

Acceleration of the Energy Transition

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South Africa's great energy choice:

- adopt 21st century technologies to ensure security of supply with the cheapest most reliable energy available in the world today
- or, remain wedded to 20th century technologies

A global energy transition is underway (that will leave all laggards behind) at precisely the moment when South Africa has to close down an ageing fleet of coal-fired power stations.

Note: security of supply is the focus of SA debate, not only climate change & carbon

Global context

- Investments in RE reached \$500 bn, double investments in fossil fuels & nuclear combined
- Prices of RE dropped by 85% in a decade
- Divestments from coal, and now starting with oil & gas
- Massive quantities of cheap capital available for investments in RE
- Technology leaps: 24/7 supply, system-wide tech mixes, storage, H2, etc
- New 'gold rush': find the places with best solar & wind resources - SA ranks near the top

Global power generation mix

(Source: BloombergNEF)

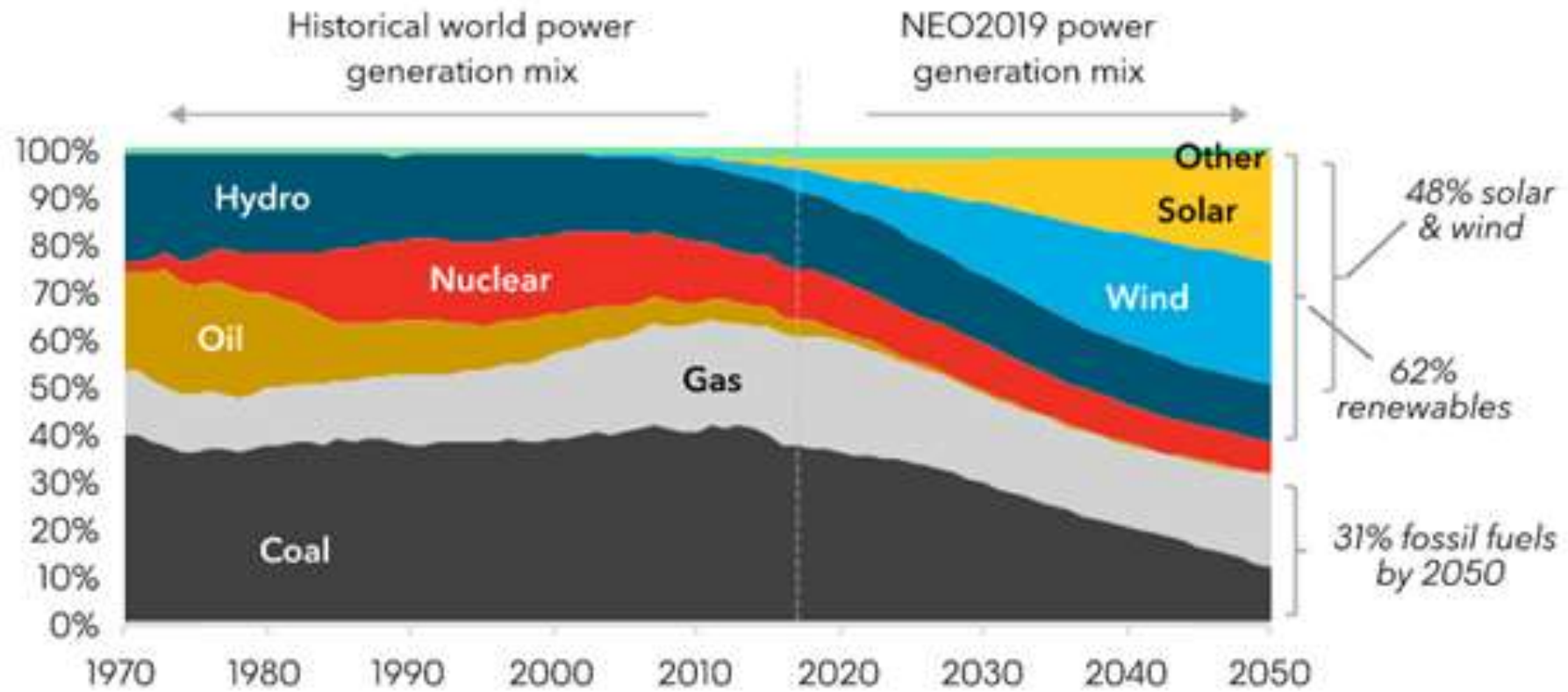
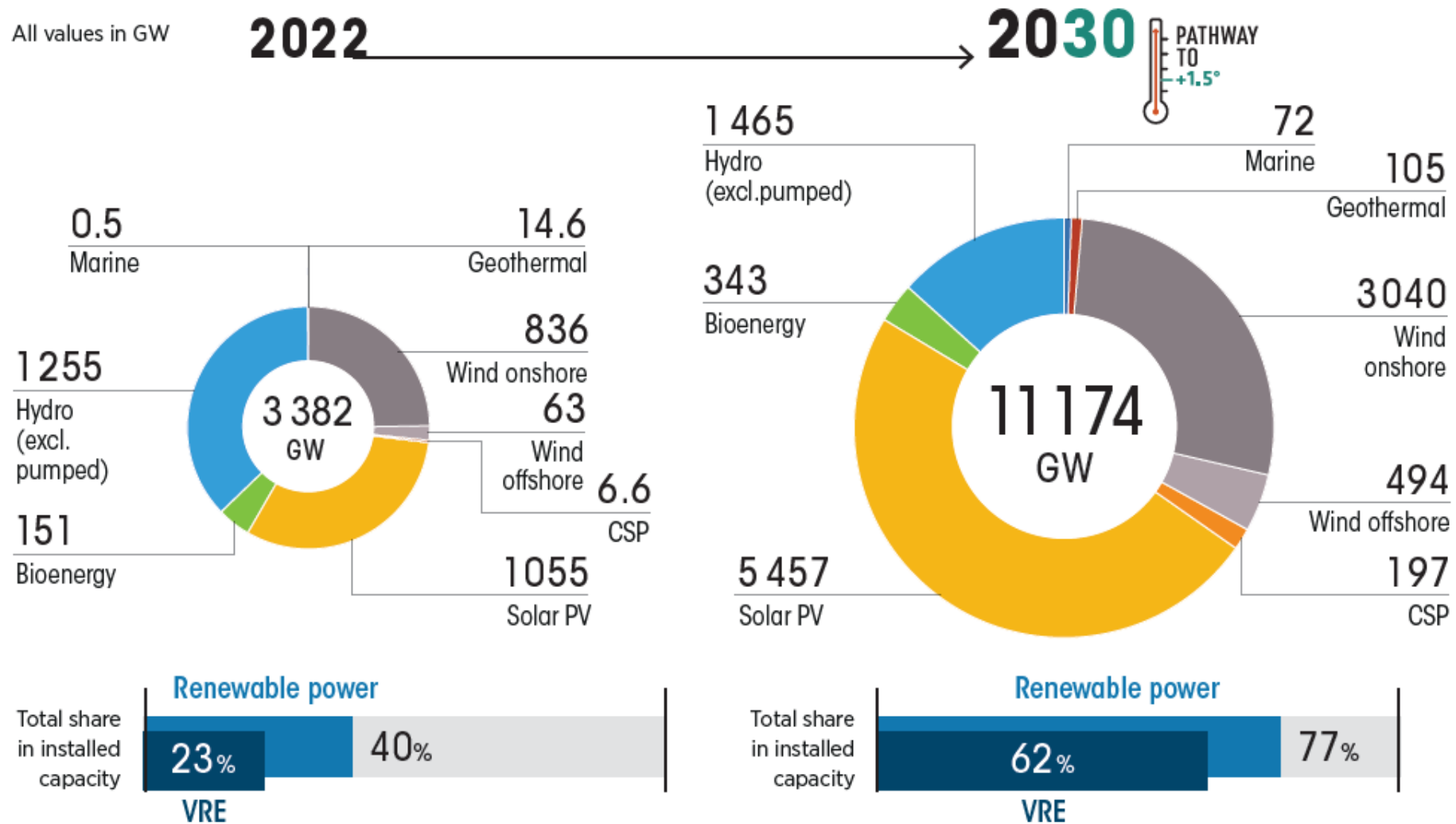


