



MINISTRY FOR ELECTRICITY AND ENERGY

Portfolio Committee on Electricity & Energy - IRP 2025



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Minister of Electricity and Energy

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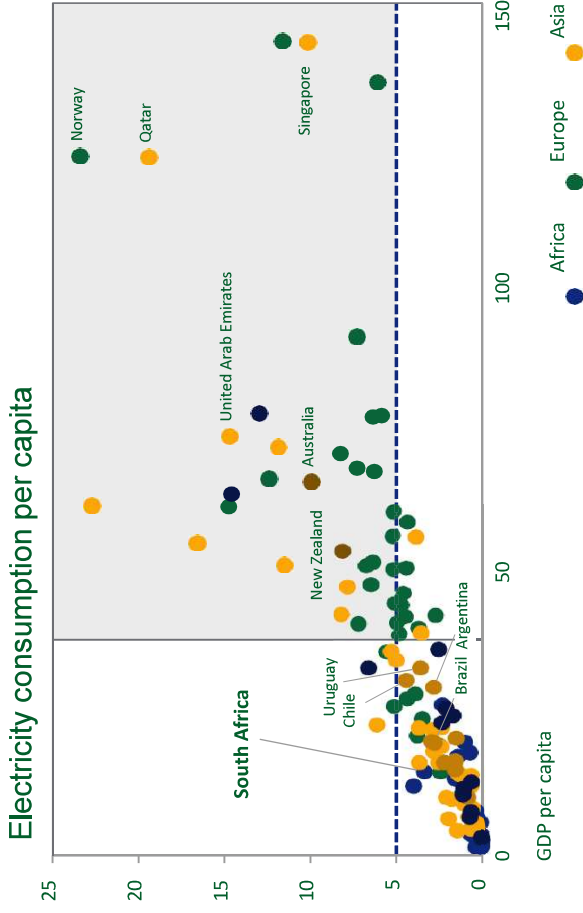
GLOBAL AND DOMESTIC ENERGY COMPLEX IN CONTEXT

Energy security challenges over past 15 years have prevented us from realising this ambition, and moving towards a high growth trajectory

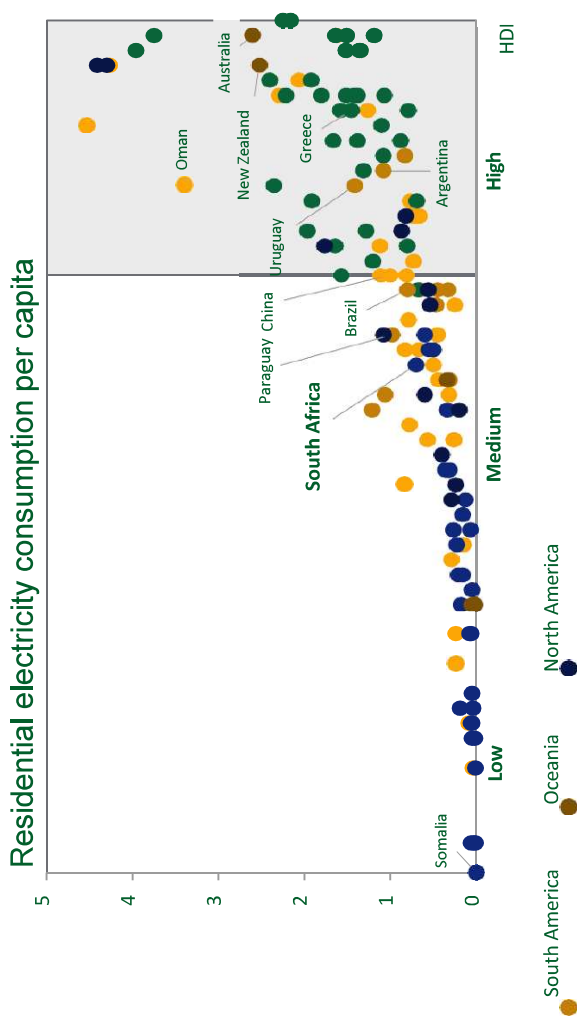
A reliable power system underpins economic growth

High electricity consumption is correlated with high quality of life

GDP per capita (USD PPP, thousands) vs electricity consumption per capita (MWh)



Human Development Index (HDI) vs residential electricity consumption per capita (MWh)





Integrated Resources Plan (IRP) 2025

What does IRP in the South African context mean?

