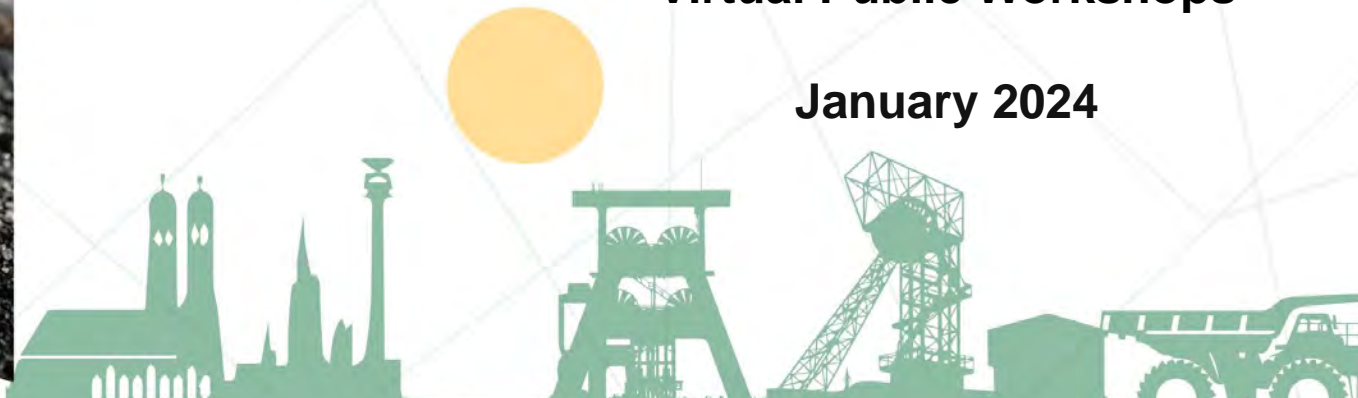




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INTEGRATED RESOURCE PLAN 2023
Virtual Public Workshops

January 2024



PURPOSE

➤ The purpose of this presentation is:

- to engage the public on the update of the IRP, share the key assumptions, scenarios used, observations made;
- to encourage the public to make comments, submit data and inputs to the IRP process by the 23rd February 2024



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ASSUMPTIONS MADE IN THE IRP 2019 HAVE CHANGED SIGNIFICANTLY, NECESSITATING A REVIEW

1



Eskom Generation Plant

- Plant performance is currently trending below 60%, with year to date (YTD) energy availability factor (EAF) at ~ 54%, well below the ~75% assumed in the IRP 2019
- The shutdown plan of generating units, predominantly coal-fired, has been updated in line with Eskom's strategy

2



New Generation & Grid Capacity

- Procurement and rolling-out of new generation capacity did not materialise as per the IRP 2019 timelines
- Transmission capacity constraints in high resource locations further inhibit new generation capacity rollout

3



Demand

- Global economic slowdown negatively impacted Gross Domestic Product (GDP) growth



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OBJECTIVES OF THE TWO HORIZONS APPROACH

Horizon 1 of the IRP review seeks to establish the Power System Reference and Test Cases up to year 2030

- Assess the power system supply and demand balance
- Quantify the shortfall and evaluate the impact of energy initiatives pursued by both government and the private sector.
- Recommend as a plan that updates the current 'IRP 2019 Emerging Plan'

Horizon 2 seeks to establish the Power System Reference Case and evaluate energy pathways up to year 2050

- Identifies existing and anticipated ESI challenges that are impacting security of supply.
- Analyses a core set of energy pathways in the medium to long term, considering mitigation of the challenges to ensure an adequate and stable power system.
- Proposes a set of outcomes that will be used to inform the final energy mix.



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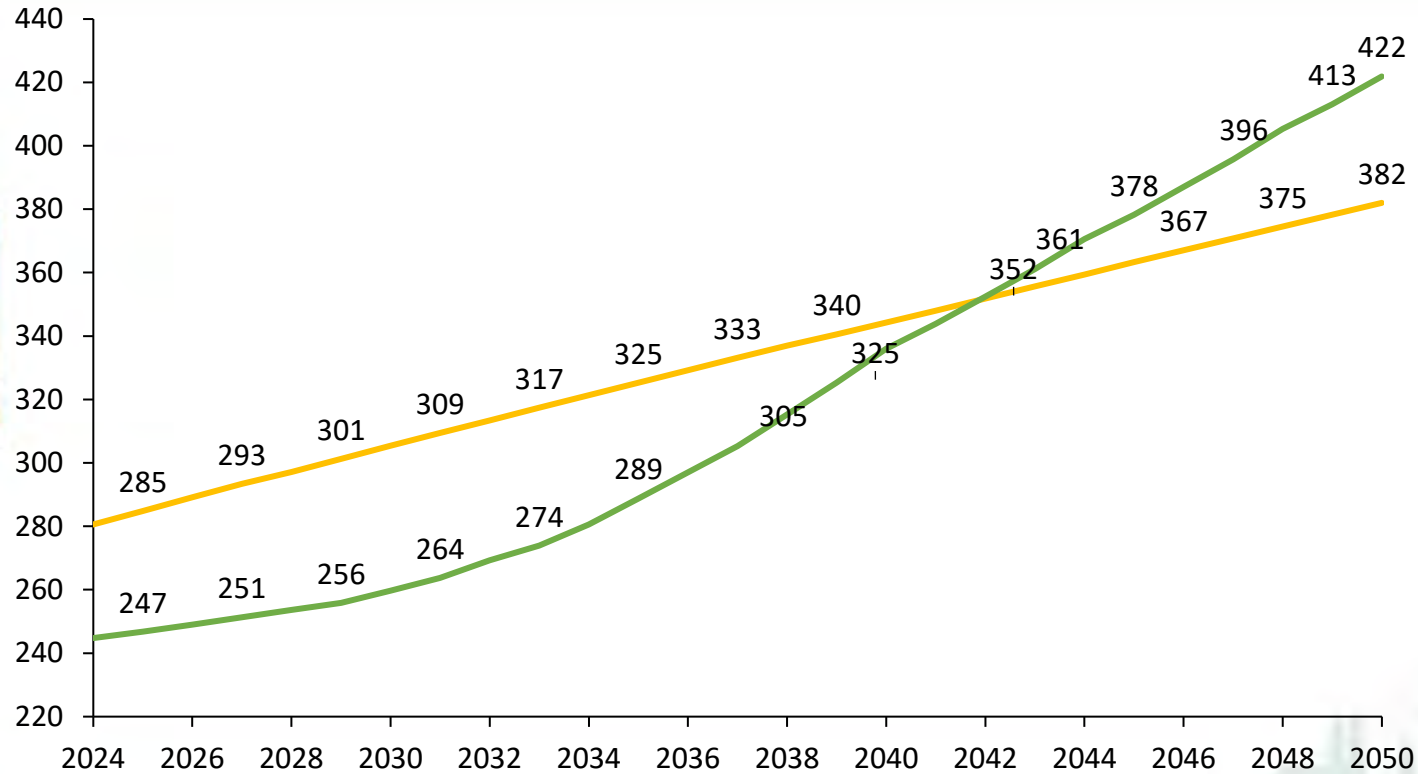
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DEMAND ANALYSIS POST IRP 2019

Overview of energy demand assumptions across scenarios.

Energy Demand (TWh per calendar year) — IRP2019 — IRP2024



Insights

- Several factors negatively impacted global and local economic growth which led to lower than envisaged energy demand forecast.
- GDP tracks recent projections, drifting upwards to 3.2% by 2030
 - Composition assumed relatively constant demand, with slight growth in tertiary sector
- Energy demand is expected to grow at a higher rate reaching 3.8% by 2050.

Source: UCT (June 2023)



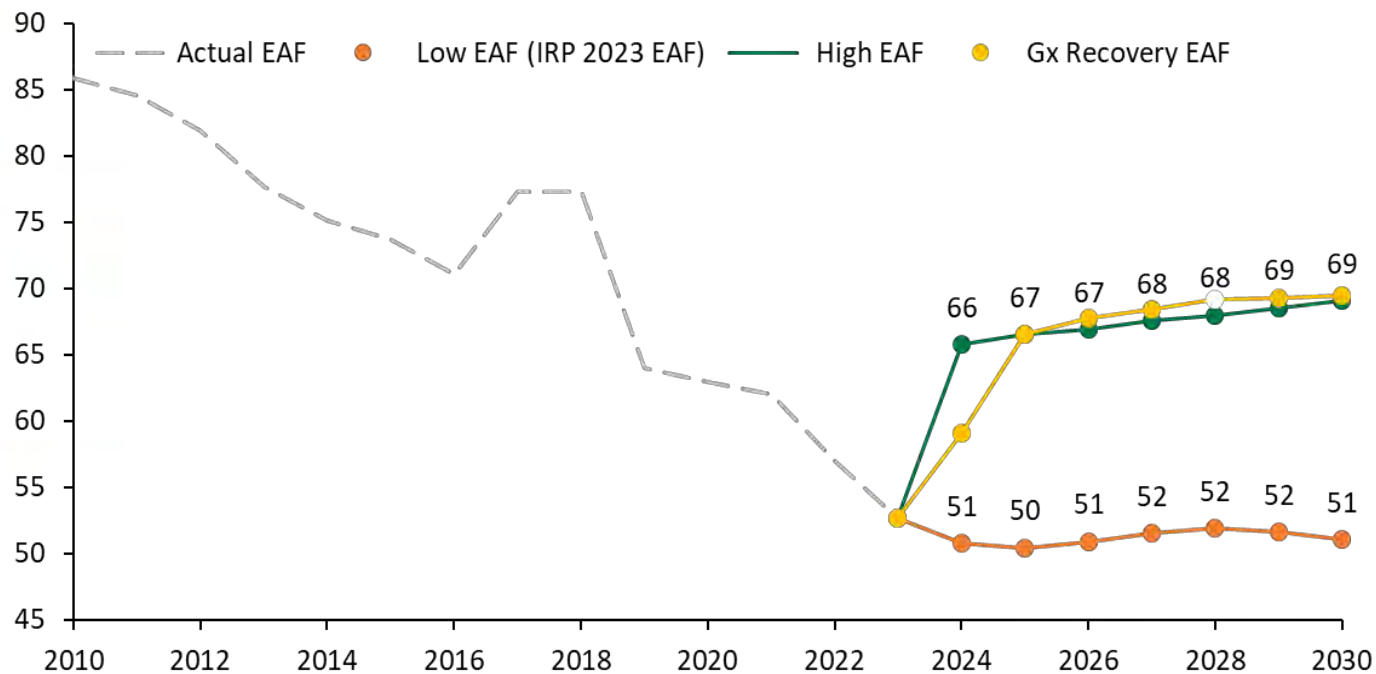
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PLANT PERFORMANCE SCENARIOS

Overview of existing fleet EAF assumptions (%)



Insights

- Reference EAF based on the Eskom submission assuming that the current trend continues
- EAF improvements in the Reference are based on bad performing stations shutting down according to the Eskom 2035 Strategy.
- High EAF assume is that Eskom's stations targeted for reliability maintenance results in an improvement
- As of December 2023, EAF was 55.3%.