Figure 1 Global renewable power capacity in the tripling pledge, 2022 and 2030



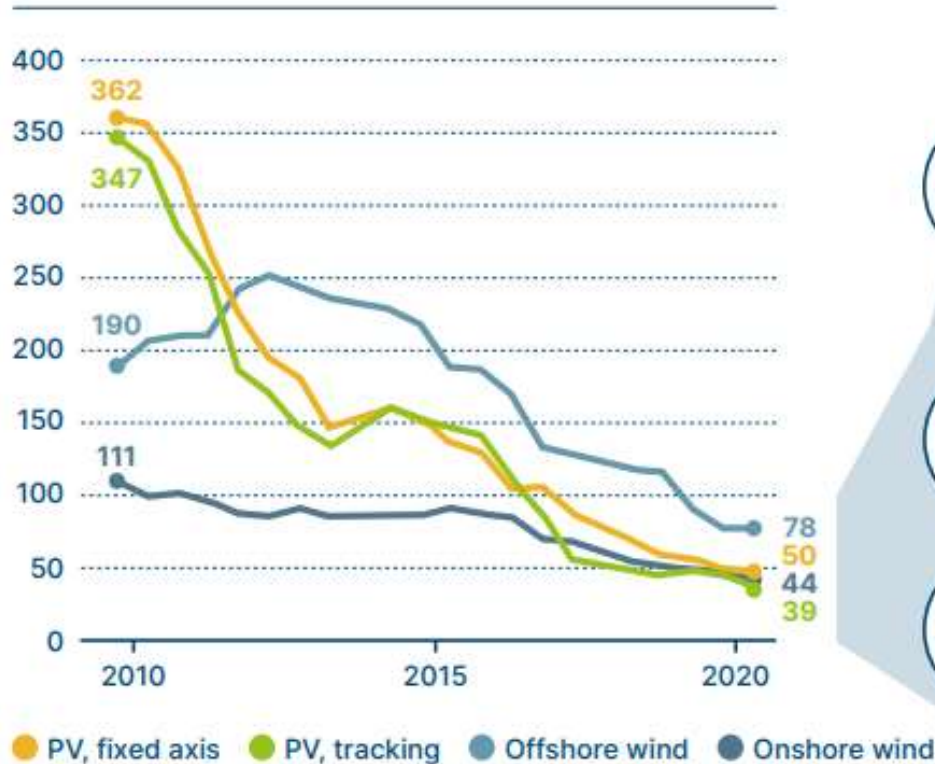
Source: (COP28 Presidency, IRENA and GRA, 2023).

Note: CSP = concentrated solar power; GW = gigawatt; PV = photovoltaic; VRE= variable renewable energy; bioenergy includes biogas, biomass waste and biomass solid

(Source: IRENA, 2023)

Wind and solar LCOE have dramatically decreased in the last 10 years with latest lowest auction LCOEs for solar PV below US\$20/MWh

PV and wind LCOE global benchmarks
LCOE, US\$/MWh, 2019 real



Lowest auctions prices



- Portugal:** US\$13.3/MWh (lowest offer) for 670MW (August 2020)
- India:** US\$38/MWh for solar + batteries delivering 80% of hours per year (June 2020)
- Abu Dhabi:** US\$13.5/MWh (lowest offer) for 2 GW (April 2020)
- Qatar:** US\$15.7/MWh for 800MW (Jan 2020)
- Saudi Arabia:** US\$16.9/MWh for 900MW (2019)
- California:** US\$20/MWh for 400MW (June 2019)



- UK:** US\$51/MWh (£39.7/MWh) for 6GW (2019)
- France:** US\$48/MWh for 600GW (2019)



- Chile:** US\$32.5/MWh for 240MW (mixed with solar and geothermal)
- US:** average wind price at US\$20/MWh (2017)
- Mexico:** US\$20.6/MWh for 250MW (2017)

Exhibit 1.10

LEFT-HAND SIDE: the global benchmark is a country weighted-average using the latest annual capacity additions.
RIGHT-HAND SIDE: economics of auction prices may be favoured by local tax treatments and other implicit subsidies.
SOURCE: Press research, Bloomberg New Energy Finance (2020), 1H 2020 LCOE update