1. The IRP is a **living plan** that is expected to be regularly reviewed, as **necessitated by changing circumstances**.

2. Primarily, the IRP ensure security of electricity supply **necessary by balancing supply with demand**, while optimizing the environmental impact and **total cost of supply**.



3. South Africa continues to pursue a **diversified energy mix** that will provide security of supply while ensuring compliance with its emission reduction plan.

South Africa's approach to **energy security is in line with international trends** and developments

"Planning today for tomorrow's power"



IRP 2025 Objective

What are we seeking to achieve?

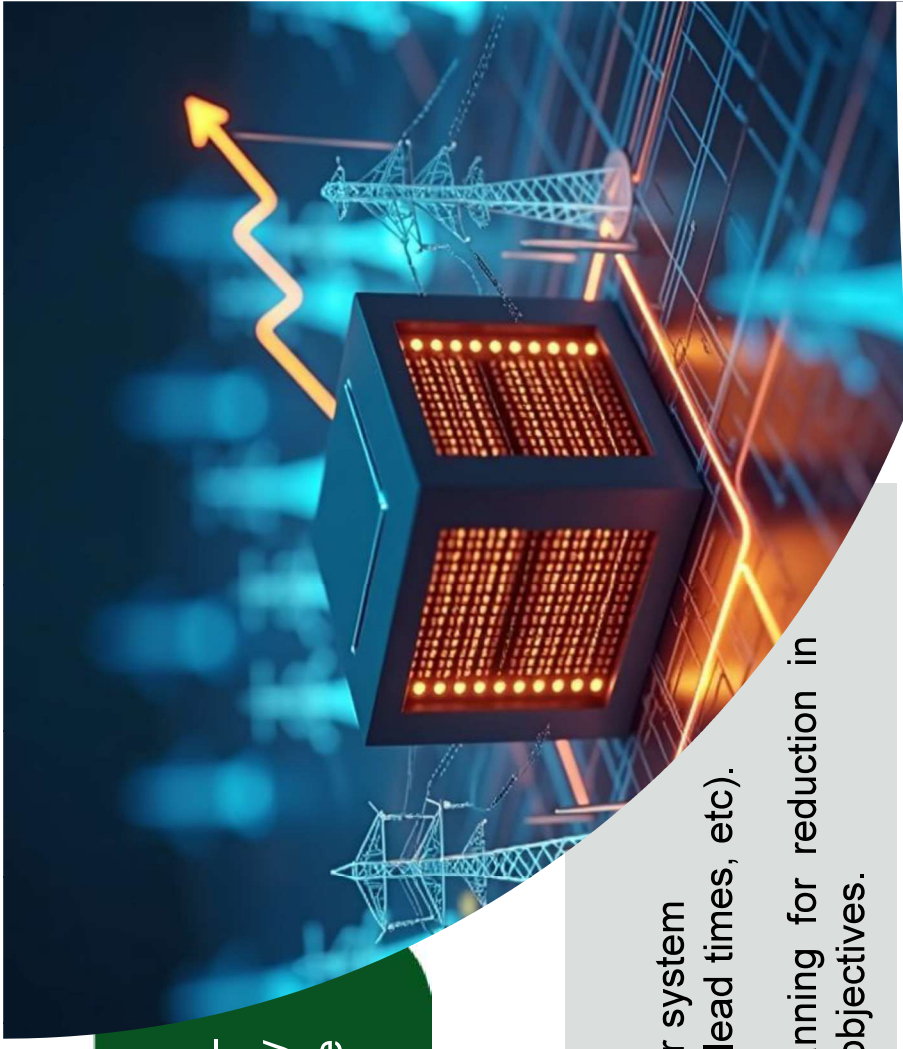
Security of Electricity Supply

ensuring security of electricity supply in South Africa – planning for adequate capacity to satisfy electricity demand and a power system which can endure contingencies or disruptions without interrupting supply

Minimize

- **cost of electricity to the economy** – least cost power system planning, subject to certain constraints (environment, lead times, etc).
- **environmental impact of electricity supply** – planning for reduction in global and local emissions while achieving the above objectives.