Source: Eskom Generation



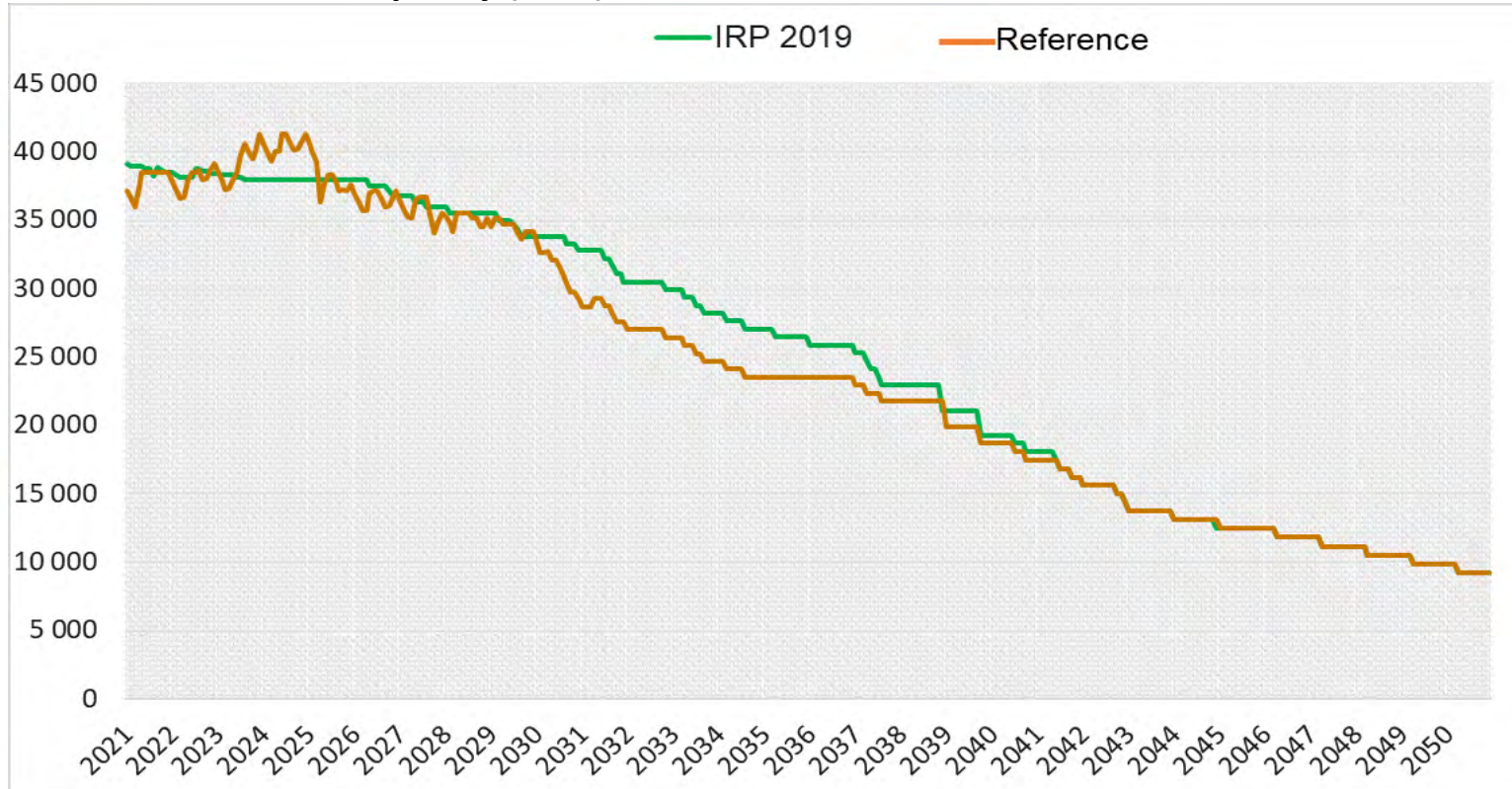
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IMPACT OF SHUT DOWN DATES ON ESKOM COAL FLEET CAPACITY

Installed coal fleet capacity (MW)



Insights

IRP 2019

- Followed 50-year life of plant and earlier shutdown for some older coal stations.

Reference (Eskom Strategy 2035)

- Shut down dates differ from IRP 2019.
- The net impact is increased capacity in the immediate term due to:
 - Life extension of some older coal stations while some units are planned for earlier shutdown
 - Delayed commissioning of new build units
- Tutuka shuts down earlier than 50-years, all units shut down by September 2030.

Sources: Eskom Gx Data submission



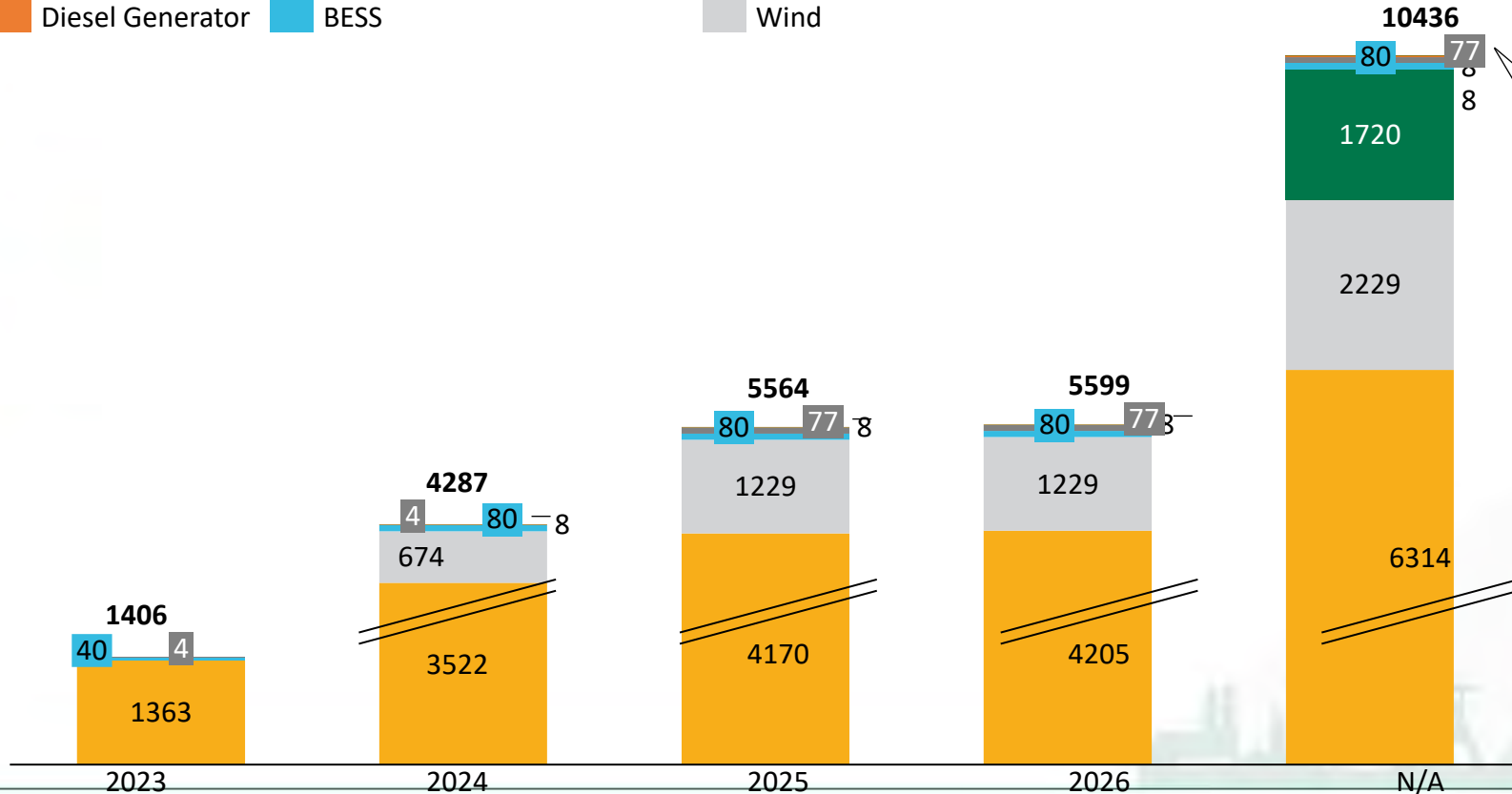
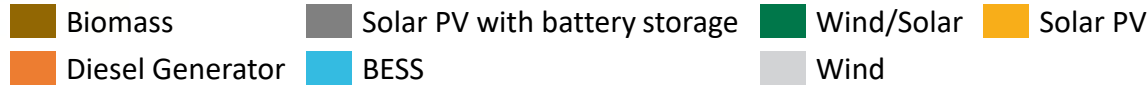
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BUSINESS INITIATIVES: POTENTIAL FOR 10.4 GW ADDITIONAL CAPACITY BY 2030

Additional Capacity* (MW)



Comments

- The total Business Initiatives amount to 10 400 MW as of August 2023
- This includes projects ranked to have low likelihood as they do not have location and/or Commercial Operation Date (COD).
- Solar PV accounts for ~ 60% of the total



