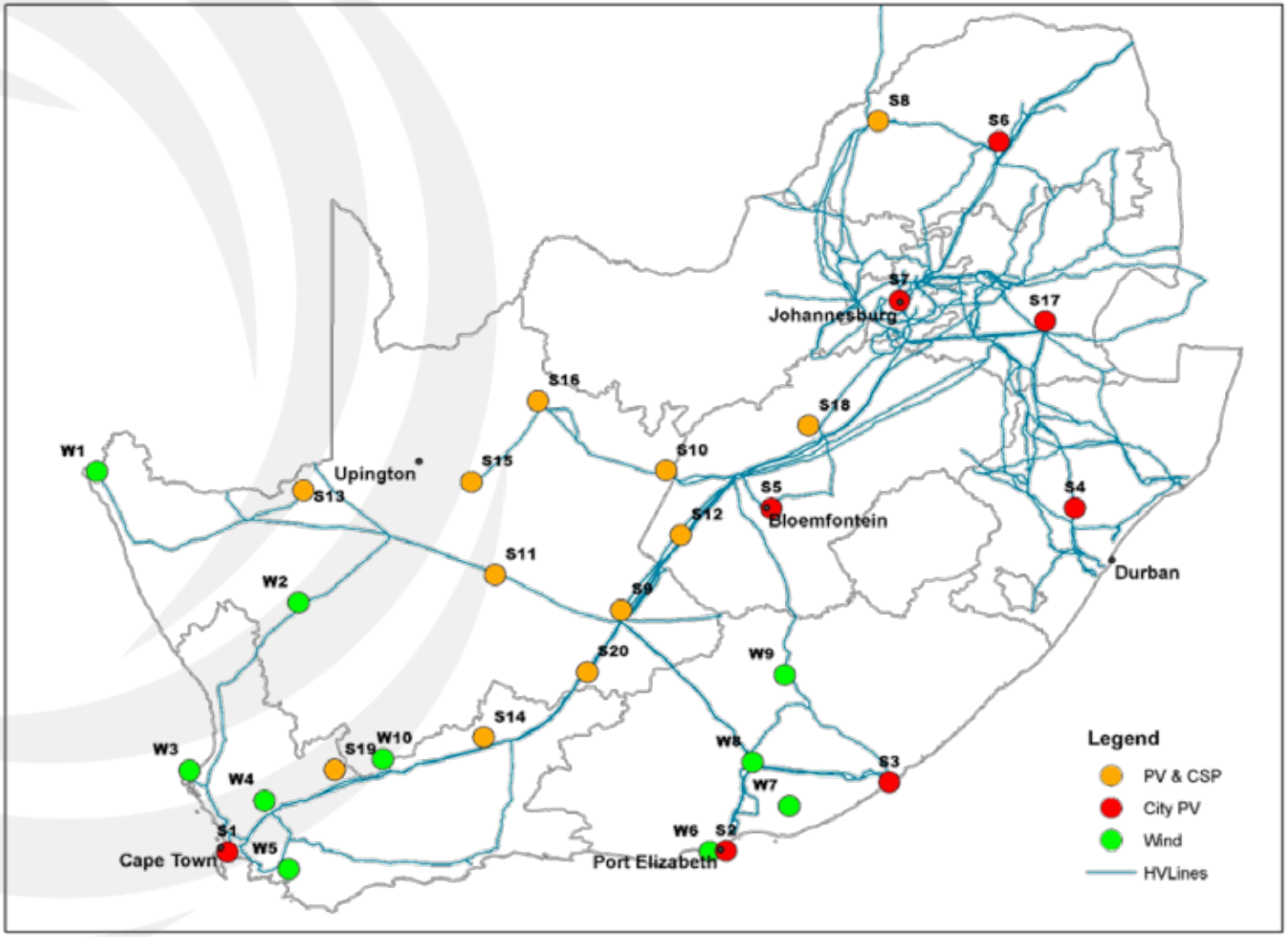
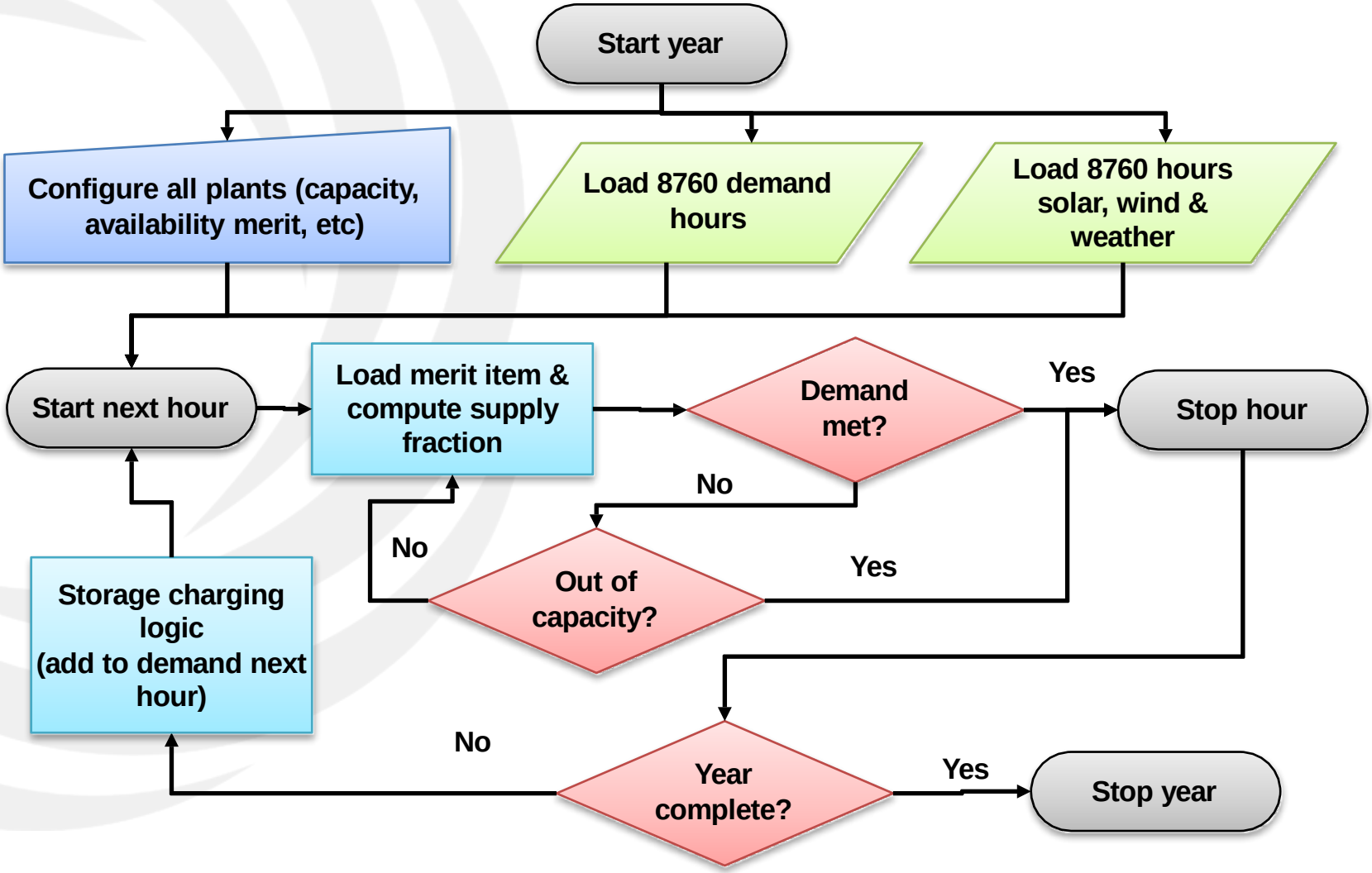