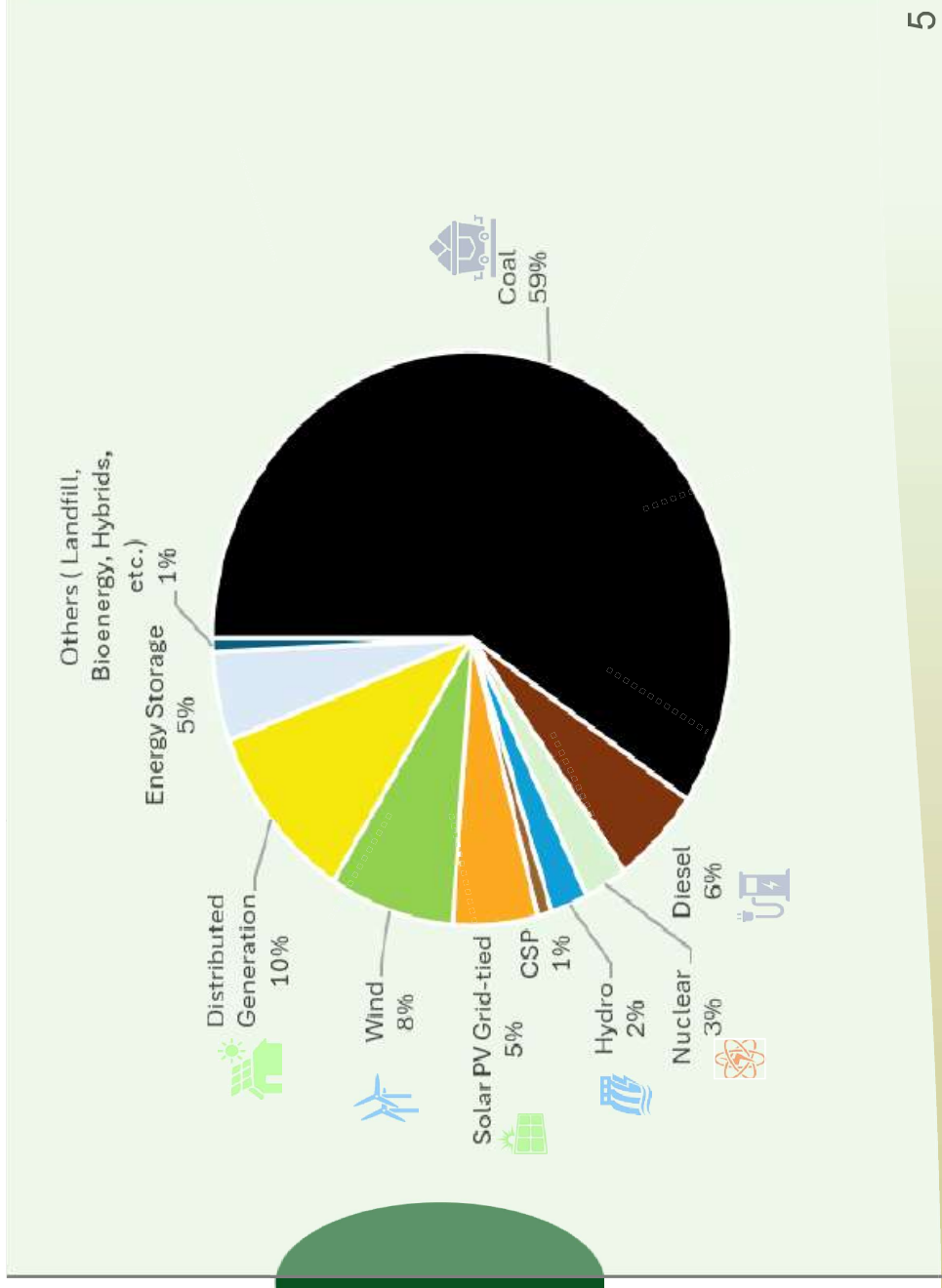
“A living plan for reliable power”





Current Energy Mix

Installed Electricity Generation Capacity (2025)



What is South Africa's current installed electricity generation capacity?