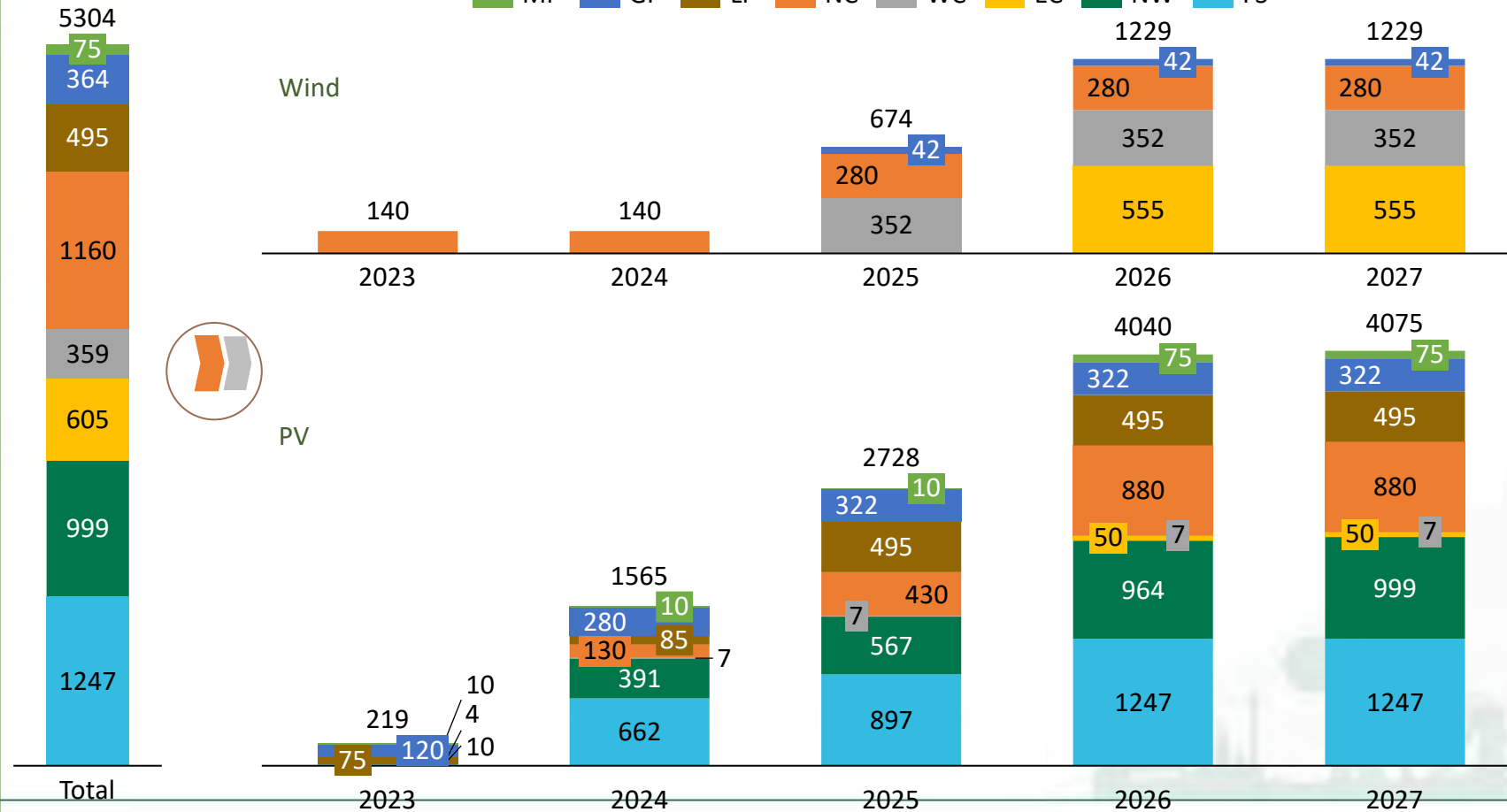
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BUSINESS INITIATIVES IN THE REFERENCE CASE

Additional Capacity* (MW)



Comments

- A derivation of the total Business Initiatives amounting to 10 400 MW excludes projects without a location and/or COD, reducing the Business Initiatives capacity to 5 300 MW.
- This capacity is the basis for the Reference case in Horizon 1.



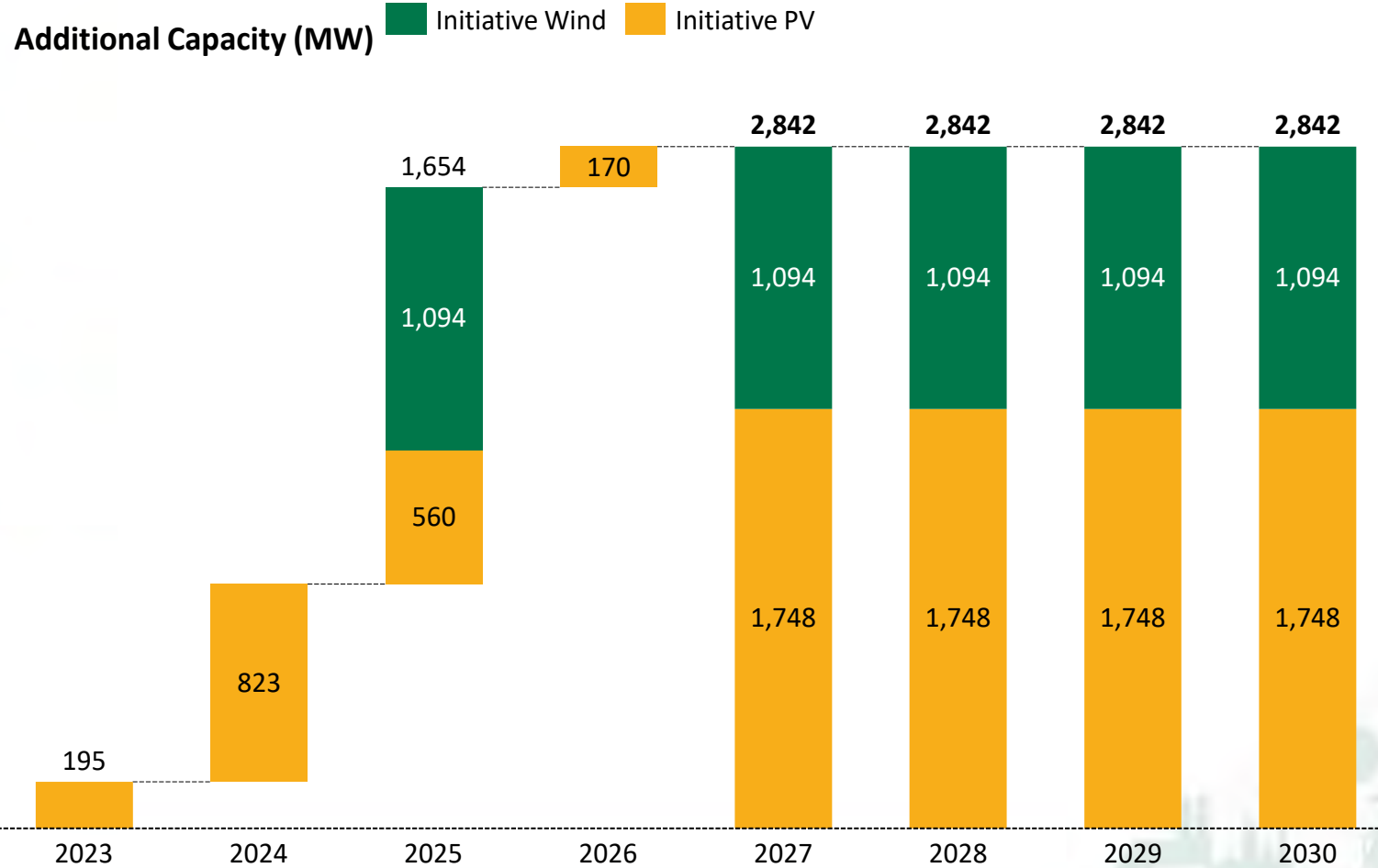
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BUSINESS INITIATIVES IN THE FIRM CASE

initiatives that are highly likely and included in the Firm Case amount to 3.8 GW by 2030



Comments

- Criteria for 'highly likely' considers projects that are either under construction or have Environmental Impact Assessment (EIA) approval, reached financial close, record of decision and reserved grid capacity
 - Risk Mitigation** - projects totalling 150 MW expected in 2024
 - Business Initiatives** - A total of 2 842 MW, considered priority by Business is expected by end 2025.
 - REIPPP BW5** - projects to yield 784 MW expected in 2025



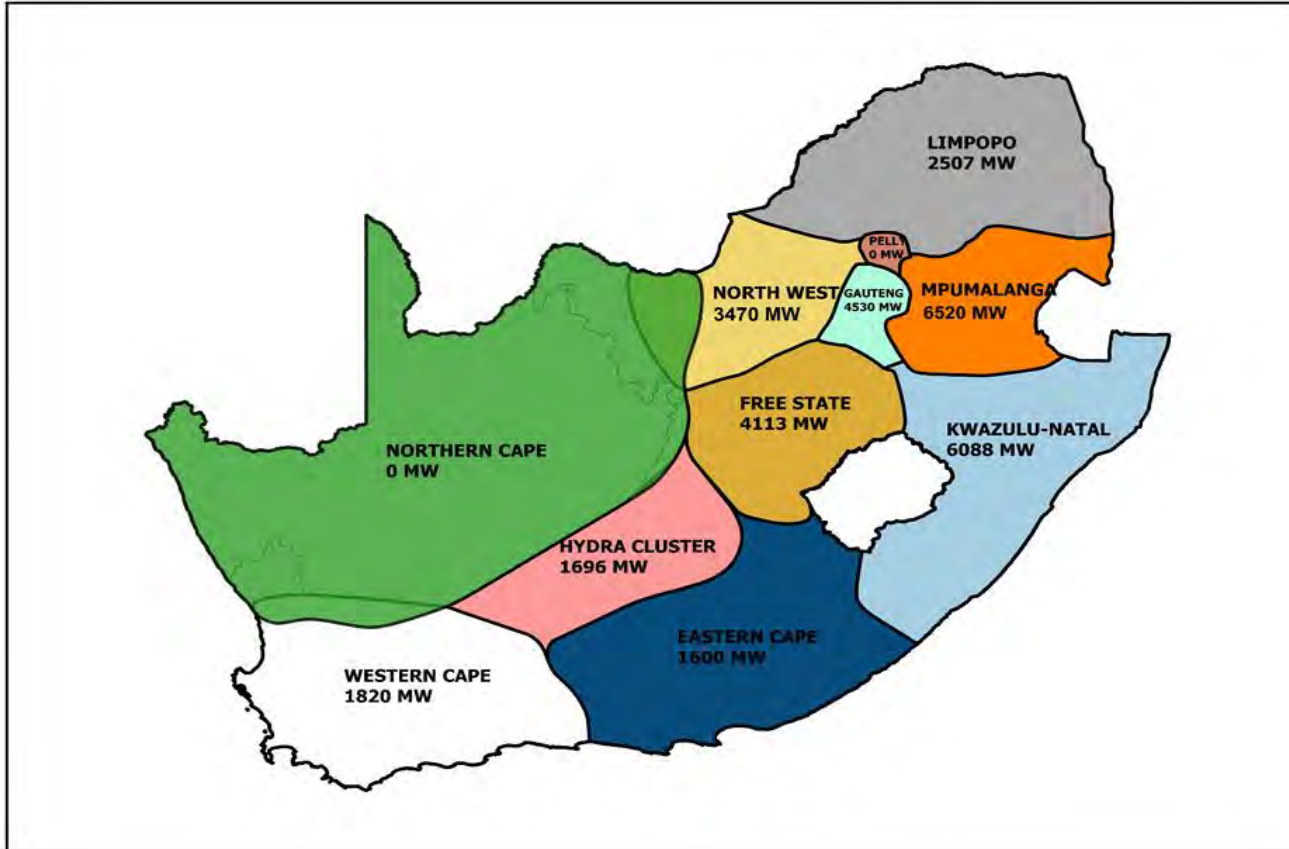
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OVERVIEW OF ASSUMED GRID CONNECTION CAPACITY ACROSS PROVINCES