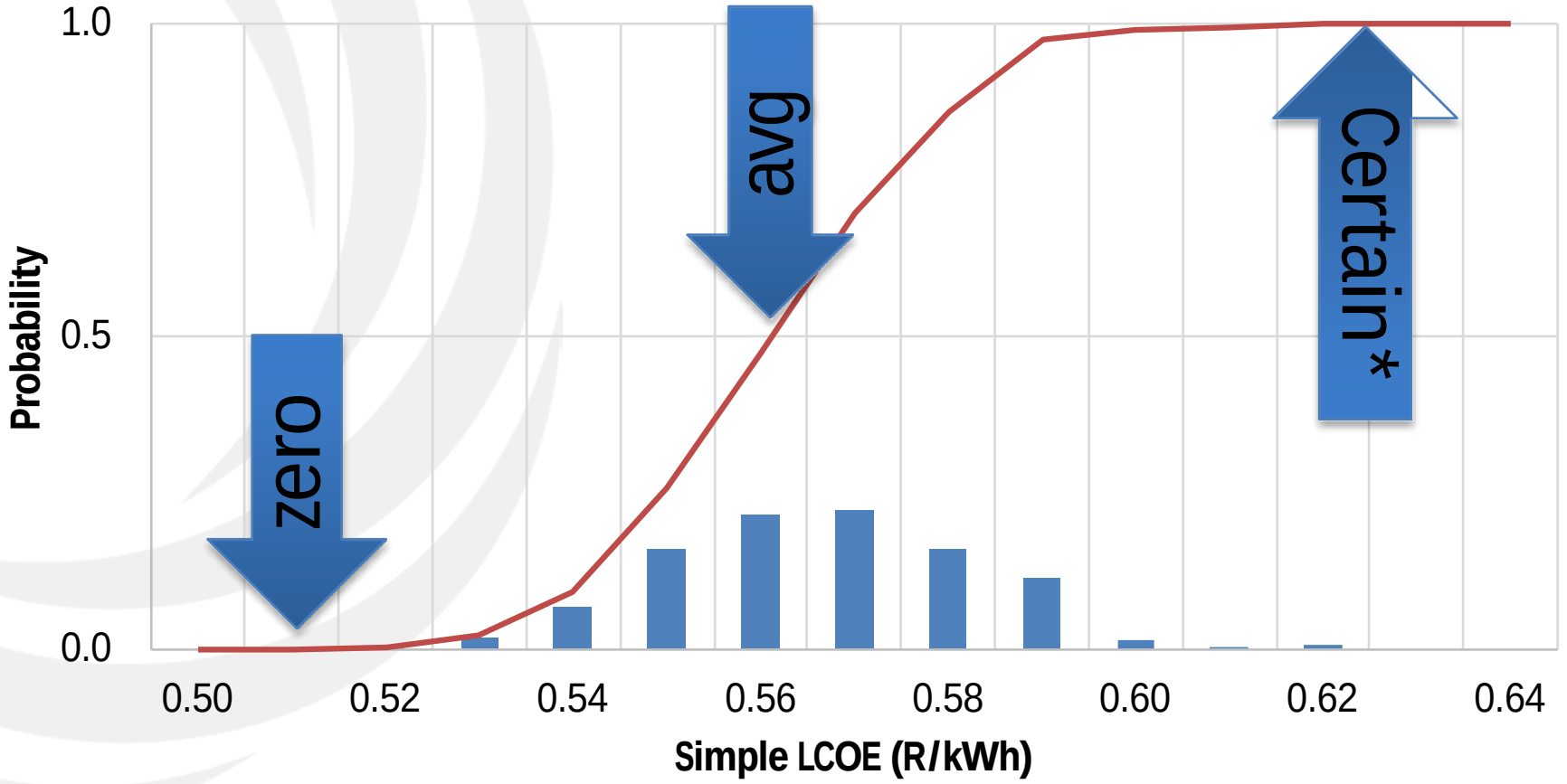
Image credit: Silinga, Rudman

Solving in time

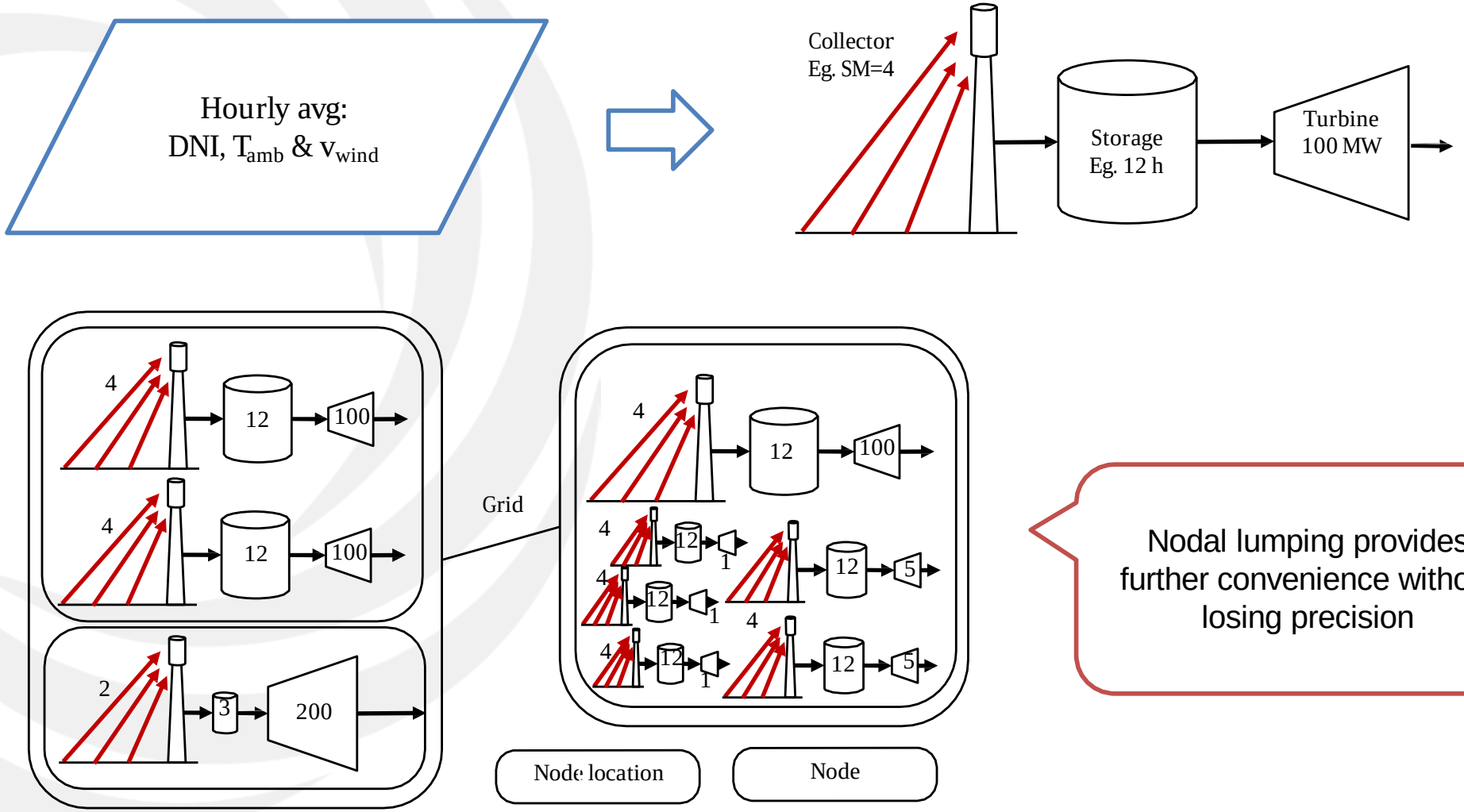


Forecasting by probability

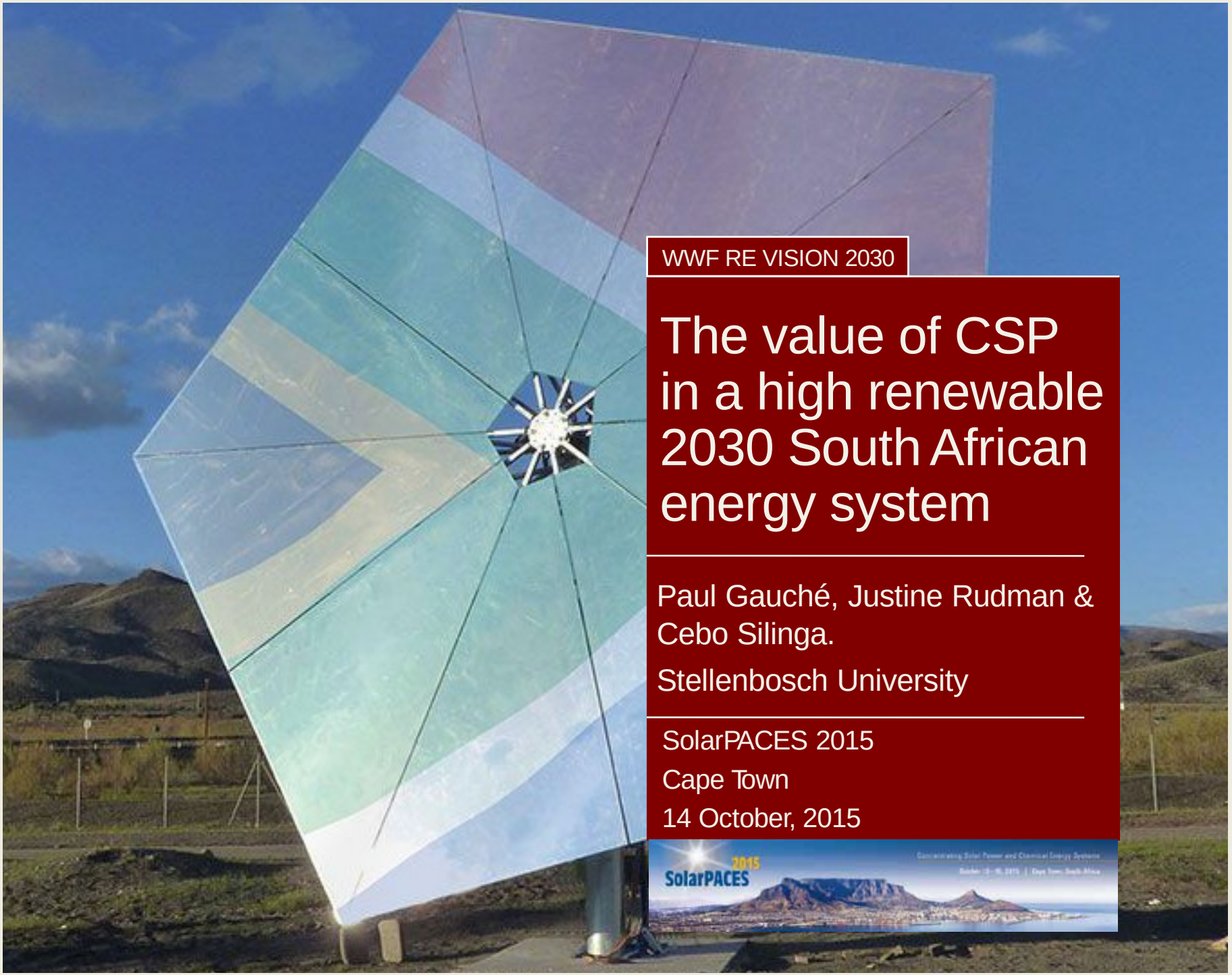
Cost | account for wide range of futures probabilistically



CSP treatment



Nodal lumping provides further convenience without losing precision



Stellio heliostat - image copyright of sbp gmbh

WWF RE VISION 2030

The value of CSP in a high renewable 2030 South African energy system

Paul Gauché, Justine Rudman & Cebo Silinga.