"Coal still dominates, but clean technologies' share is growing fast"



IRP 2025 New Generation Capacity

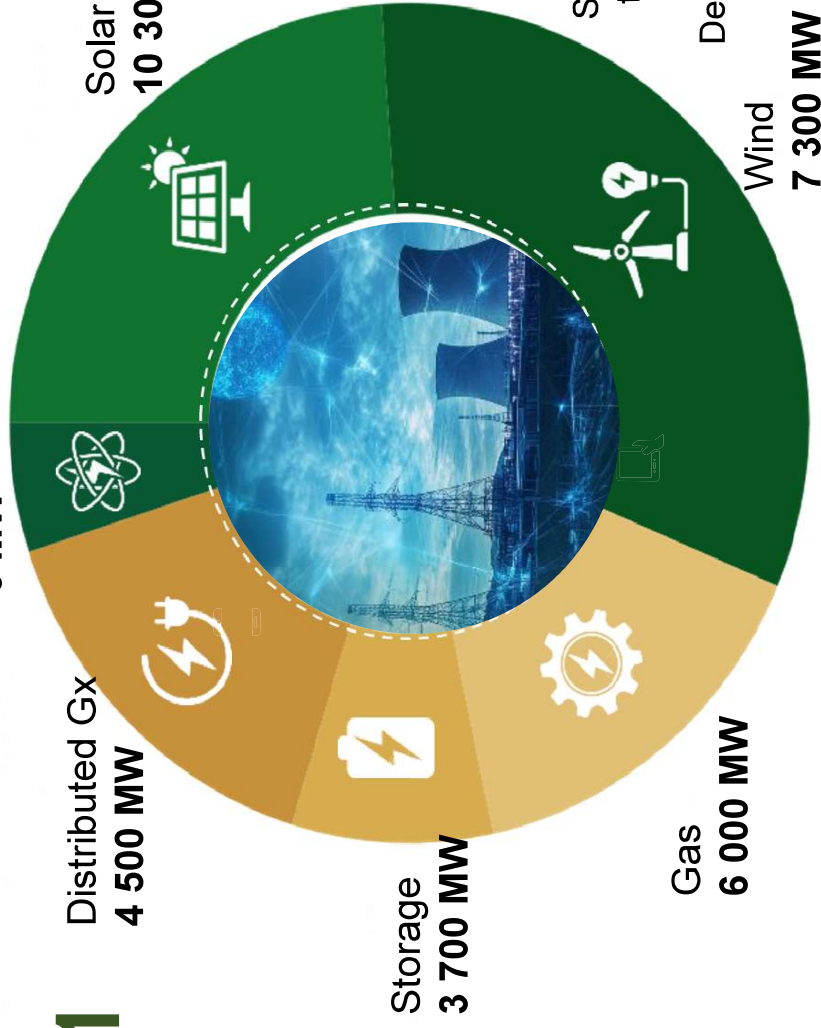
Proposed Electricity Generation Capacity (2026 to 2030)

6000 MW of new gas-to-power by 2030 is critical for energy security and a stable power system.

1

Distributed Gx
4 500 MW

Nuclear
0 MW



2

Clean Coal Technologies
Demonstration Plant by 2030. SA explores alternative solutions that are potentially cheaper and more efficient than Flue Gas Desulfurization for the continued use of coal power generation.

“A diverse, balanced, and greener energy future.”