MW of new generation capacity that can be added based on grid availability



Insights

- Grid availability per province as per the Generation Connection Capacity Assessment 2024
- Capacity reserved for REIPPP Bid Window 5 and 6 as well as RMIPPPP.
- Development of the Transmission Grid is as per the TDP 2023-2032
- Estimated new transmission lines total more than **14 000 km** and more than **170** transformers in the period



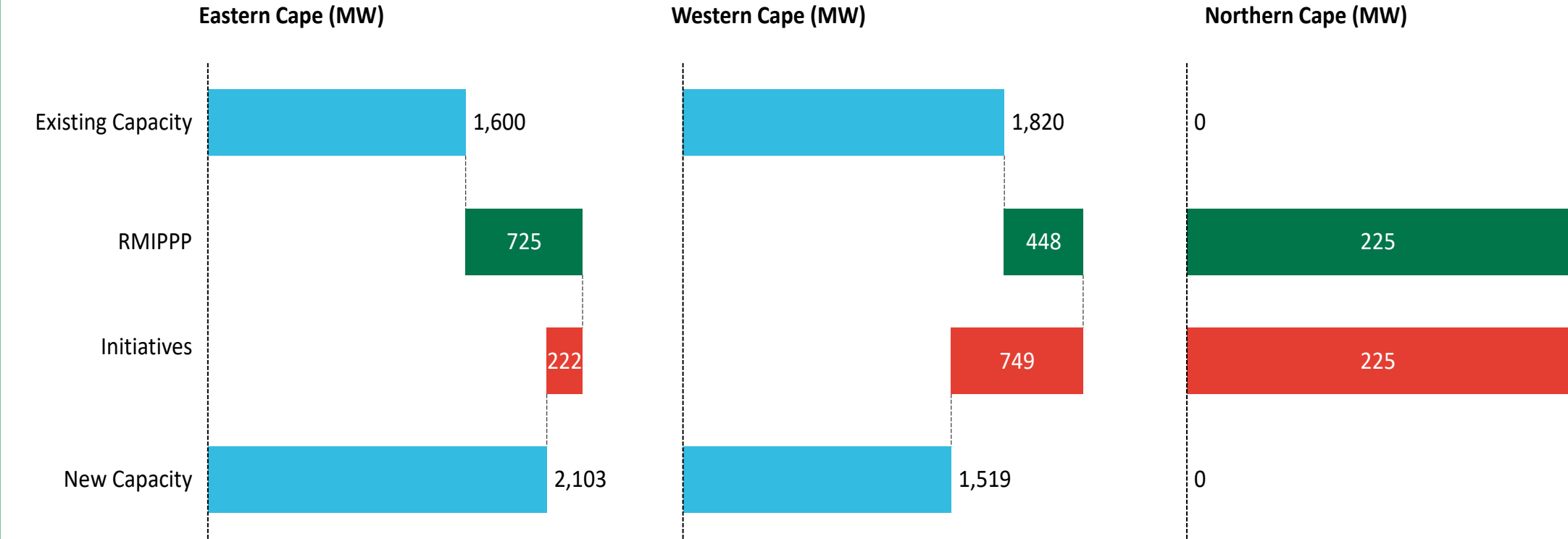
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2024 GRID CAPACITY IN THREE PROVINCES – NORTHERN CAPE REMAINS CONSTRAINED

Existing Capacity RMIPPP REIPPP New Capacity



- Grid is no longer reserved, RMIPPP projects that have not reached financial close are added back
- Business Initiative projects that have reached financial close are allocated capacity, i.e., Sasol

- 749 MW is allocated to Business Initiative projects that have reached financial close

- No remaining capacity in 2024

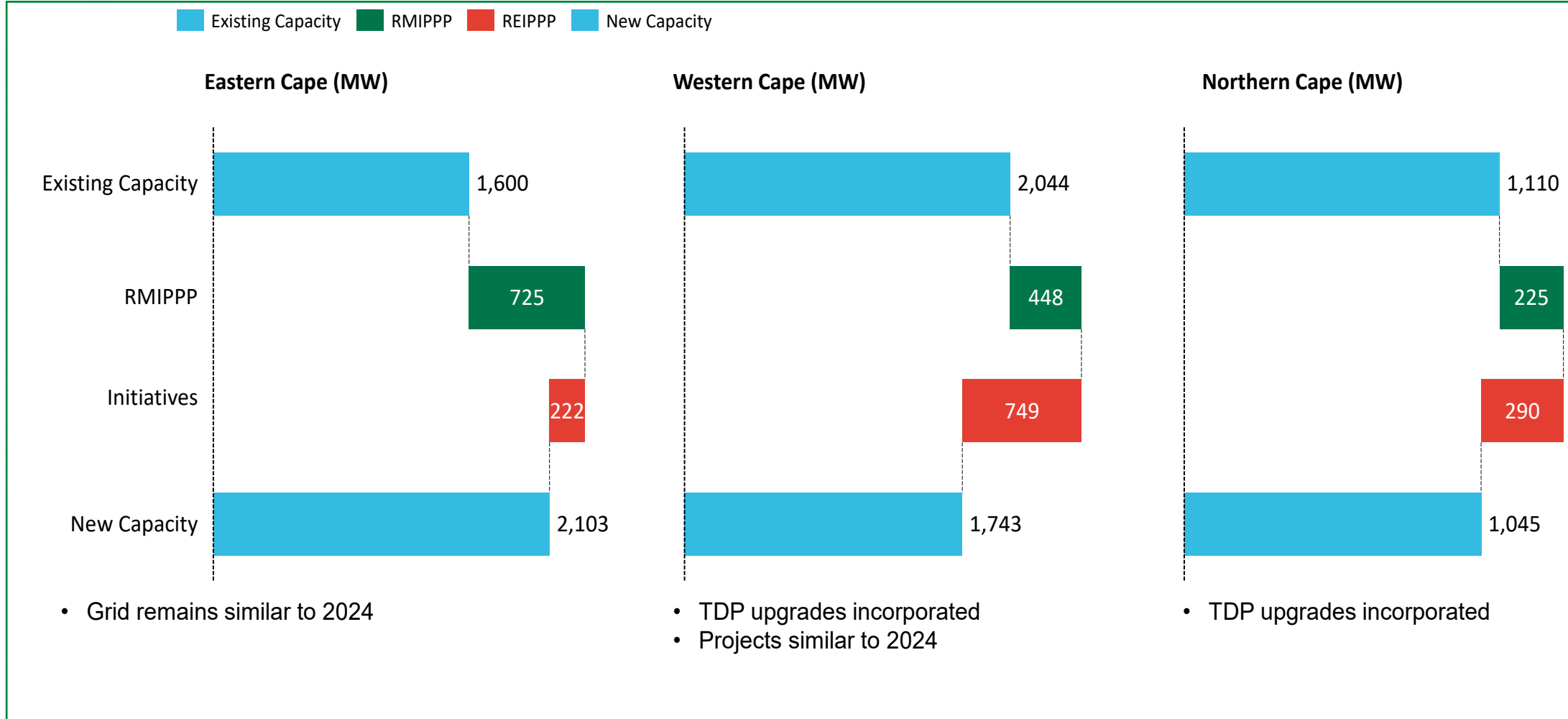


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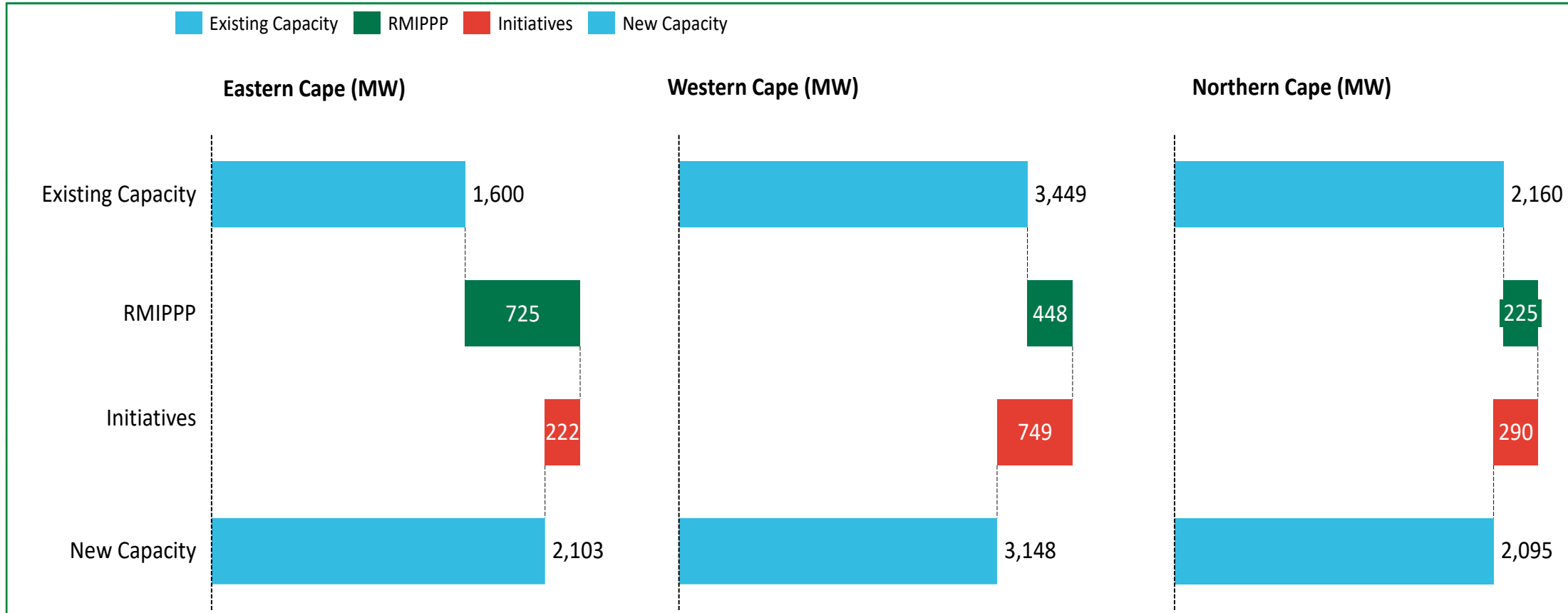
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2027 GRID CAPACITY IN THREE PROVINCES – NORTHERN CAPE REMAINS CONSTRAINED