Battery prices have decreased annually by 18% in the last decade and are expected to reach US\$100/kWh by 2023

Battery prices – Observed
US\$/kWh of storage

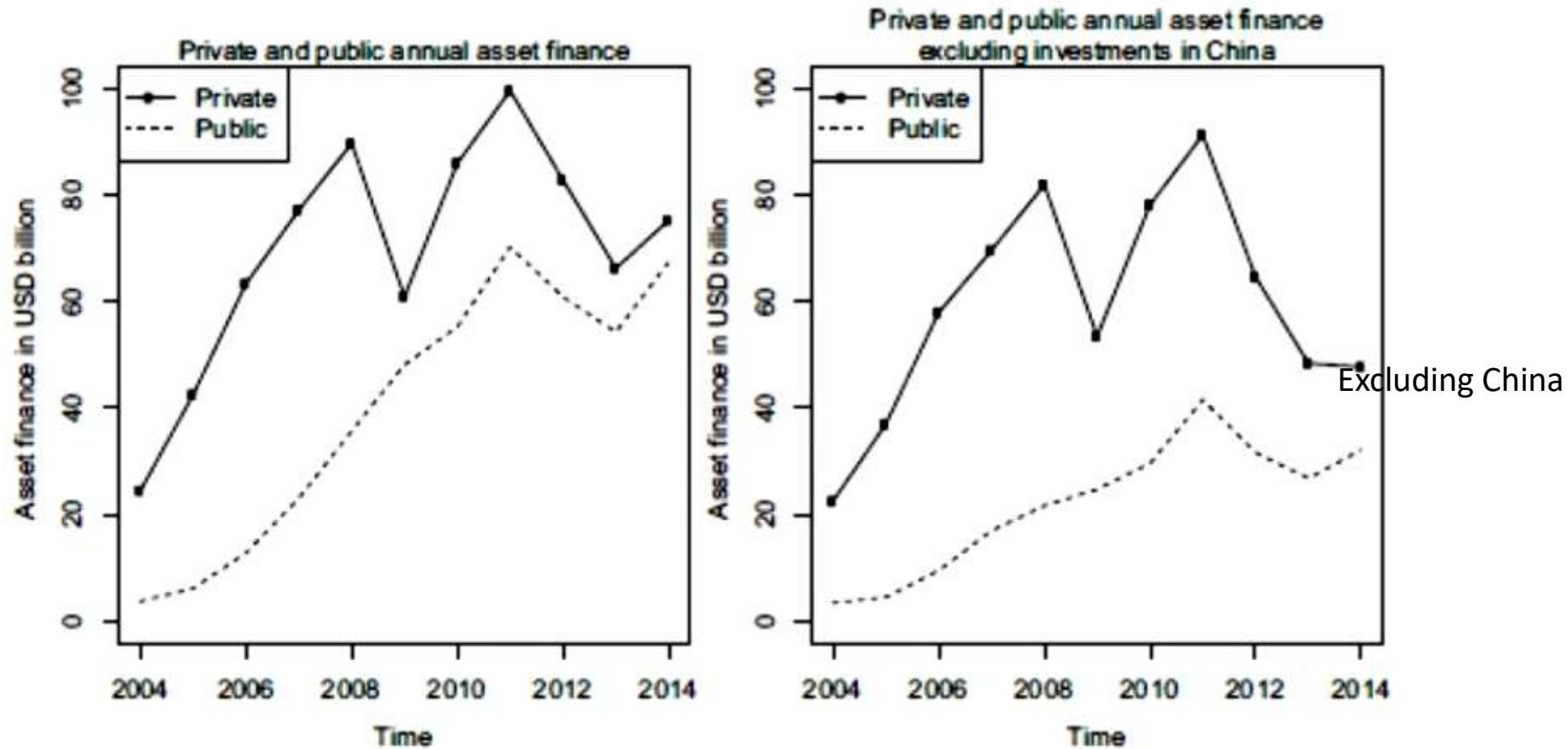
Battery prices – Outlook
Predicted



Exhibit 1.11

SOURCE: Bloomberg New Energy Finance (2019)

Role of the state, 2004-2014



Public sector investments in high risk technologies reduces risk over time, enabling private sector investments in new technologies as their risk profiles come down

Source: Mazzucato and Semieniuk, 2018:15

ReSET Project (SU, Utrecht, Freiberg, IIHS)

- Germany, South Africa, India, The Netherlands
- Focus: transition period framed by the auction mechanism (2009-2022)
- Triple-RE: re-imagining, re-coding, re-configuring
- Transition pathways: turning points where the ‘triple re:-’ is being made to happen – ‘creating, maintaining, disrupting’ (institutional work literature)
- Question: what is the relationship between investments in RE and social justice outcomes as the transitions unfold?