Stellenbosch University

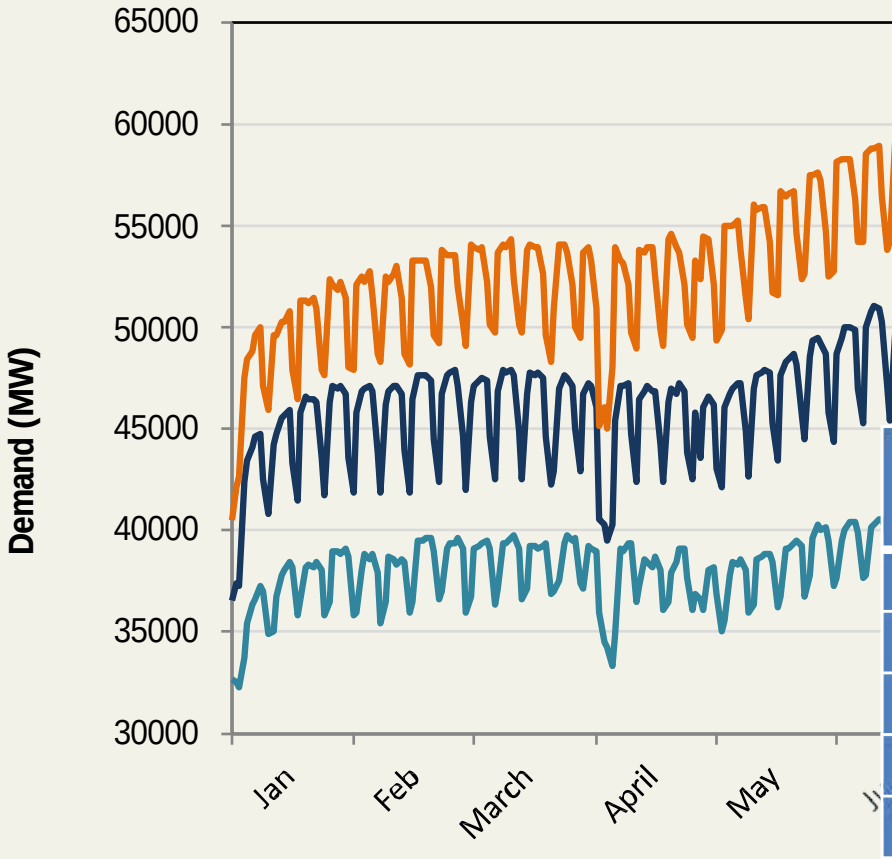
SolarPACES 2015

Cape Town

14 October, 2015

The value of CSP in a high renewable 2030 South African energy system

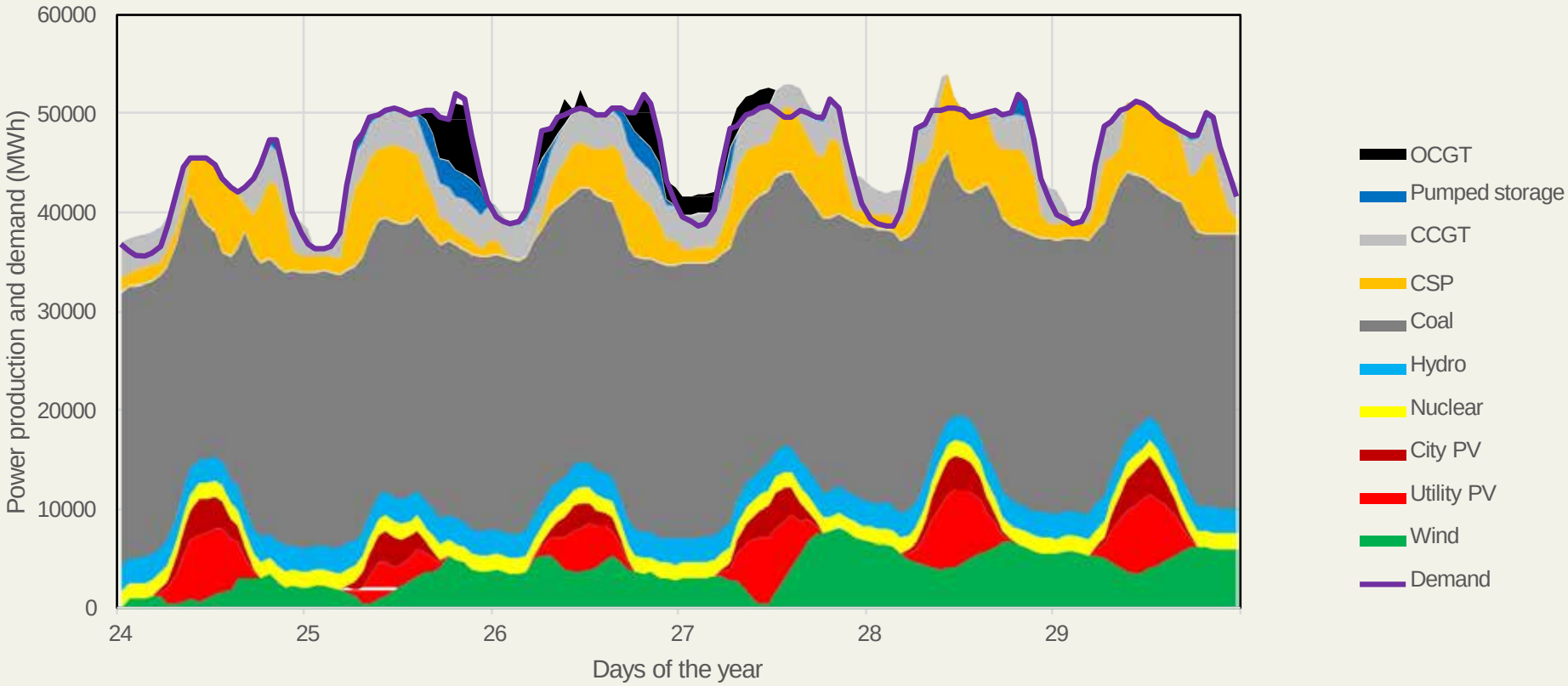
Demand | scaling the entire yearly shape



Annual demand (TWh)	Scenario	Multiples
250	2010	n/a
358	WWF Low	1.430
407	WWF High	1.625
409	IRP Update	1.634
454	IRP 2010	1.816

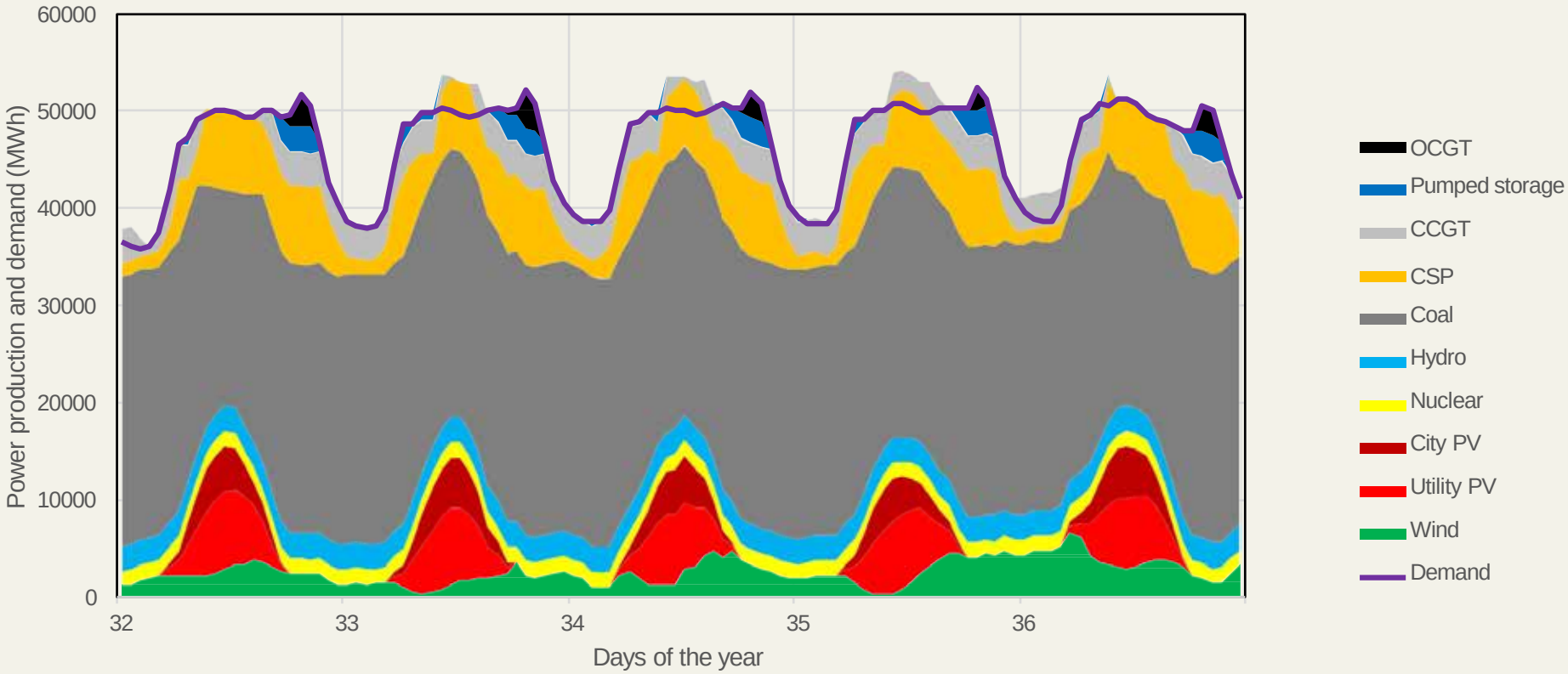
The value of CSP in a high renewable 2030 South African energy system