2030 GRID CAPACITY IN THREE PROVINCES – NORTHERN CAPE REMAINS CONSTRAINED



- Grid remains similar to 2024

- TDP upgrades incorporated
- Projects similar to 2024

- TDP upgrades incorporated



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HORIZON 1: SCENARIOS STUDIED TO ADDRESS THE ENERGY SHORTFALL

	Scenarios	EAF	Initiatives (MW)	Gas Programme (MW)	Comments
1	Firm Initiatives	49% – 51%	Business RMIPPPP 150 REIPPPP BW5 Wind 784	0	<ul style="list-style-type: none"> Priority Projects as ranked by business and have grid capacity reserved as at June 2023 Government projects in the RMIPPPP + REIPPPP programme under construction
2	Reference	49% – 51%	Business RMIPPPP 626 REIPPPP BW5 PV 975 REIPPPP BW5 Wind 1 608 REIPPPP BW6 PV 1 140 BESS BW 1-3 + Eskom 2 080	0	<ul style="list-style-type: none"> Business initiatives with COD and location Business and Government projects in the pipeline
3	Firm Initiatives & All Initiatives	49% – 51%	Business RMIPPPP 626 REIPPPP BW5 PV 975 REIPPPP BW5 Wind 1 608 REIPPPP BW6 PV 1 140 REIPPPP BW7 PV 2 000 REIPPPP BW7 Wind 3 000	0	<ul style="list-style-type: none"> All initiatives including those with no grid capacity reservation, COD and/or location Includes REIPPPP 7 due for RFP
4	Firm Initiatives & Gas	49% – 51%	Same as 'Firm Initiatives Scenario	7 220	<ul style="list-style-type: none"> Gas includes DMRE Gas, Eskom Richards Bay Gas and RMIPPPP dispatchable Gas
5	Firm Initiatives & Recovery	66% - 69%	Same as 'Firm Initiatives Scenario	0	<ul style="list-style-type: none"> Eskom's EAF improvement as per its Generation Recovery plan

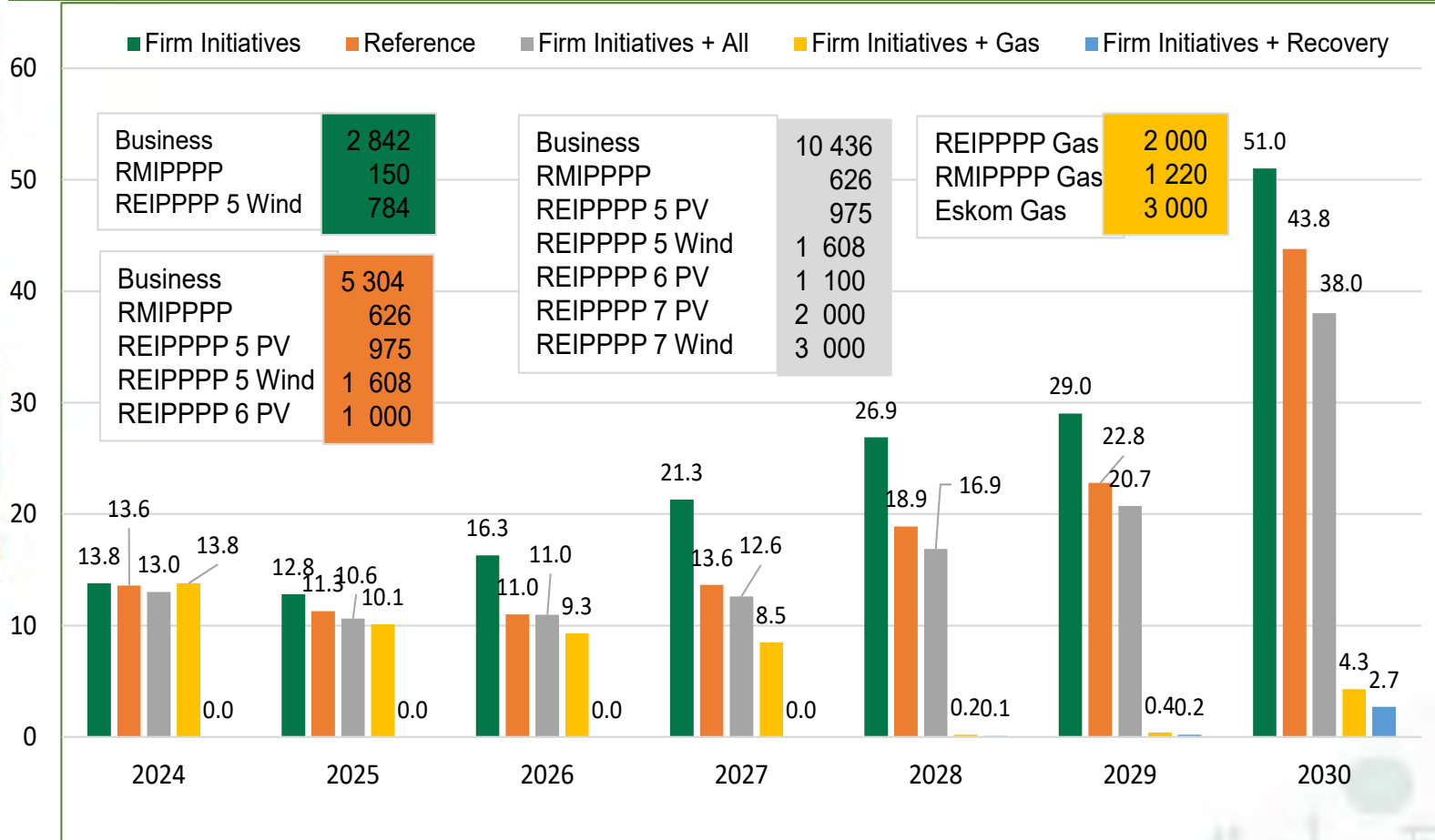


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HOW THE DIFFERENT SCENARIOS ADDRESS IDENTIFIED ENERGY SHORTFALL



- Unserviced energy reaches a high of **50 TWh** in 2030 (equivalent to 2 times Lethabo at 70% production), with firm new capacity and declining EAF trend.

- New dispatchable gas** has a more pronounced impact & reduces energy deficit from 2028

- EAF Recovery** addresses energy shortfalls immediately

- Eskom **shutdown plan** ~ 10 000 MW by 2030 (~4 000 MW in 2030)

- Gas utilization** is excessive except where New Gas is introduced (< 30% in years 2029 and 2030) or when EAF recovers (within acceptable levels)



OBSERVATIONS FOR HORIZON ONE

- The different electricity generation initiatives or projects currently being implemented will contribute to reducing unserved energy, but they must include dispatchable capacity. This is because of the inherent characteristics of the South African power system and the erratic performance of existing coal fired power plants.
- The system requires generation options that are of a similar characteristic to replace the lost dispatchable capacity as and when the failures occur.
- Improvement in EAF and deployment of gas to power provides these options to the system and hence low or no unserved energy is observed for Scenarios Four and Five.
- The emissions analysis for Horizon One indicate that carbon emissions are within the National Determined Contribution (NDC) until 2025 and thereafter begin to show a decline below the nationally determined threshold.



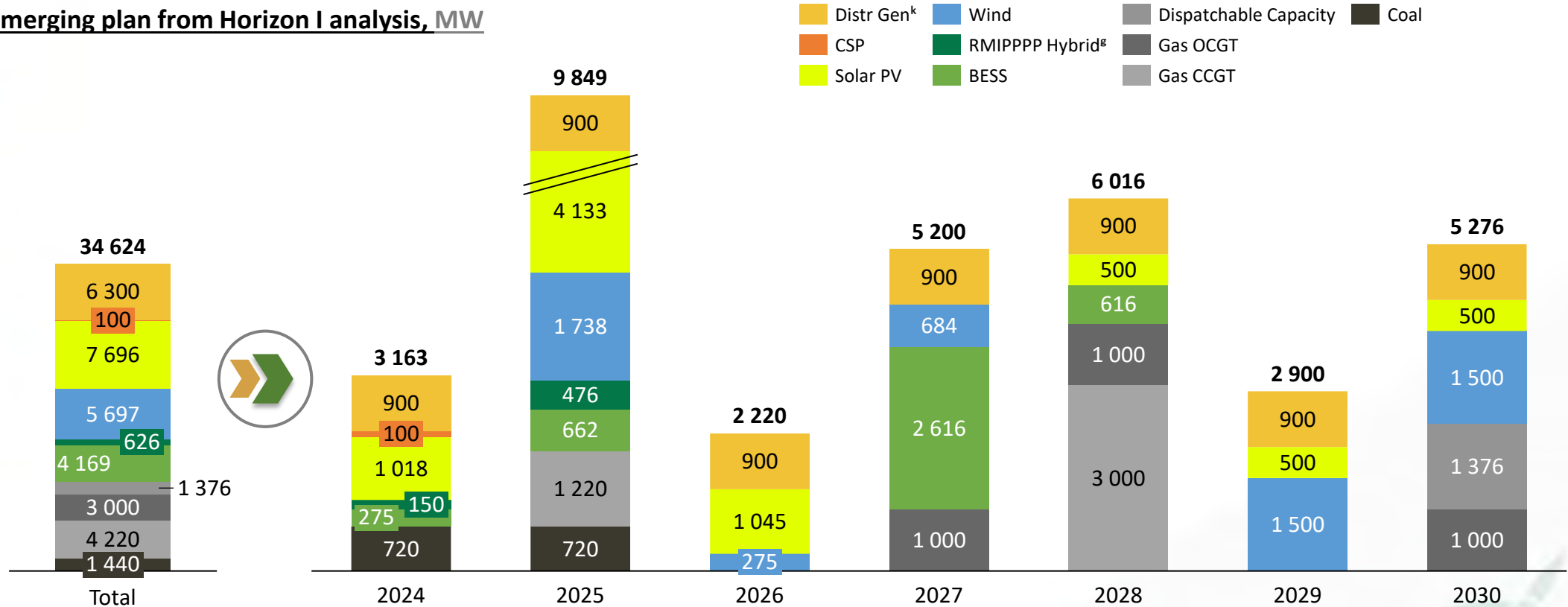
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Emerging Plan from Horizon I Analysis – Total new build, (Business initiatives + Government)

Emerging plan from Horizon I analysis, MW



- The emerging plan considers more than 30 000 MW of new capacity by 2030
- Wind, CSP, PV and rooftop PV account for close to 60% of new build



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HORIZON 2: ENERGY PATHWAYS STUDIED