IRP 2025 New Generation Capacity

Proposed Electricity Generation Capacity (2026 to 2042)

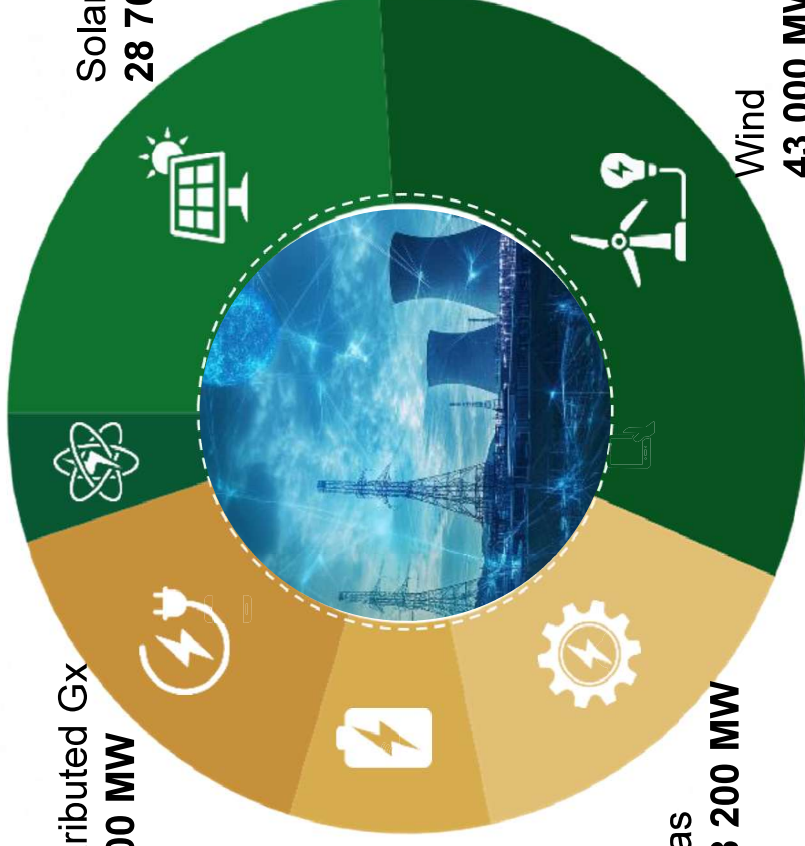
IRP 2025 projects more than **100 000 MW** of new generation capacity by 2039.

1

Distributed Gx
9 000 MW

Nuclear
5 200 MW

Solar PV
28 700 MW



Storage*
9 500 MW

Gas
18 200 MW

Wind
43 000 MW

2
The nuclear industrialization plan will determine the merits of **10 000 MW** new nuclear generations capacity.

*includes Pumped Storage

“A diverse, balanced, and greener energy future.”



IRP 2025 New Generation Capacity

Nuclear Case

South African has experience in operating a nuclear power plant safely and securely for more than forty years (Koeberg* power plant).

Nuclear scenario demonstrates that nuclear technologies provide reliable baseload power whilst complementing intermittent renewable energy generation and energy storage.

To implement the nuclear build capacity beyond the capacity outlined in the Proposed Balanced Plan (**5 200 MW**).

South Africa must develop a **Nuclear Industrialisation Plan** outlining a roadmap towards a generation capacity quantum sufficient to achieve the development of nuclear economy across the entire nuclear fuel cycle value chain.

A case for **10 000 MW** of nuclear rests on the economic viability of re-establishing the nuclear fuel cycle, using nuclear for both power and industrial applications (non-power). This case will be elaborated further in the Nuclear Industrialization Plan.

***Koeberg Nuclear Power Station** is a nuclear power station in South Africa, the only one built on the African continent. It has a rated nameplate capacity of 1926 MW and effective generation capacity of 1800 MW with an estimated energy yield of 13,668 GWh per annum.