WWF High | summer with poor sun event



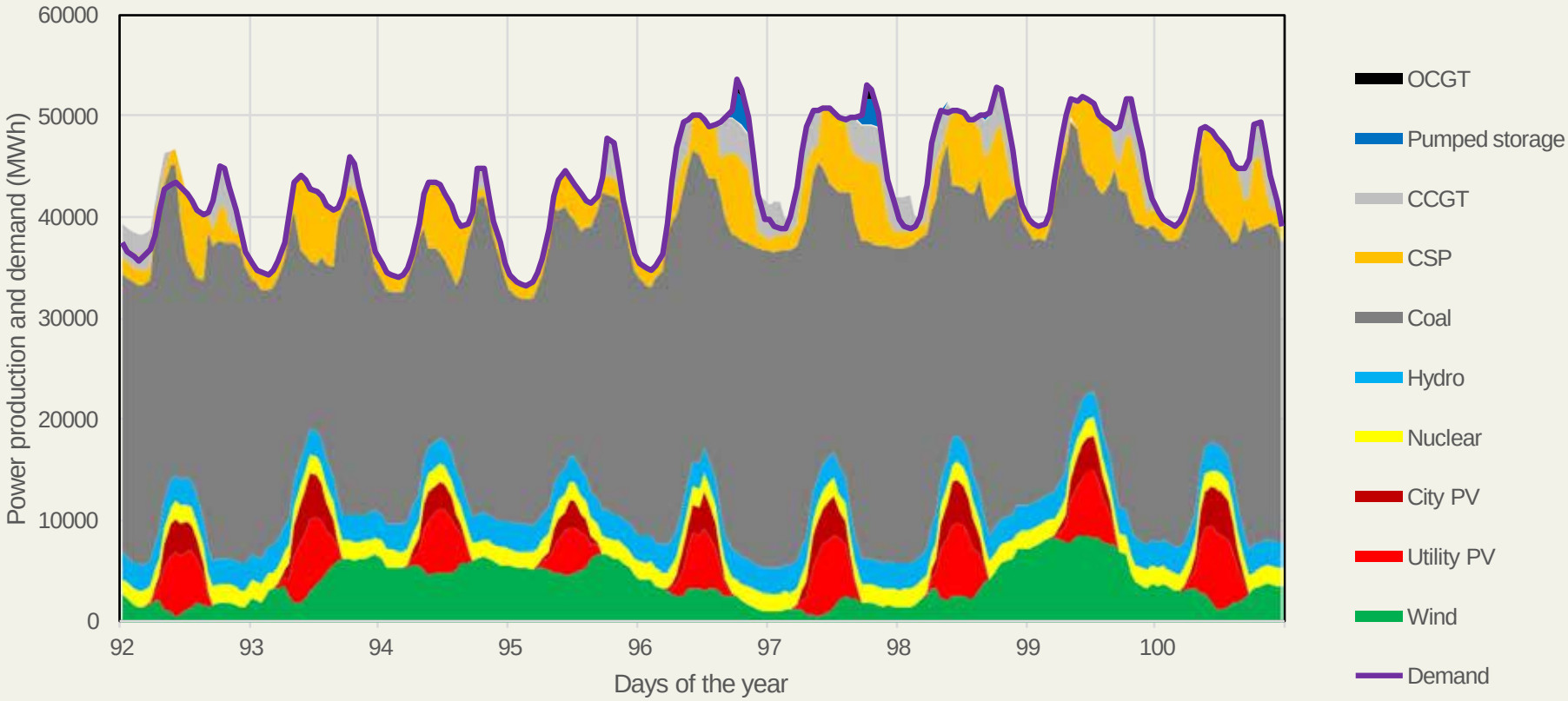
The value of CSP in a high renewable 2030 South African energy system

WWF High | summer with wind drop



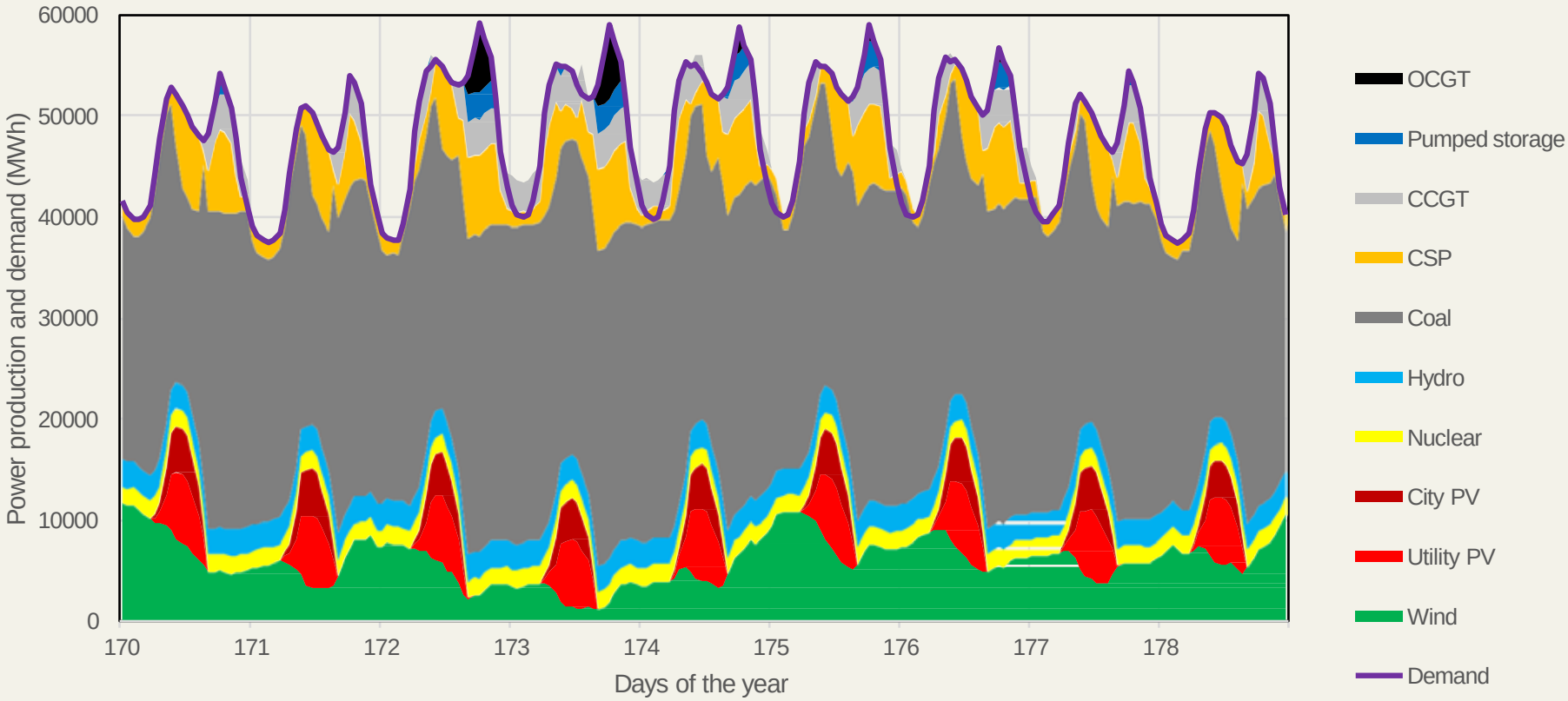
The value of CSP in a high renewable 2030 South African energy system

WWF High | transition to winter



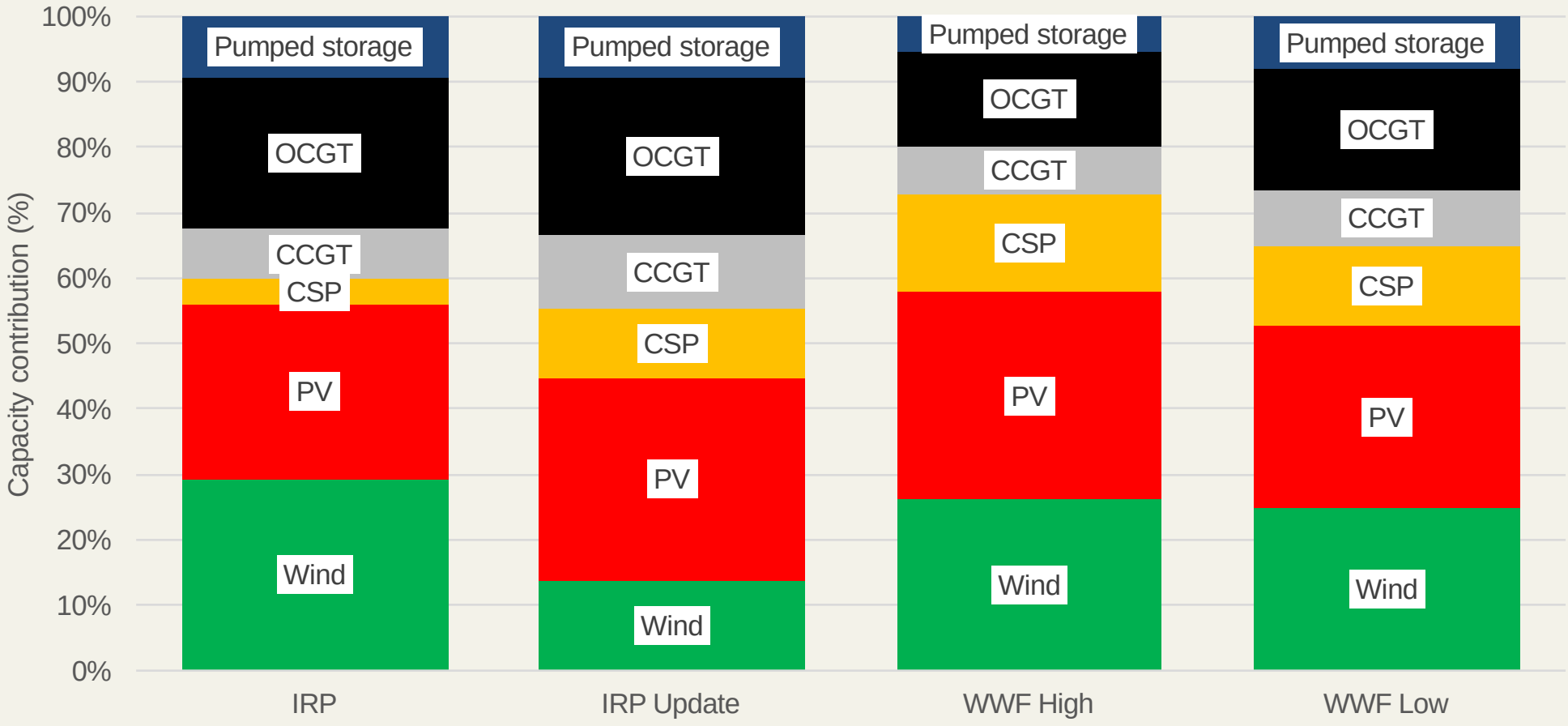
The value of CSP in a high renewable 2030 South African energy system