Pathway	Policy Guiding Principles	Energy Pathways	Comments
1	Establishing a reference for benchmarking	Reference Case	<ul style="list-style-type: none"> Supply and demand balance based on least-cost. Optimisation model provided with an array of generation expansion options from which to select an optimum plan up to 2050
2	Power System Transition	Renewable Energy	<ul style="list-style-type: none"> Optimize only green energy technologies and storage as candidate options; Wind (on-shore & off-shore); Solar PV; Hydro, Storage (BESS, CAES, WPS); and Bioenergy
3		Renewable Energy and Nuclear	<ul style="list-style-type: none"> Optimize non-CO₂ emitting technologies as candidate options; Wind (on-shore & off-shore); Solar PV; Hydro, Storage (BESS, CAES, WPS); Bioenergy and Nuclear (PWR & SMR)
4	Shut down of existing coal fired station post 2030	Delayed Shutdown	<ul style="list-style-type: none"> Delayed shutdown of coal-fired stations earmarked to shutdown post 2035 by 10 years
5	Clean Coal	Renewable Energy and Coal	<ul style="list-style-type: none"> Assess impact of new cleaner coal technologies

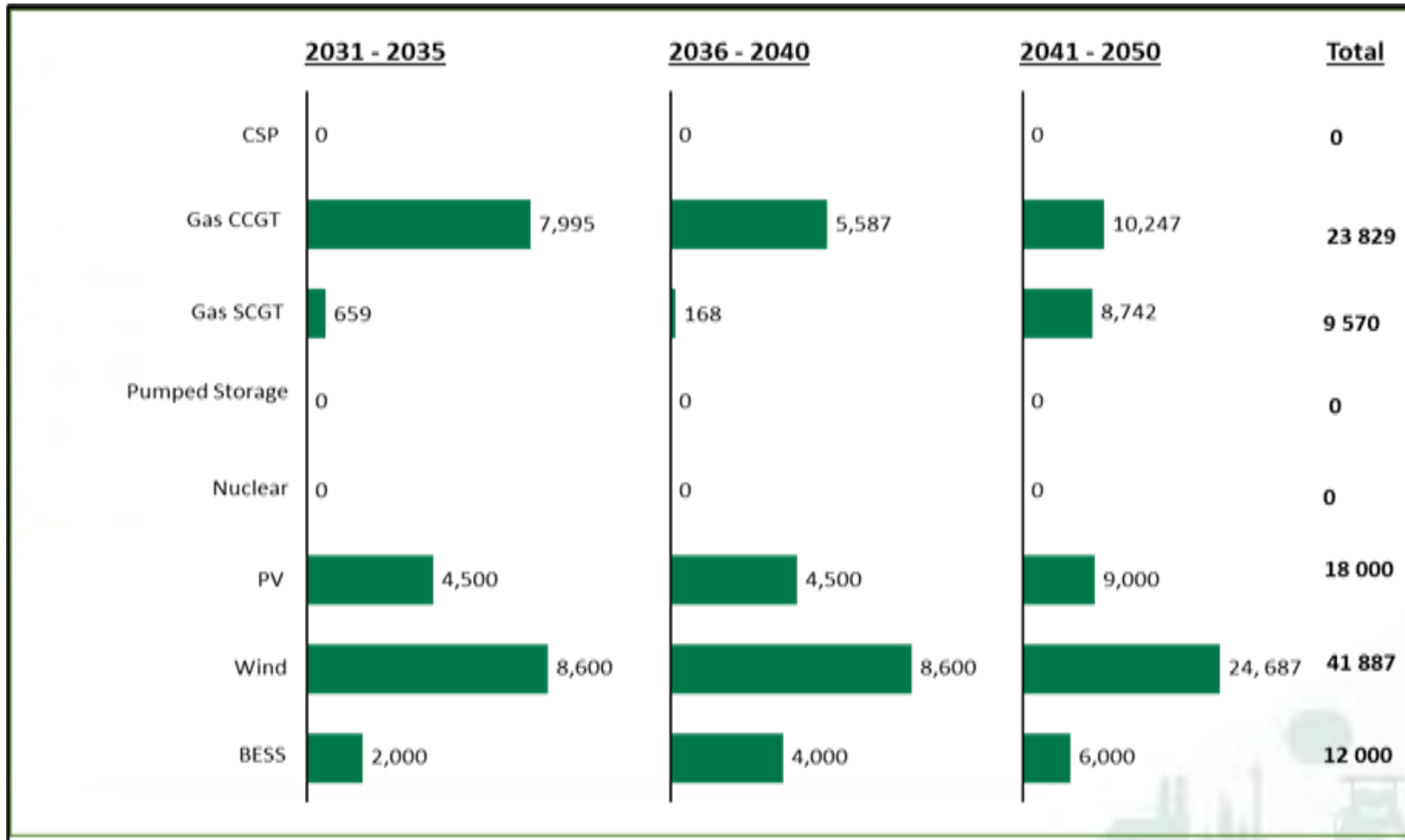


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REFERENCE ENERGY PATHWAY



- Least cost plan
- Requires more than 23 000 MW of new capacity between 2031 to 2035



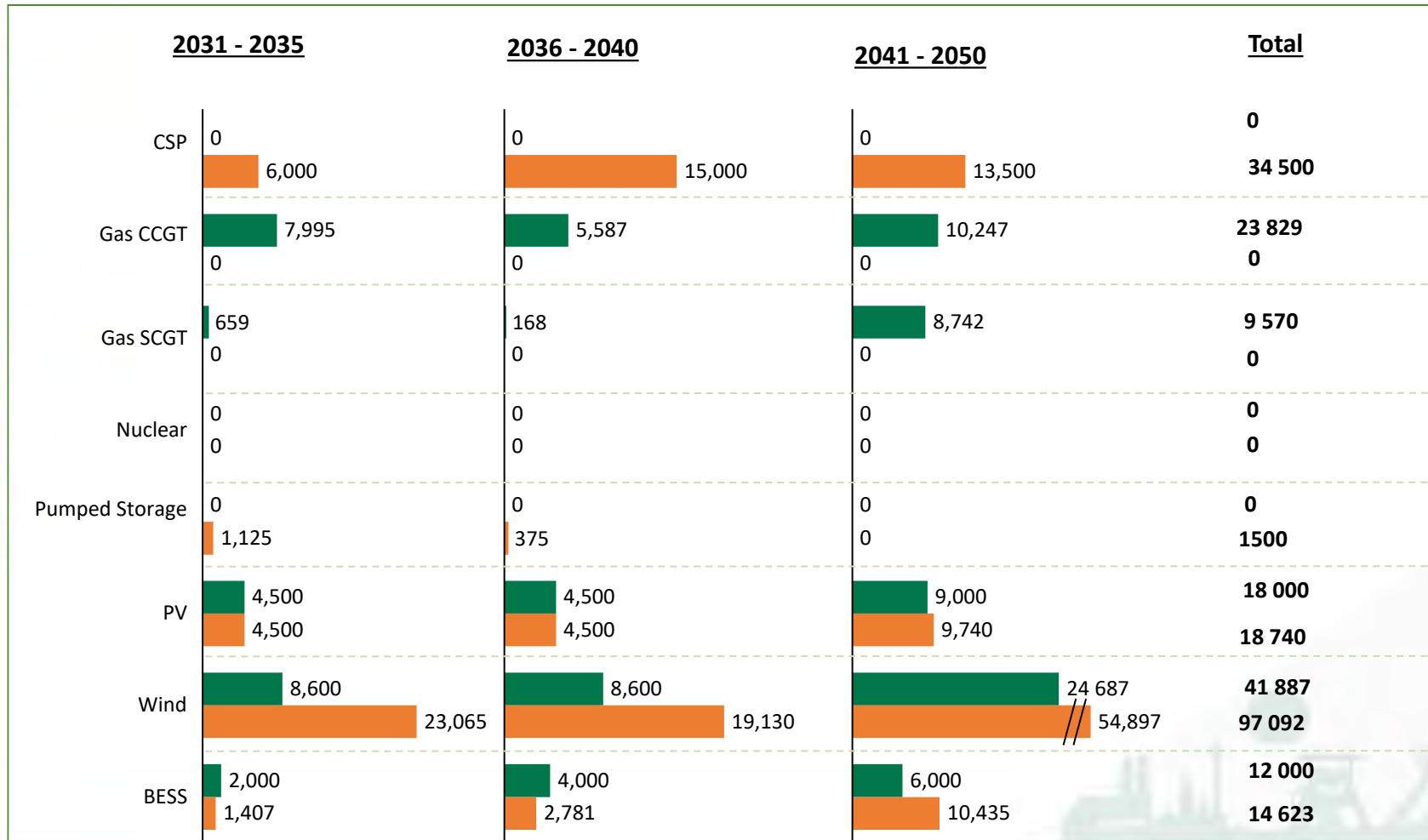
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RENEWABLE ENERGY PATHWAY

Reference Renewable Energy



- Builds more capacity than the Reference Pathway across all periods
- Requires about 36 000 MW between 2031 and 2035