GLOBAL CONTEXT FOR NUCLEAR

Global resurgence and emerging trends

- There's a momentum to build new and/or resuscitate nuclear programmes in many countries following the European Parliament's taxonomy for nuclear and gas as clean energy sources in July 2023
- At COP 28 in the UAE in December 2023, over 20 countries committed to **tripling the contribution of nuclear energy by 2050**. The number stands at 31 to date
- **14 of the world's top financing institutions** have indicated their willingness to fund nuclear programmes with the **World Bank** joining the ranks recently
- The World Nuclear Association's **Nuclear Performance Report, 2024** shows:
 - Nuclear reactors worldwide operated at an average **capacity factor of 83%**
 - Generated 2667 TWh of electricity in 2024, surpassing the previous record of 2006 – This equates to **avoiding 2.1 billion tonnes of carbon dioxide** emissions from equivalent coal generation & enough to **wipe out the carbon footprint of the entire global aviation industry nearly twice over**
 - **Seven reactors completed** construction and were **connected to the grid in 2024**. Three in China, with the remaining four in the United Arab Emirates, France, India, and the United States
 - **70 reactors currently under construction** worldwide, with construction on nine reactors starting in 2024, six in China and one each in Pakistan, Egypt and Russia



Energy Availability Factor

Available Energy for a Growing Economy



The Energy Availability Factor (EAF) refers to **the percentage** of the maximum energy a plant can supply to the grid when not undergoing planned or unplanned outages.



Assuming partial implementation of the generation recovery plan, **IRP 2025** is based on a forecast of **255 TWh** of electricity demand by 2029, with Energy Availability Factor range: **66% in 2025** and rising to **68% in 2030**.



A higher EAF means **more electricity** generation capacity is available to meet the country's electricity demand.



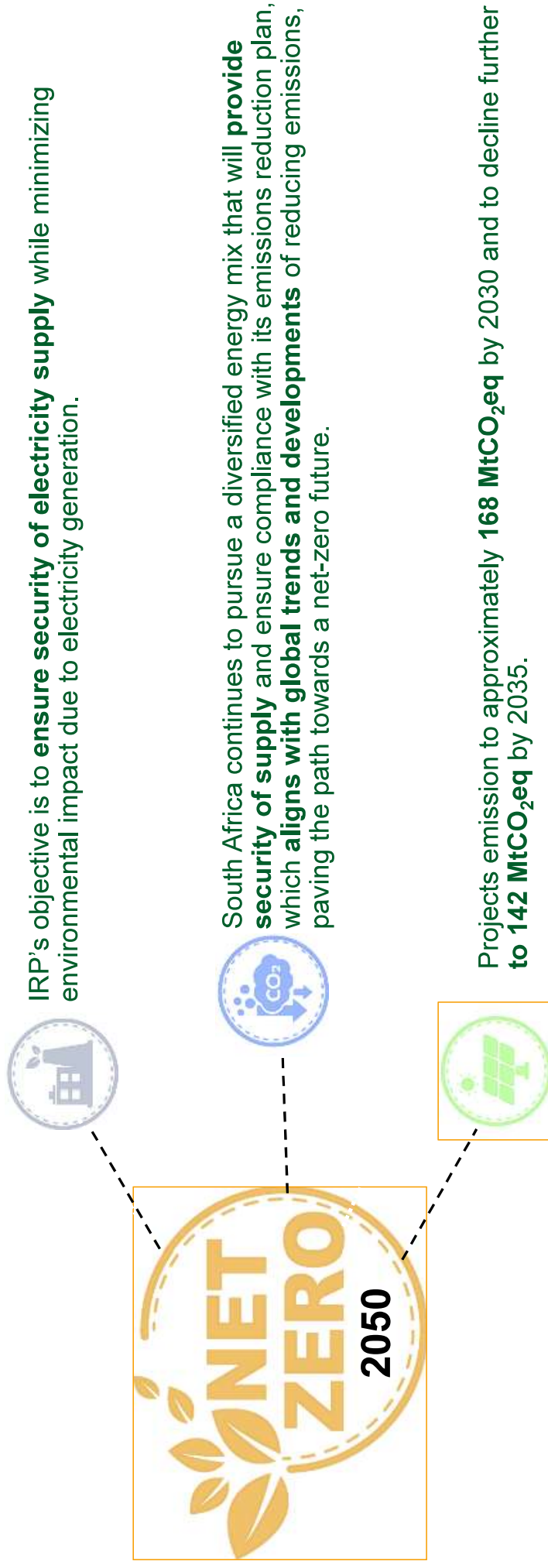
The power system will be **able to absorb any shocks** resulting from emergencies. Additional **economic growth** can be unlocked due to having a stable power system.