WWF High | deep winter



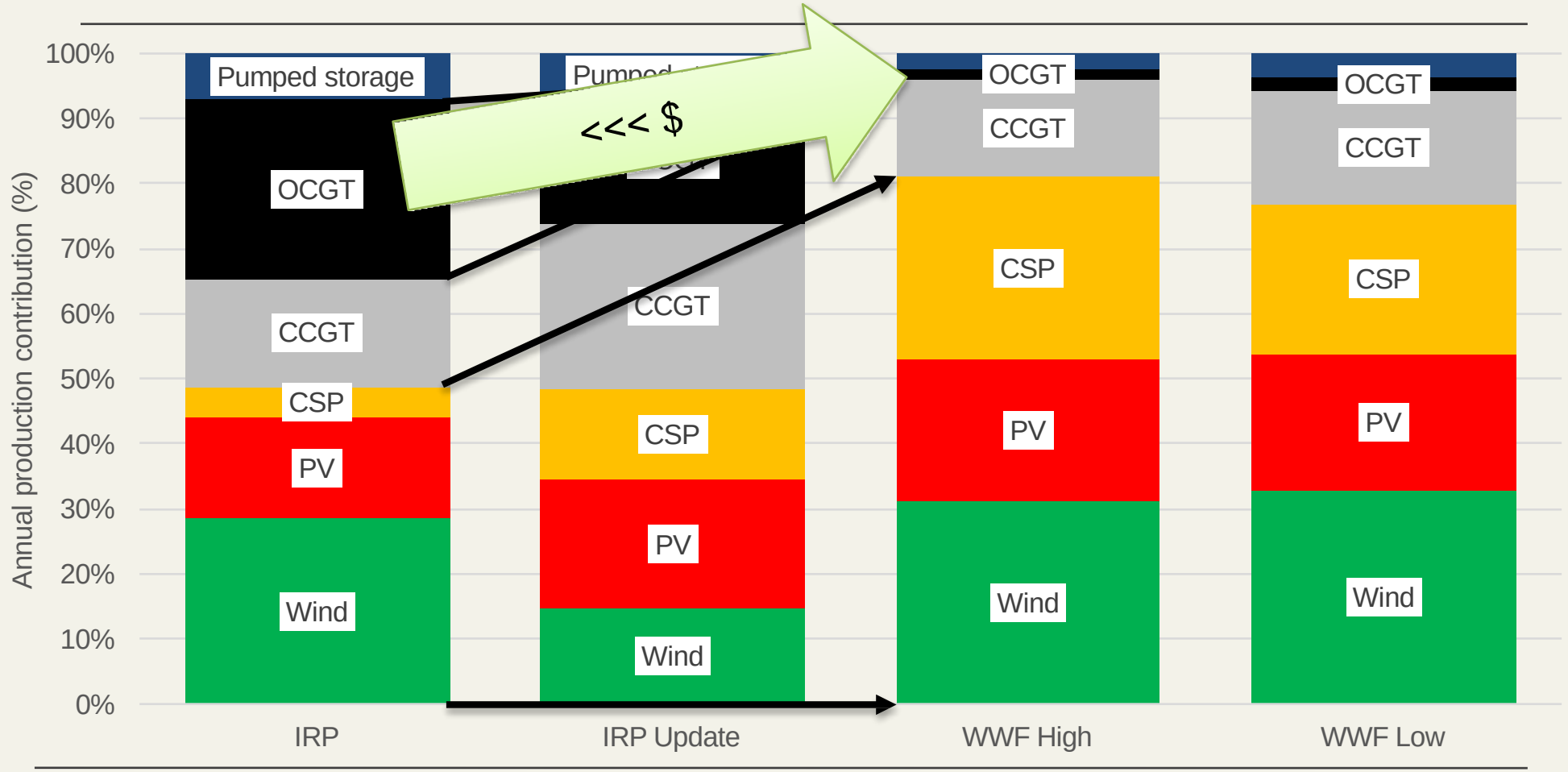
The value of CSP in a high renewable 2030 South African energy system

Capacity | renewables, mid merit & peaking



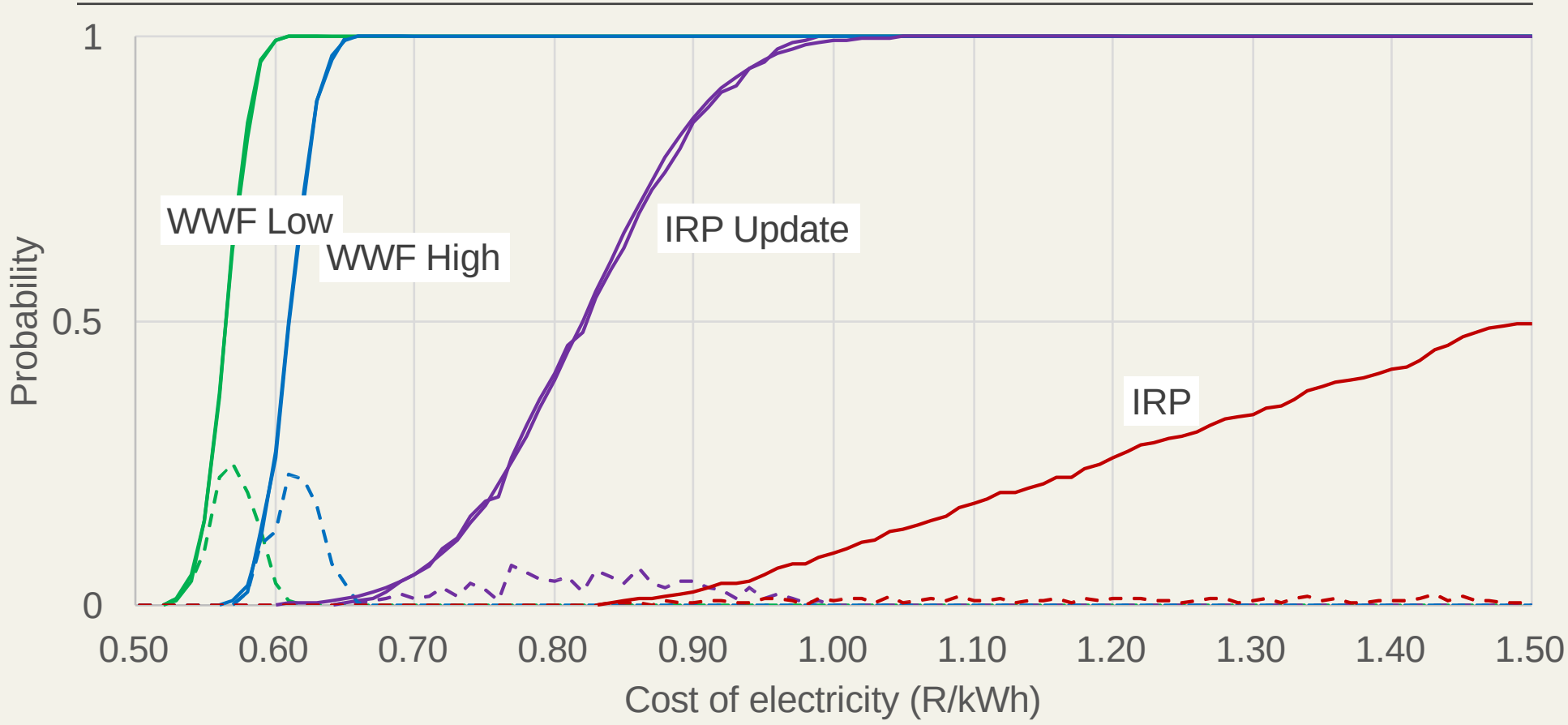
The value of CSP in a high renewable 2030 South African energy system