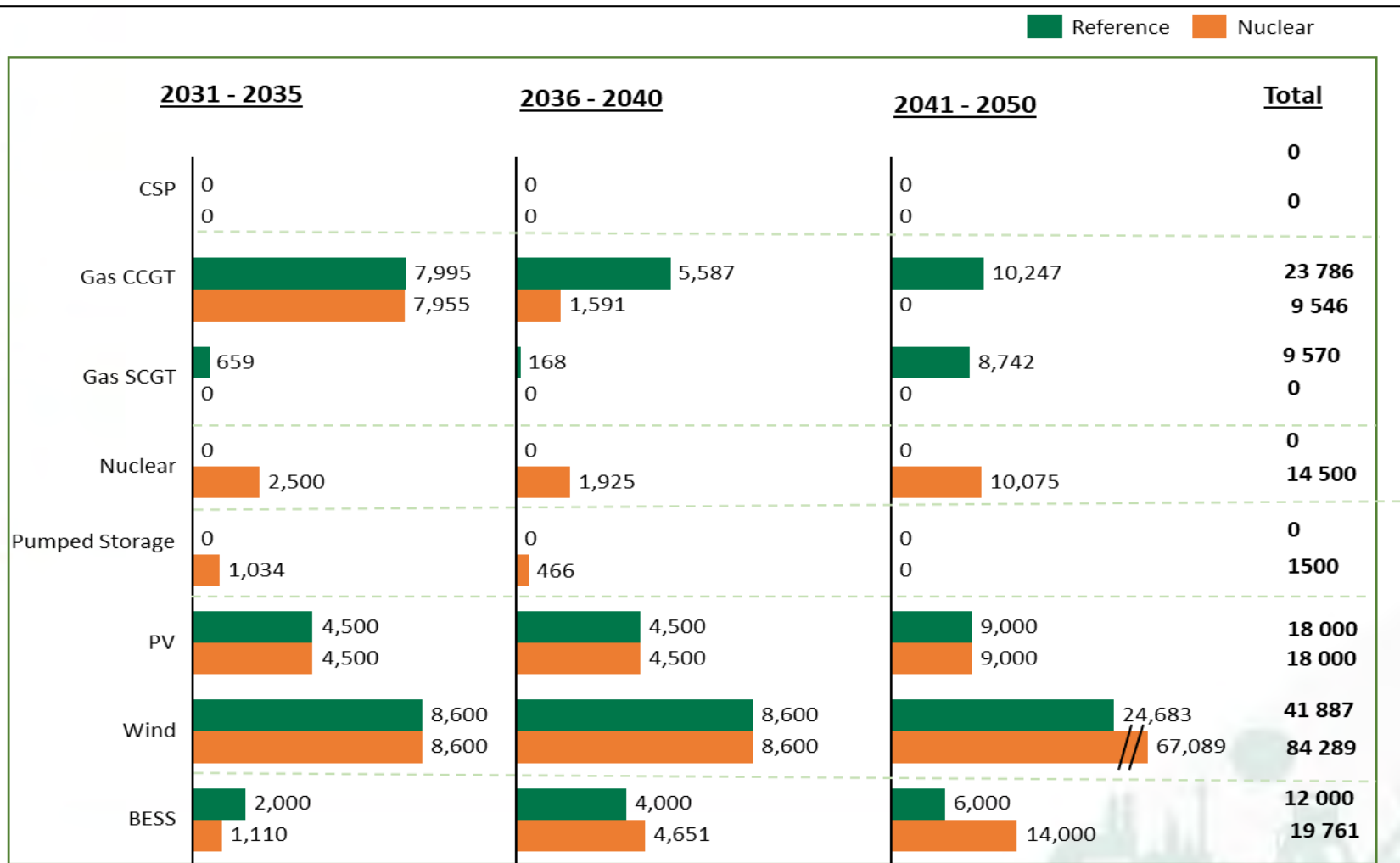


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NUCLEAR ENERGY PATHWAY



- Nuclear build assumed to start from 2034 and 2036



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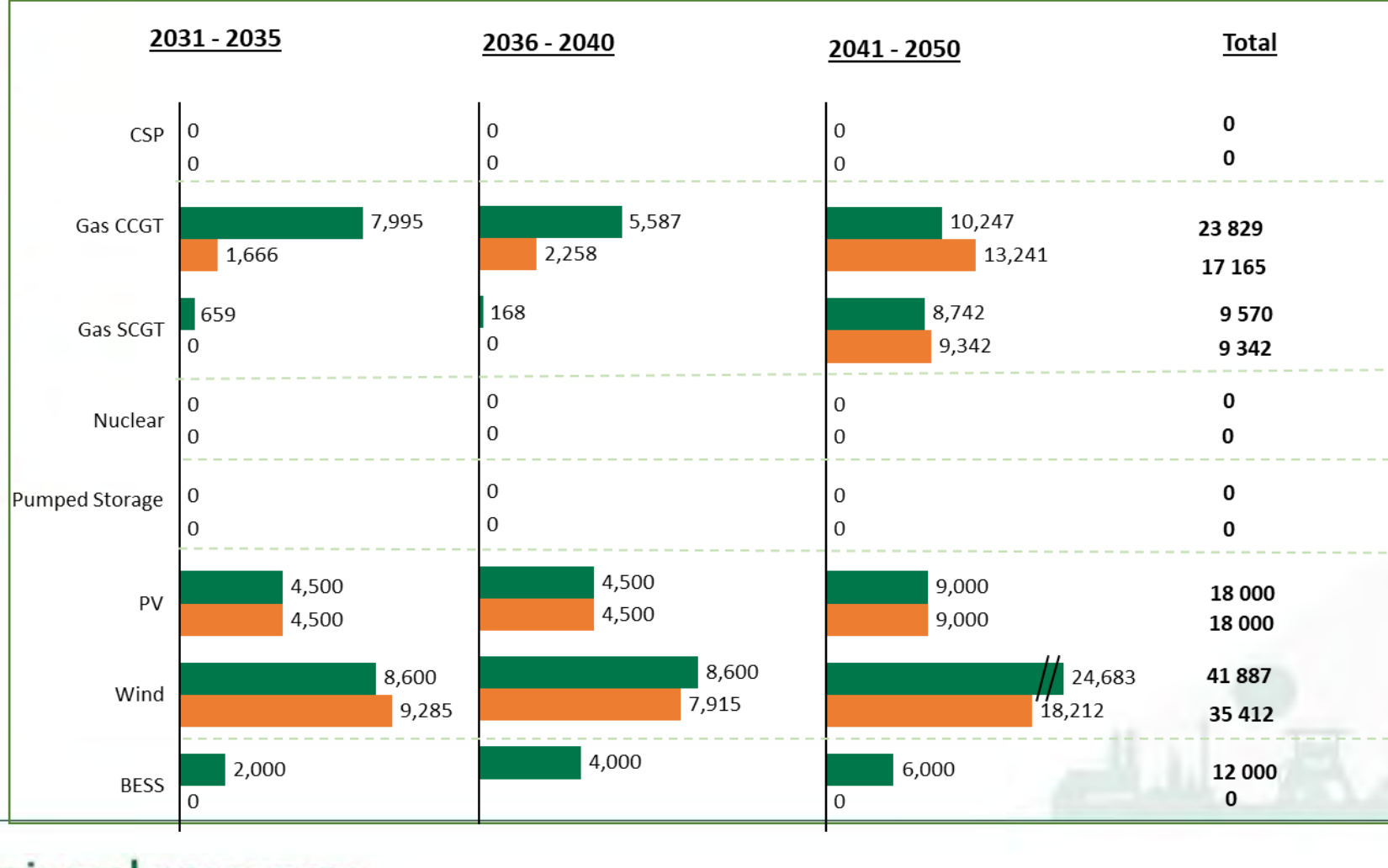
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DELAYED SHUTDOWN PATHWAY

Reference Delayed shutdown



- Incorporates improved EAF as part of the delayed shutdown
- Requires ~15 000 MW of new capacity between 2031 and 2035
- Least new capacity build overall



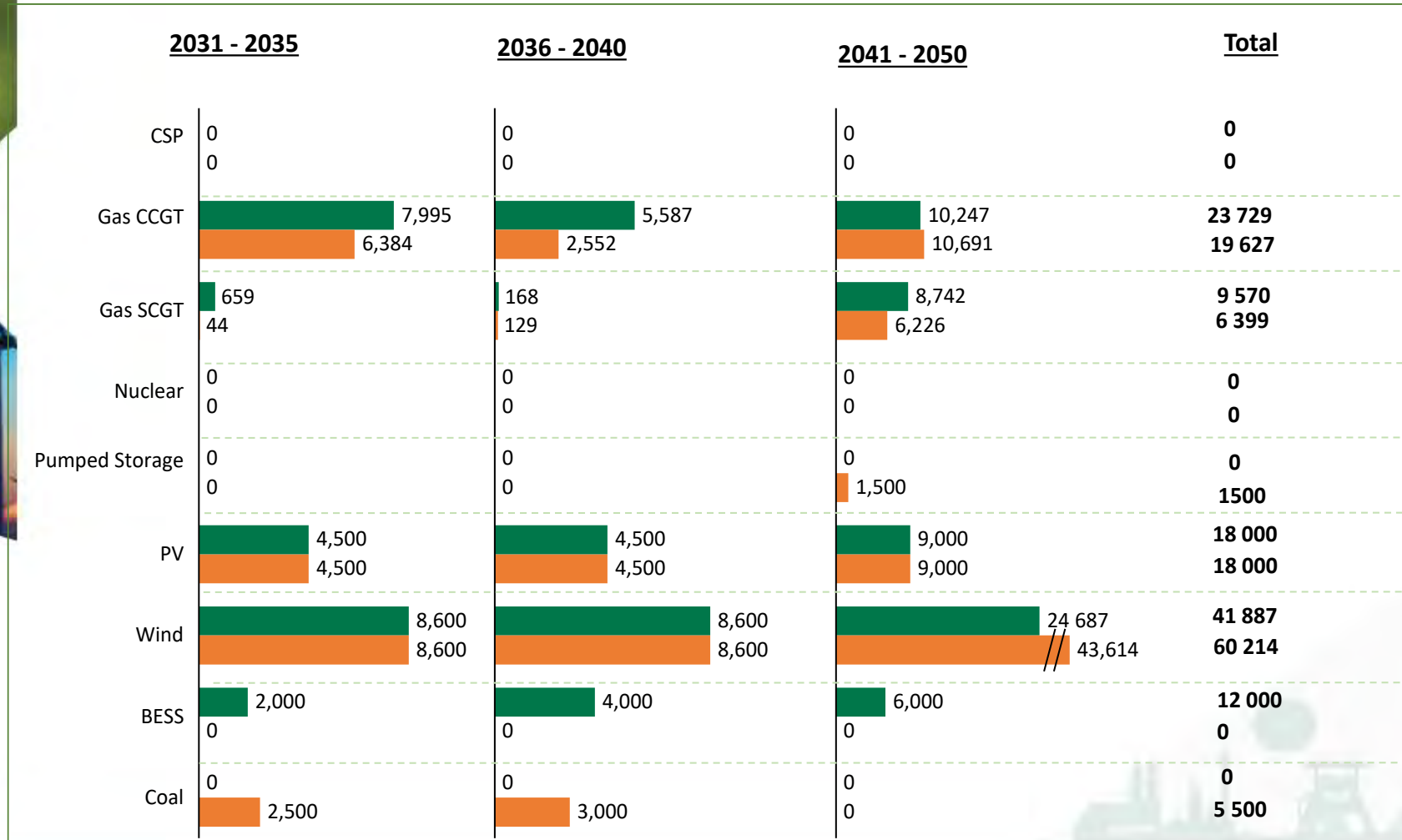
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RENEWABLE ENERGY AND COAL PATHWAY