Just
transition:
four
meanings

just about carbon – trickle down

decarbonization plus social mitigation -
welfarism

decarbonization, plus social mitigation,
plus upstream industrialization

only possible via post-capitalist
transition

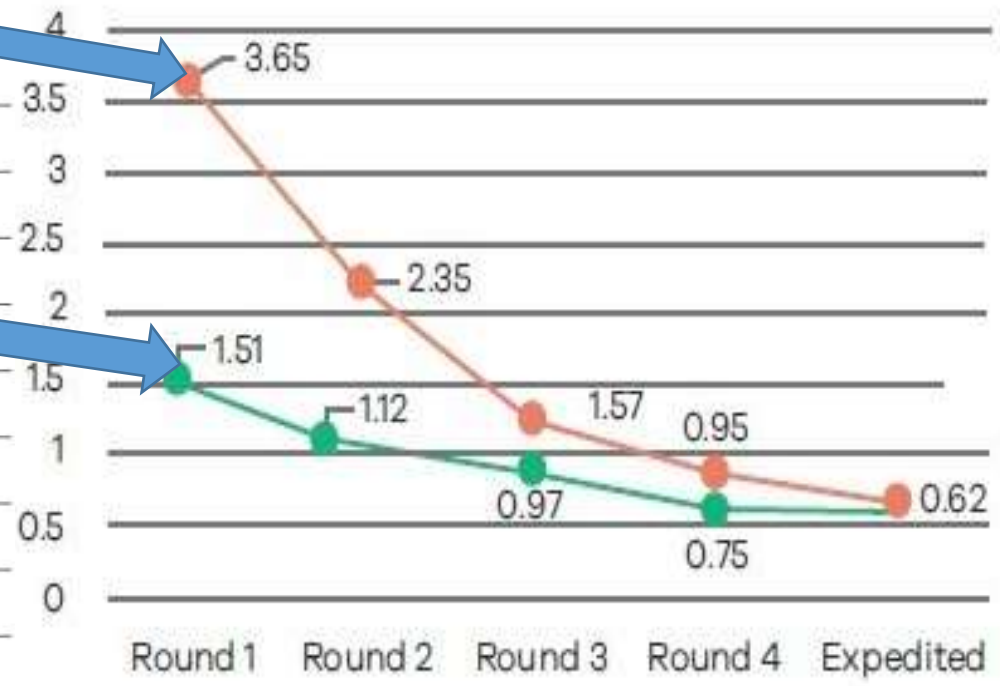
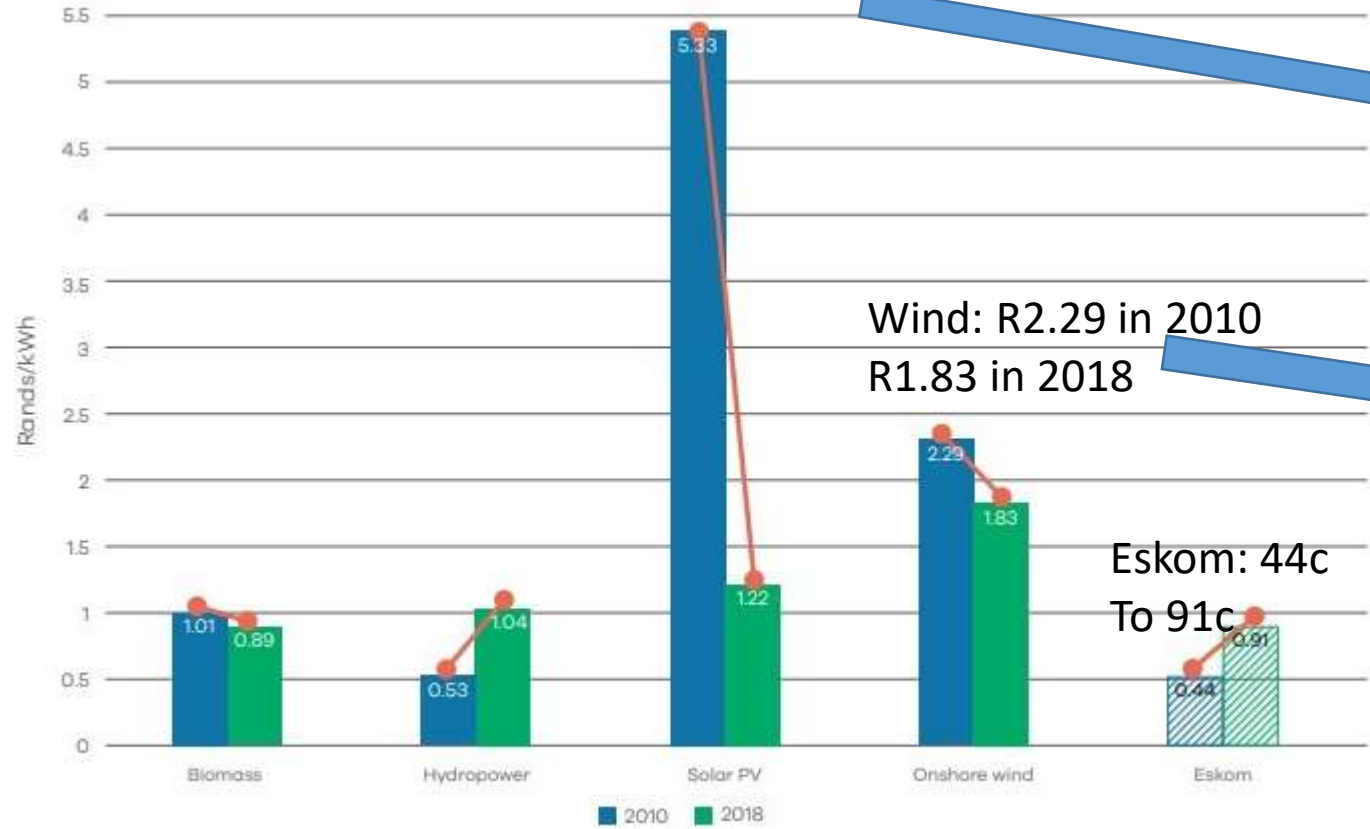
Solar: R5.33 c in 2010
R1.22 in 2018