Annual generation | renewables, mid merit & peaking



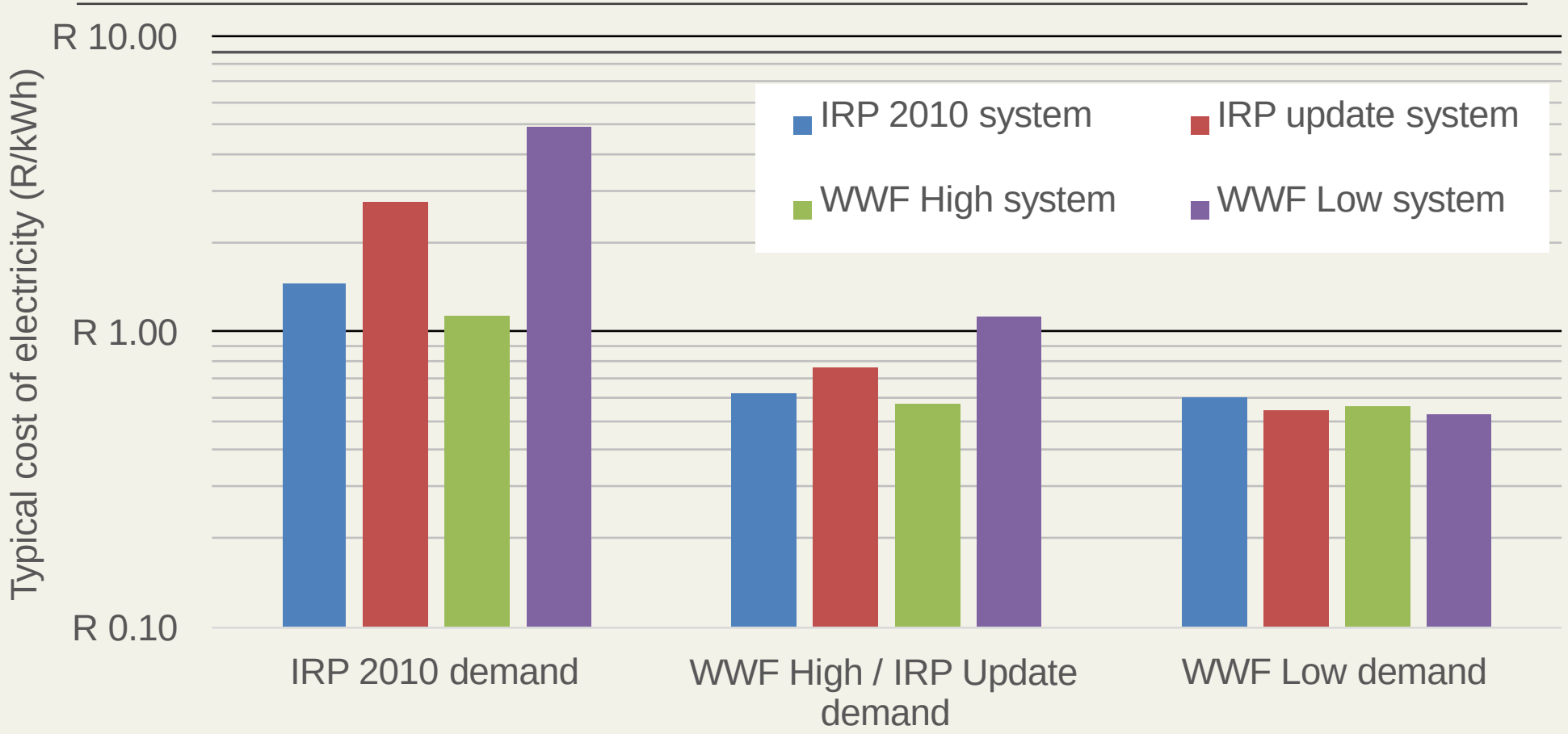
The value of CSP in a high renewable 2030 South African energy system

Cost | each scenario probability costing



The value of CSP in a high renewable 2030 South African energy system

Cost resilience | the final test



WWF scenario findings

- CSP in balance offers two key system attributes
  - Resilience to gas (and other fuel) price fluctuation
  - Resilience to sudden demand changes (up and down)
- In WWF scenario, this caused 8 GW of CSP by 2030 to lead to the lowest cost system

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Towards Electricity Autonomy: Namibia's Unique CSP Case Explored

Presenter: Paul Gauché

Contributors: Grant Muller (NP), Margaret Mutschler (NP), Elena Broughton (UE) & Karin Kritzinger (CRSES)

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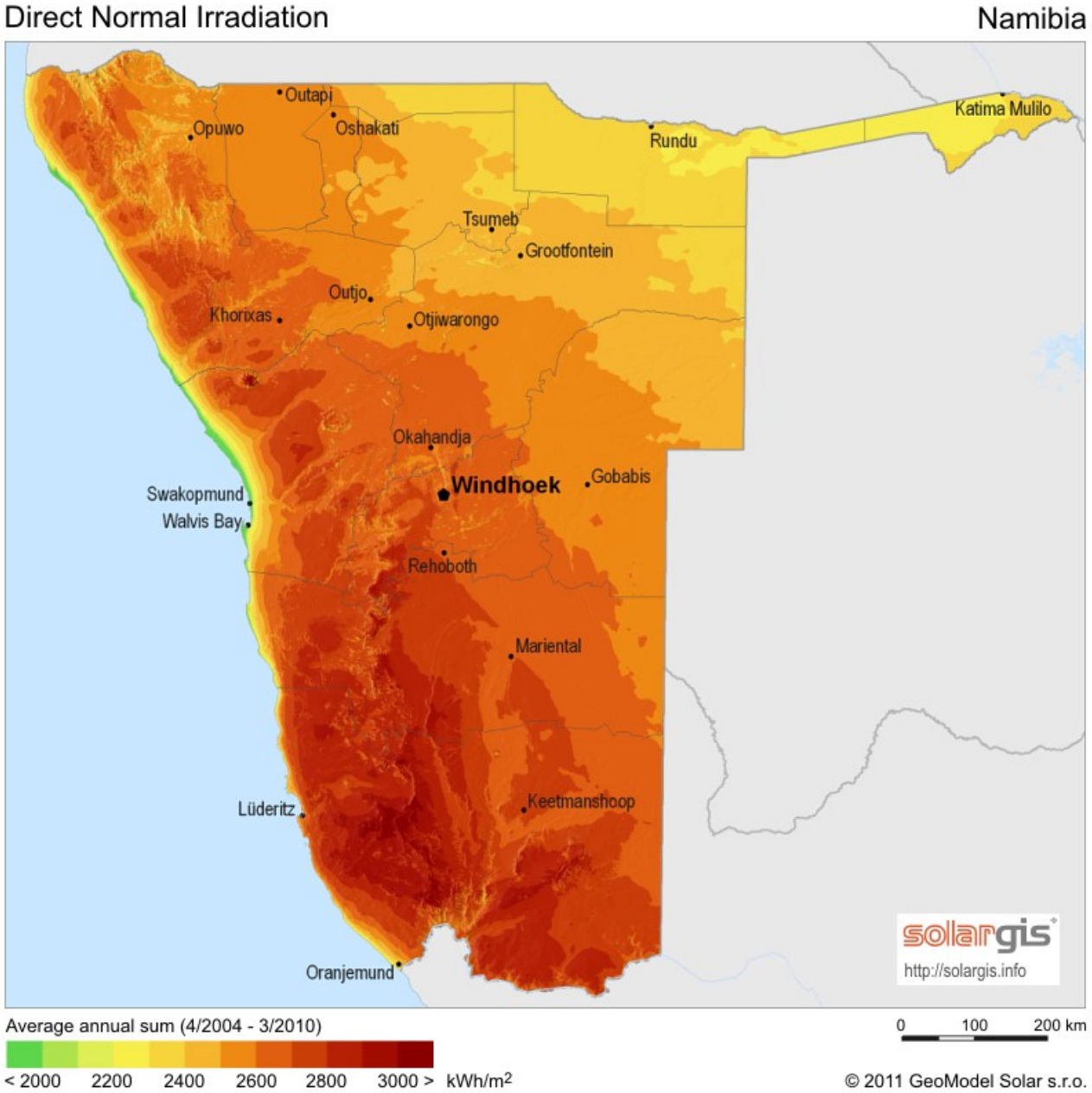
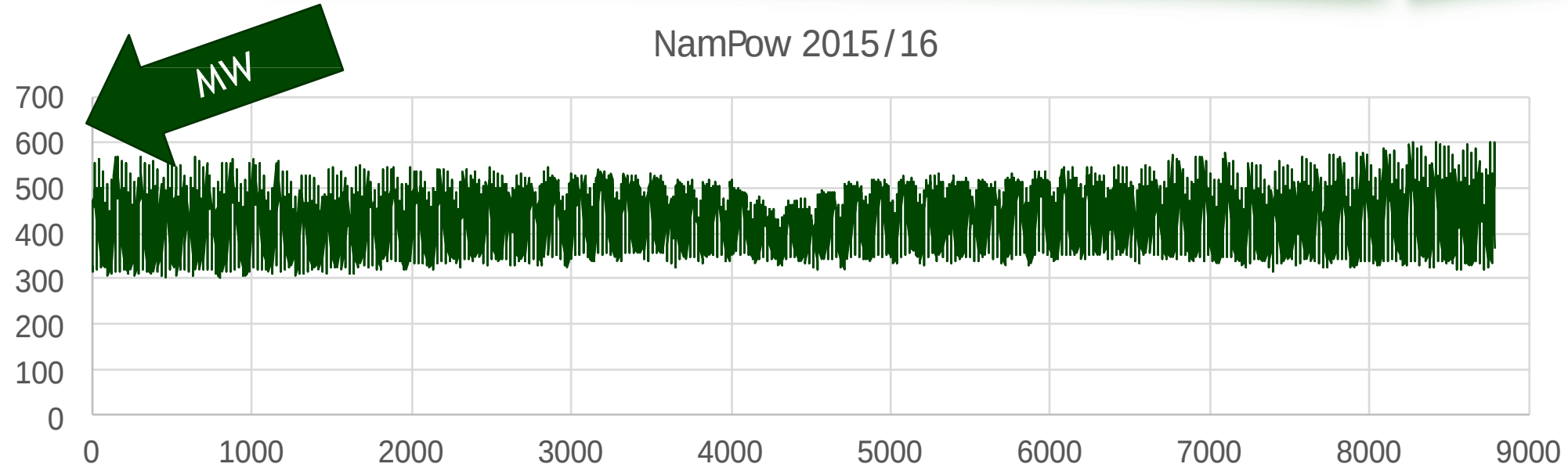
NamPower