Reference Renewable & Coal



- Builds a lot more renewables than the Reference case



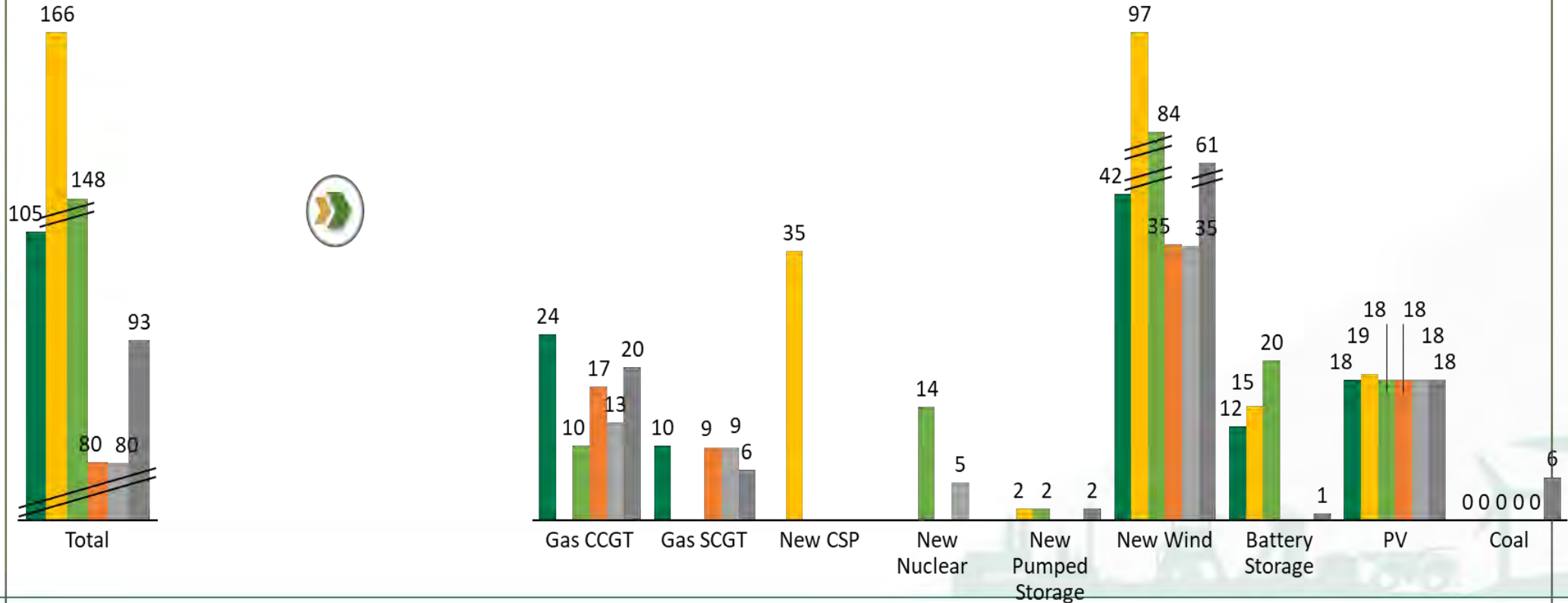
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HORIZON 2: SUMMARY OF CAPACITY EXPANSION PLANS OF THE PATHWAYS

Additional New build required across the different scenarios, GW



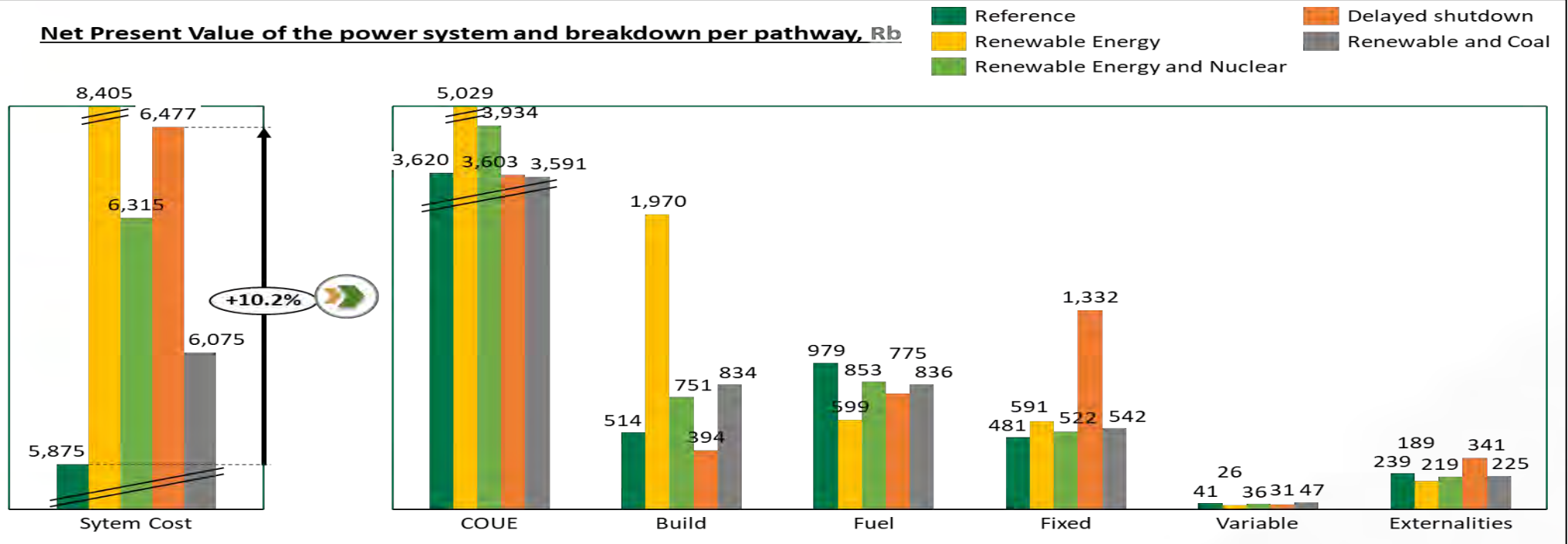
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POWER SYSTEM COSTS OF REFERENCE & ENERGY PATHWAYS

Net Present Value of the power system and breakdown per pathway, Rb



- The Reference Pathway has the lowest total system costs of all the Energy Pathways despite high fuel costs due to high gas utilisation.
- The Delayed Shutdown and the Delayed Shutdown and Repowering have the highest fixed cost component compared to all other scenarios.
- The Renewable Energy Pathway is the most expensive scenario due to high unserved energy and new build costs.
- Due to the magnitude of their total system cost differences, the Renewable and Nuclear, the Delayed Shutdown; and the Delayed Shutdown and Repowering warrant further studies to ascertain their cost structures.

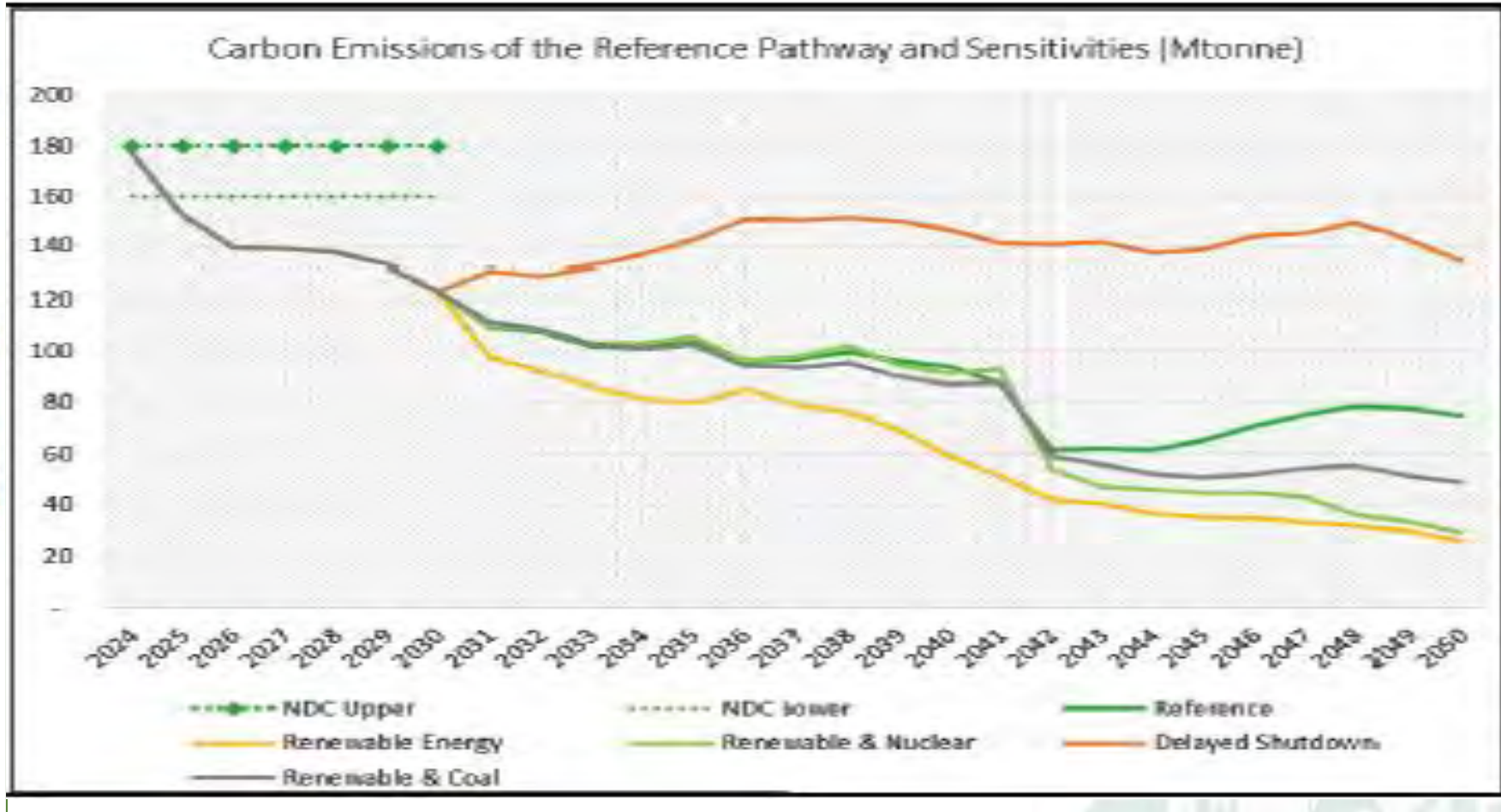


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CARBON EMISSIONS (Mtonne)



Comments

- All the proposed scenario emissions fall within the DFFE's NDC range from 2025. Post 2026 the emissions start falling below the NDC range.
- All scenarios have a declining trend. Even where the coal life extension is concerned.



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OBSERVATIONS FOR HORIZON TWO

- Energy pathways based on renewable and clean energy technologies deliver the desired outcome for decarbonising the power system. However, these pathways do not provide security of supply while carrying the highest cost to implement.
- In the period between 2031 to 2050 the system will require a massive new build programme with significant capacity required in just over a decade from now. The implication of this is that implementation of generation capacity required for this horizon including associated transmission network will have to begin in earnest.
- Pathways comprising of dispatchable technologies with high utilisation factor provide security of supply. Other than delayed shutdown, these technologies include different combinations of nuclear, renewables, clean coal and gas. Notably these pathways support the carbon reduction commitments.
- To ensure security of supply in the long term while ensuring decarbonisation and least cost of supply will require a combination of technical analysis (power system modelling and simulation) and policy adjustment that considers practical implementation constraints and implications.



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NEXT STEPS

Public Comments

04 Jan - 23 Feb
2024

Review and Consideration Public Comments

18 & 31 Jan 2024

Feb – Mar 2024

Apr 2024

Final IRP

May 2024

Public Workshops: Unpacking the IRP.

NEDLAC.



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QUERIES

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