“Increased availability = High reliability of supply.”



IRP 2025 – Minimizing Impact on Environment

Transitioning of Energy System to Lower Emissions



“A diverse, balanced, and greener energy future.”



Projected Installed Capacity Mix

Electricity Generation Capacity (by 2042)

Technology Type	Capacity (MW)	Percentage (%)
Coal	17 960	11
Wind	48 300	30
Solar PV	32 300	20
Gas	22 000	14
Distributed Gx	16 000	10,1
Nuclear	7 000	4,4
Storage (inc PS)	12 900	8,1
Hydro	1 600	1
CSP	600	0,4
Total		158 660

South Africa’s installed electricity generation capacity by 2042.

* 40 960 – 23 000 (decommissioning)



Policy Decisions

Transitioning of Energy System to Lower Emissions

1. **Energy Availability Factor (EAF)** to be maintained at levels above **60%**.
2. **Gas-to-Power (6000 MW)**
 1. Minimum load factor of 50% is necessary for this initial gas-to-power programme to ensure security of supply and to anchor gas processing infrastructure.
 2. This approach should also have built-in flexibility to adjust the load factor should the need arise at any time of the contracting period. Introductions of variable load factor at a later stage.
3. **Demonstration plant on clean coal technologies by 2030** as the country explores other options which are potentially cheaper and efficient than Flue Gas Desulphurization (FGD).
 1. Crucial to demonstrate domestic operational conditions.



Policy Decisions

Transitioning of Energy System to Lower Emissions

4. **Develop a Nuclear Industrialization Plan** to plot a roadmap determining the minimum capacity to reach the economies of scale for the entire nuclear fuel cycle value chain within the country.
5. **Ensure effective implementation and monitoring** of the South African Renewable Energy Industrialization Masterplan (SAREM).
6. **Consider** implementation of transformative opportunity for “**mega bid window**” that not only accelerates energy deployment but also fast-tracks industrialisation, localisation, and job creation across the energy infrastructure value chain.



Concluding Remarks

Key Take-aways



Security of Electricity Supply

- Planning for an increasing and stable **EAF**. Stable power system unlocks South Africa's economic potential.



Estimated Investment in the Economy

- ~ ZAR 2.2 trillion by 2042.



Downward Trajectory of local and global emissions

- South Africa is keeping to its commitment on reduction of emissions, without compromising energy supply security.
- Draft NDC 2035 currently being developed. This will demonstrate further commitment and alignment to energy security.



IRP 2025 – Indicators & Comments

Transitioning of Energy System to Lower Emissions

Key Indicators

Total Cumulative NPV cost (Rb)	~2 200
Annual Expected Energy (TWh) in 2030	255
Energy Availability Factor (%) from 2025-2030)	66-68
Expected CO ₂ (Mt) Emission in 2030	168
Average Annual Gas CCGT Load Factor (%) from 2030 to 2040	51

1. **Total installed capacity of RE (Wind, PV and Embedded) generation increases from ~12 GW to more than 50 GW between 2023 and 2035**
2. **Representing ~ 50% of the total new build capacity by 2035.**
3. **Period up to 2042 shows an approximate 5 GW of new RE generation build per annum.**
4. **Proportion of RE penetration relative to installed capacity rises steeply beyond 2035 to more than 50% by 2042 whilst the share of coal generation capacity reduces significantly.**
5. **The installed capacity share of energy storage increases steadily to more than ~ 4 GW by 2030.**



THANK YOU