URBAN-ECON Development Economists

The solar resource



Demand

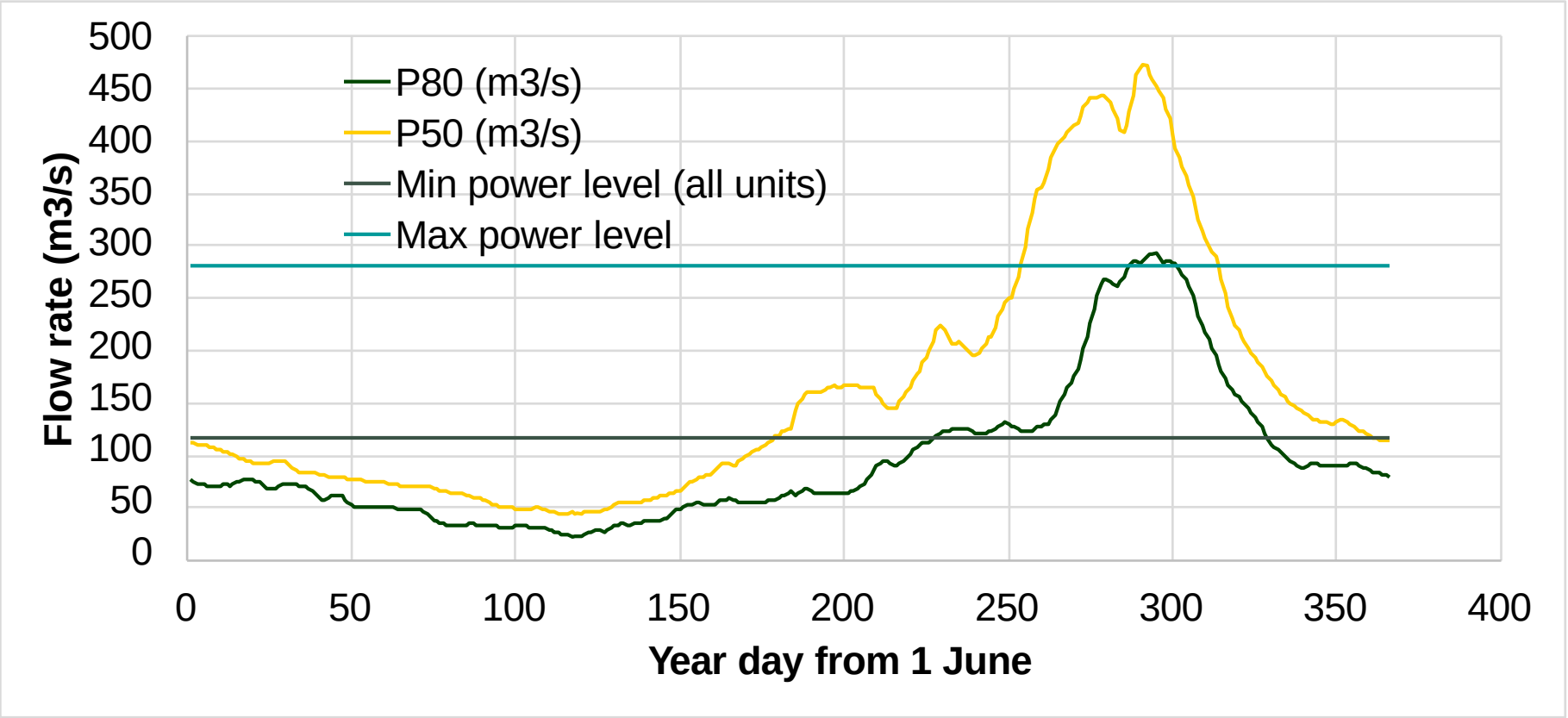


Demand multiple	demand growth [%/yr]		
Year	**1.5%**	**3.0%**	**4.0%**
2020	107.7%	115.9%	121.7%
2025	116.1%	134.4%	148.0%
2030	125.0%	155.8%	180.1%
2035	134.7%	180.6%	219.1%

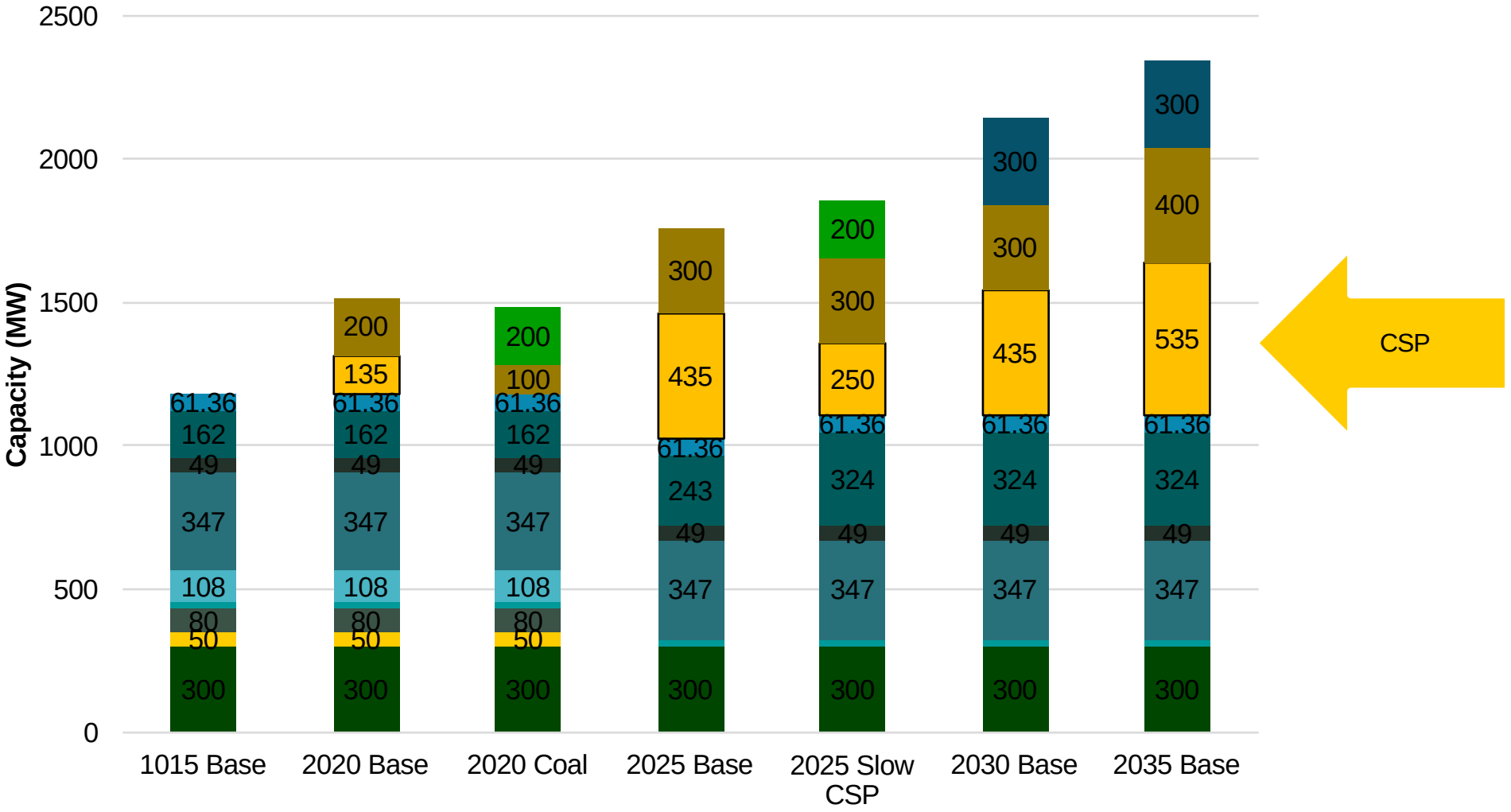
Generation options before 2020

Supply type / name	Capacity [MW]	Notes
Ruacana hydropower	347	See river flow
Van Eck coal (4 x 27 MW)	108	Old, refurb for life extension, expensive due to coal transport
Backup generators	61	Expensive to run engines
Imports	~ 400	Various regional options
Wind IPPs	~ 50	At some level of approval
Solar PV IPPs	~160	At some level of approval
CSP	?	
New coal	?	
Backup / peaking	?	