Wind: R2.29 in 2010
R1.83 in 2018

Eskom: 44c
To 91c

BWs 1 & 2: too high – ave cost spread
across BWs1-4

— Solar PV — Onshore WInds



Today's prices:
Wind: 44c – 85c
Solar PV: 48c – 70c
Nuclear: R2.23-R3.47
Coal: R1.00 – R2.58
OCGT: R2.5-R3.3 (10% capacity)
OCGT: R1.5 – R3.4 (50% capacity)

Figure 4: International levelised cost of electricity (LCOE) per renewable energy technology, and Eskom average tariff trajectory 2010-2018 (Rand/kWh)

Source: Adapted from IRENA (2019)²

(GreenCape 2018)

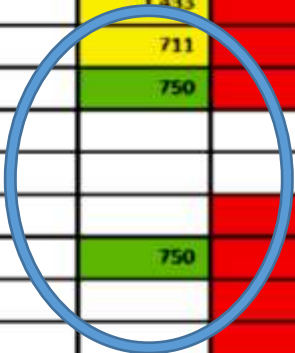
SA Policy Context:

- IRP – DMRE: 2019, 2023
- ESKOM Roadmap – DPE - 2019
- NDC (updated)
- NPC Just Transition Scenario
- PCC – Just Transition Framework
- National Infrastructure Plan 2030
- National Treasury's carbon tax etc
- Low Energy Development Strategy – Net Zero by 2050
- Presidential Economic Advisory Council reports
- Climate Change Act
- Electricity Regulation Amendment Bill is the game changer