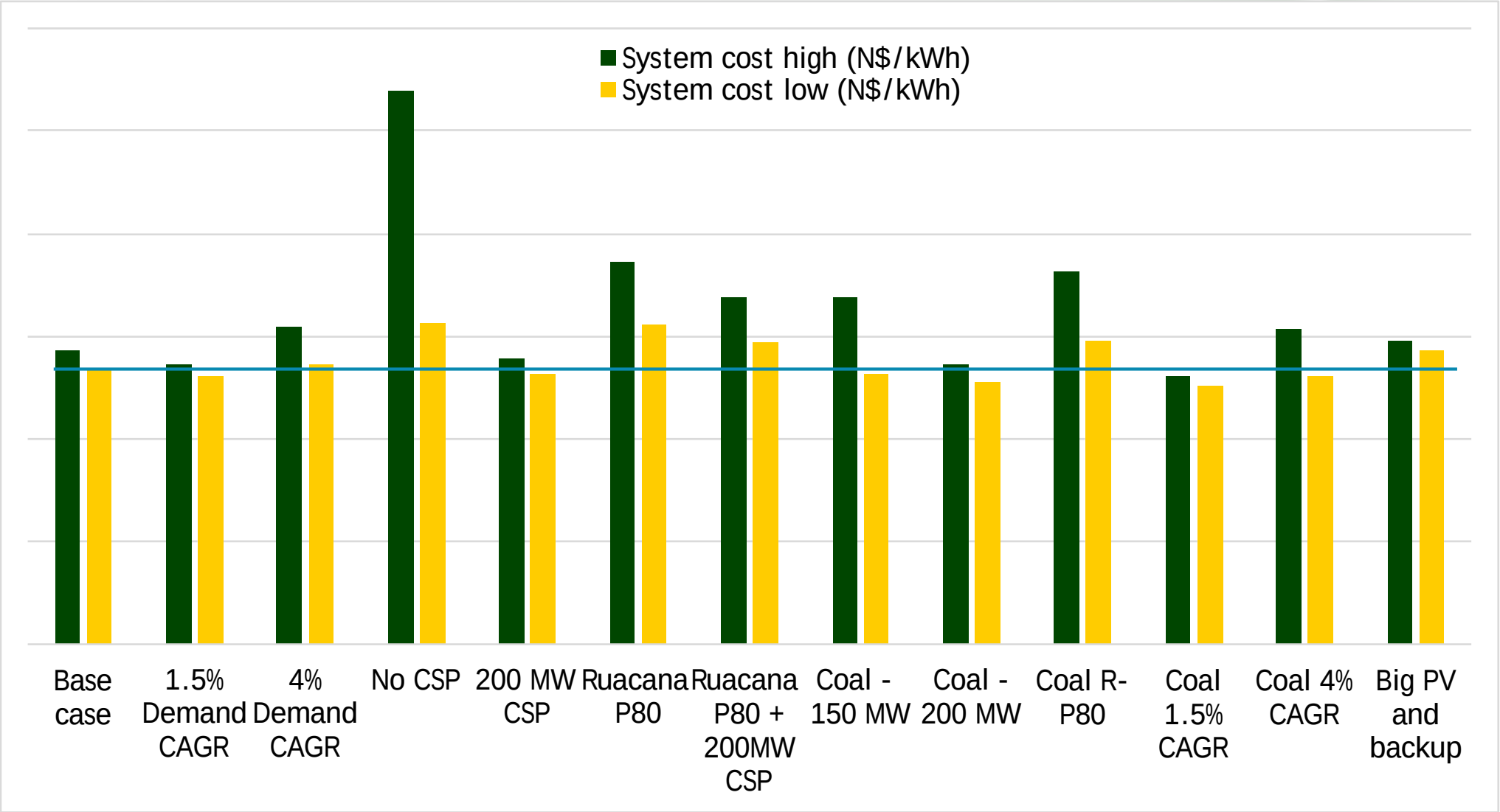
Hydro: P50 & P80 river flow



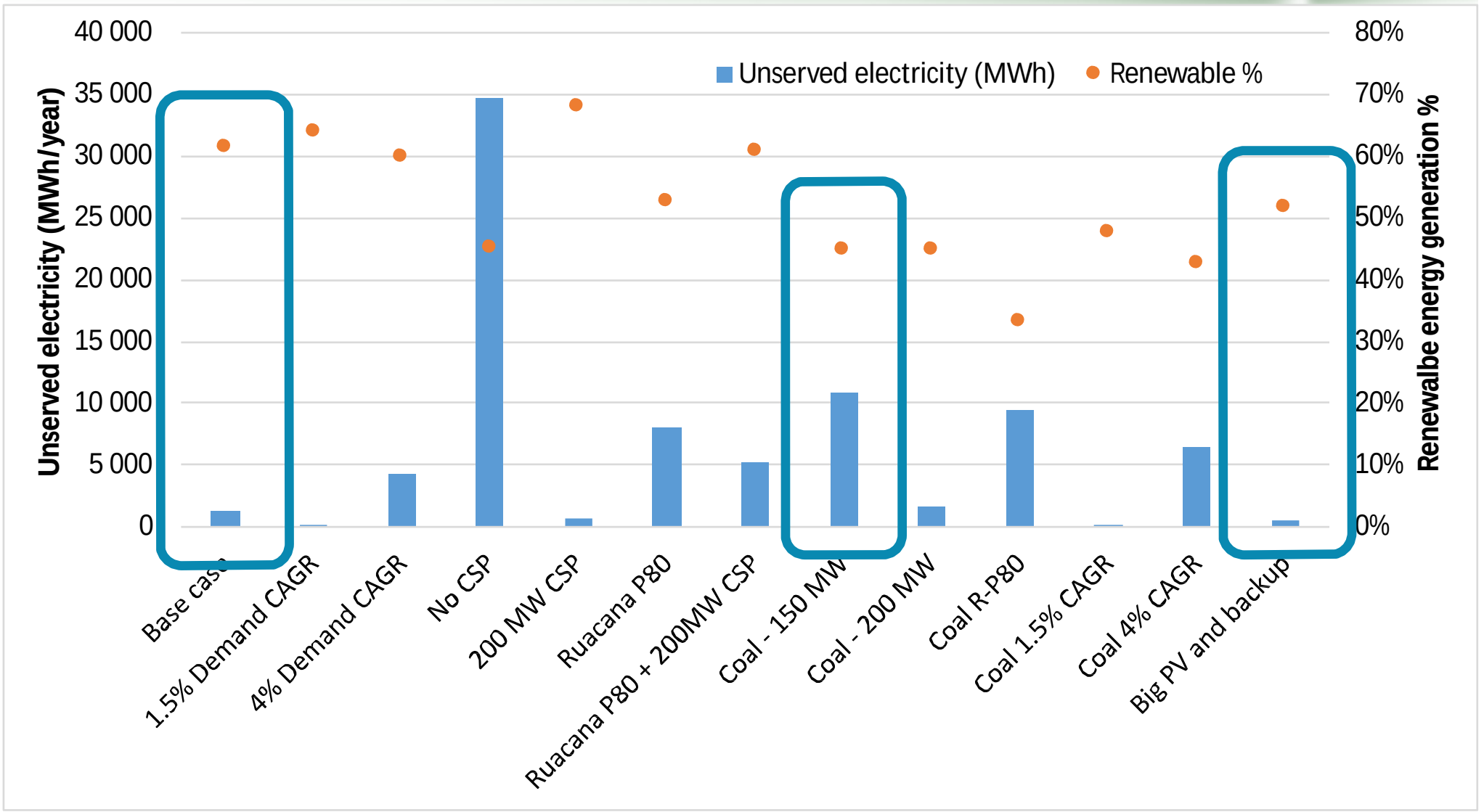
Selected scenario system outcomes



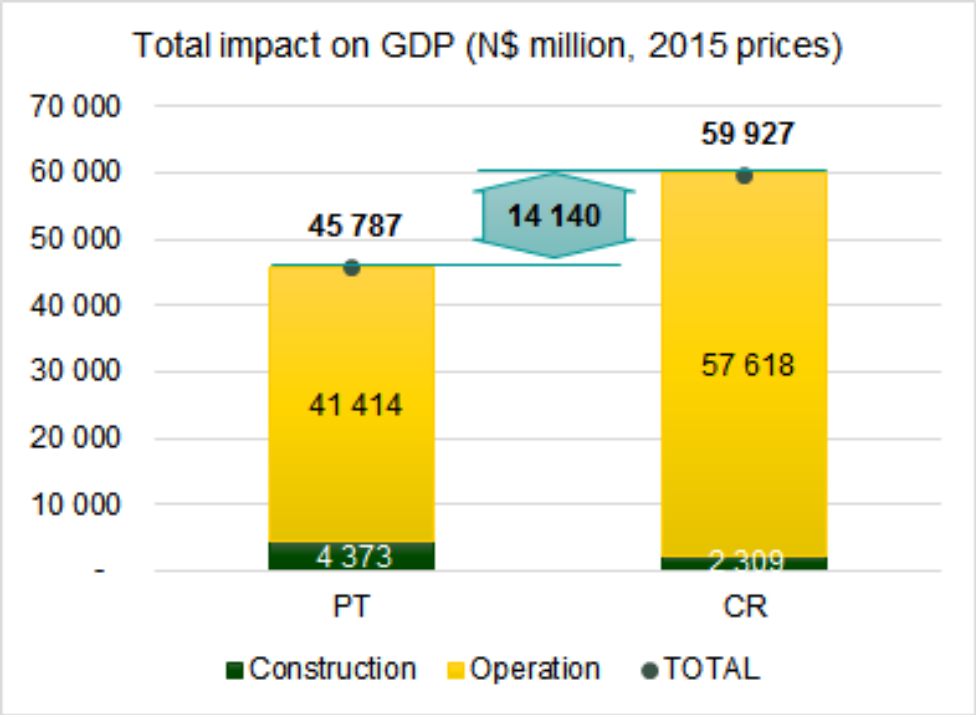
2020 – selected scenarios (lots of assumptions)

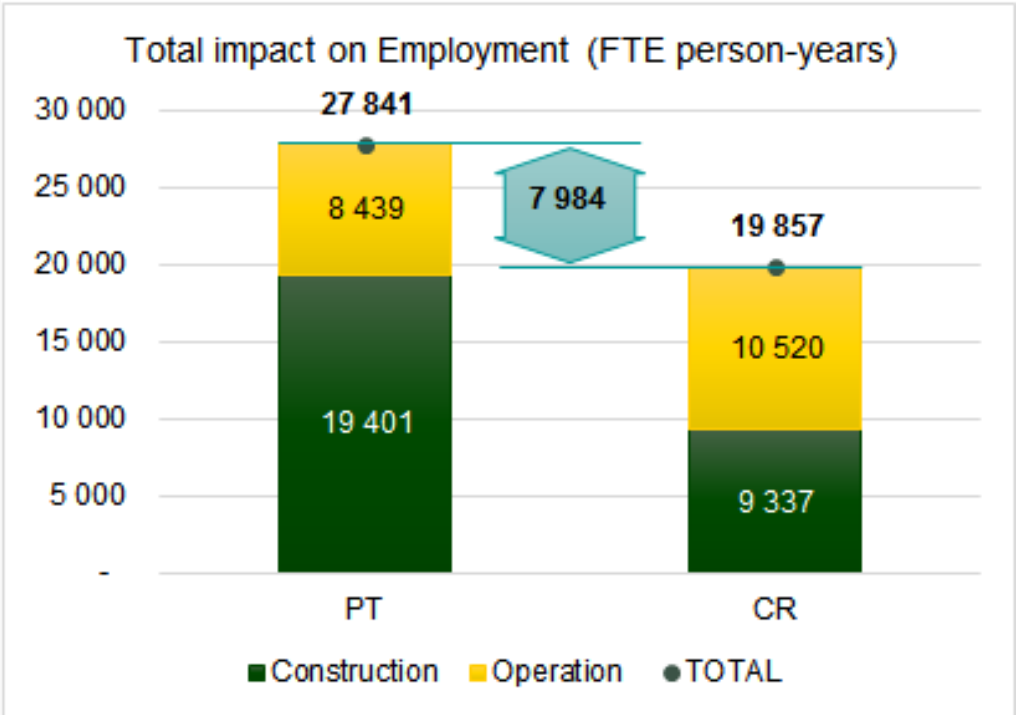


2020 – selected scenarios (lots of assumptions)



GDP impact: PT vs. CR





Big picture: Either PT or CR will be good for Namibia (as first project)

Conclusion

- For different reasons in SA and Namibia, CSP offers value to the system
  - Resilience at low system cost
  - Macroeconomic advantage

- Thanks!

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