Table 5: IRP 2019

New coal, but subject to funding availability, viability of 'clean coal'

	Coal	Gas	Nuclear	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	2 150	-2 373				244	300		Allocation to the extent of the short term capacity and energy gap.
2020	1 433	-557			114	300			
2021	1 433	-1 403			300	818			
2022	711	-844		513	400	1 000	1 600		
2023	750	-555			1 000	1 600		500	
2024			1 860			1 600	1 000	500	
2025					1 000	1 600		500	
2026		-1 219				1 600		500	
2027	750	-847				1 600	2 000	500	
2028		-475			1 000	1 600		500	
2029		-1 694		1 575	1 000	1 600		500	
2030		-10 500	2 500		1 000	1 600		500	
TOTAL INSTALLED CAPACITY by 2030 (MW)	33 364	1 860	4 600	5 000	8 288	17 742	600	6 380	
% 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	



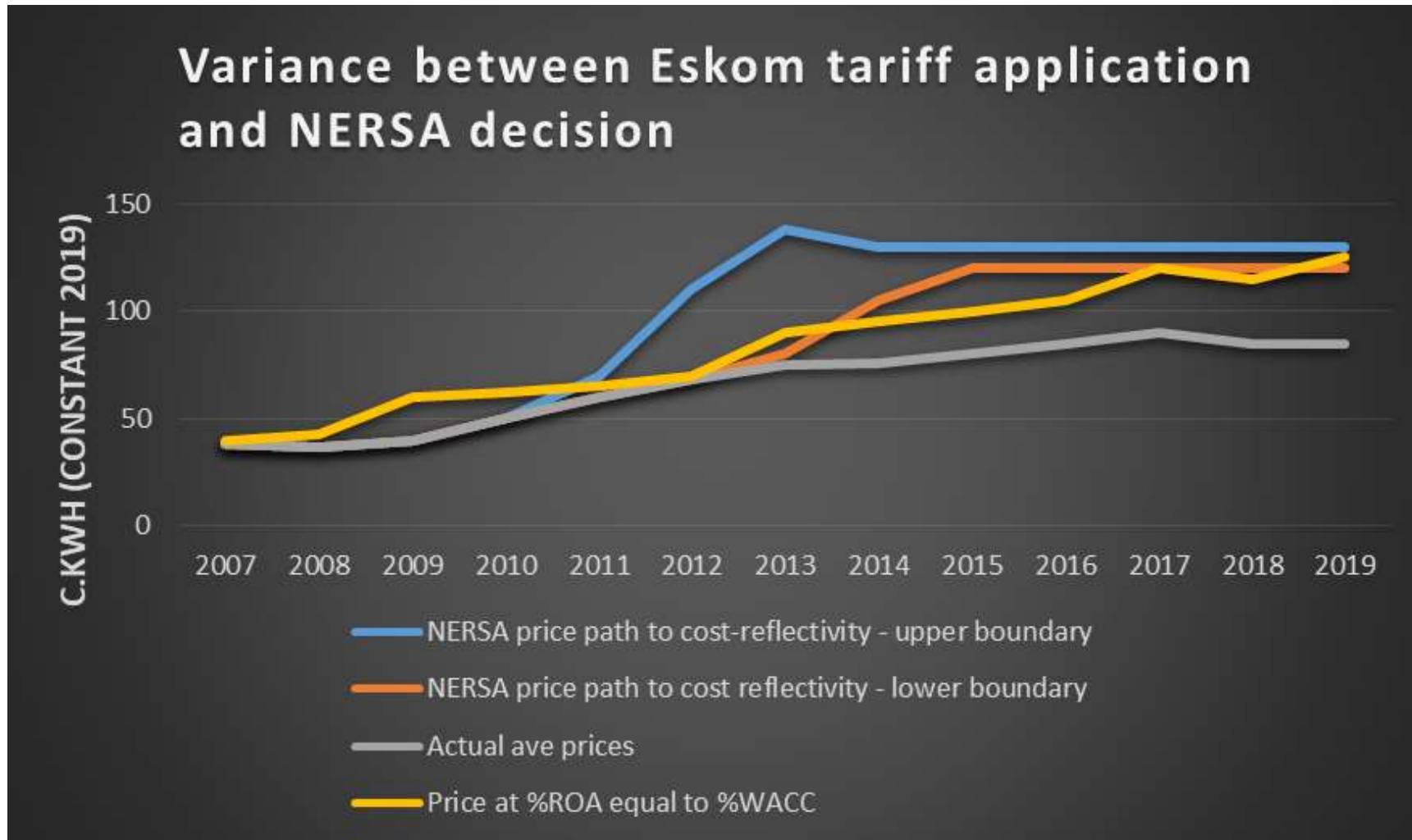
6000 MW 14400 MW

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

Eskom: Problem statement

- Changing structure of global and local coal economy
- Debt = over R400 b – a restructured Eskom can handle at most R200 b
- 50% of the debt held by DFIs plus PIC
- Eskom was reducing spending on Maintenance & Repair (M&R) to service debt
- 2023 Budget Speech – ‘resolving’ Eskom debt, restricting investment in generation, unlocking funds for maintenance and transmission
- Eskom can’t raise additional funding for generation
- Corruption still exists, high levels of inefficiency
- As prices rise demand goes down, which means less income, which puts more pressure on prices – the death spiral
- Renewables cheaper than coal, but delivered via IPPs (privatization of energy generation – surely there must be a role for Eskom?)
- Closure of power stations over next 20 years, starting with 6 in next 3 years (IRP 2019, reversed in IRP 2023)

NERSA has constantly approved tariffs below their own lower cost reflectivity boundary – resulting in a cumulative Eskom shortfall of approx. R350 billion in FY20



- shortfall between Eskom's applications and NERSA's decisions is R350bn
- Inadequate regulated tariff adjustments
- decline in sales volumes
- revenues could not cover costs of primary energy (mostly coal) and other costs
- Low tariffs did not allow Eskom to build cash reserves for the coal new build programme

State of play:

- Energy Action Plan, NECCOM, Ministry of Electricity
- Three delivery systems:
 - REI4P: Rounds 1 to 7 (6.2 GW in Rounds 1-4) – 10 GW plus?
 - Embedded generation (no cap): 15-20 GW
 - Rooftop solar: 5.4 GW, R70 – R80 billion (lapsing of tax benefit has not retarded the pace)
- Rising planned maintenance paying off, unplanned maintenance coming down – but keeping them going forever is a myth (as per IRP 2023)
- National Transmission Company up and running – funding constraints, role of private sector (BOOT/BOT)
- IRP 2023 runs contrary to many adopted policies and global trends, while largely ignored by the financial markets – out of line with the Transmission Development Plan
- 10 000 jobs per GW – 5GW pa = 50 000 construction jobs; 200 jobs per TWh, at 400 TWh = 80 000 jobs
- 56 000 coal workers work for mines that supply Eskom

Declining level of loadshedding:

- weakening demand because of weak economy
- rising prices of electricity
- loadshedding & unreliability of municipal grids
- rooftop solar revolution
- pipeline of large projects coming online

Way forward:

- Redo the IRP 2023 using open-source modelling to ensure realistic assumptions are used
- Creative ways of financing the energy transition will be needed, with much bigger role for DFIs
- Focus on the grid transmission system as the key lever of change
- Address the municipal crisis
- Unlock the catalytic funding from JET IP

Role of CST

- Education: postgraduate degrees (PGD, Mphil, PhD, post-doc) – 20 years
- Research in the energy field: developmental impact of REI4P projects, conceptualizing just transition, financing the JT to 2050, grid transmission challenge, social ownership alternatives, comparative analysis
- Policy engagement: NPC/PCC/DBSA/NT (SA TIED) –
 - what are the investment requirements to achieve the infrastructure goals of the NDP through to 2050?
 - what are the macro-economic implications of the energy transition? (non-equilibrium modeling, with AFD)
 - if fiscal and monetary policies remain the same (i.e. no spend-tax-borrow, or ‘green QE’, i.e. printing money), reconceptualize the SA financial system in ways that allow us to work out how to mobilize domestic capital (‘elasticity spaces’)
 - State capture up to 2018 (2 books) – Eskom as key focus
- Civil society engagements to reinforce the ‘coal closure’ movement