

Presentation of key findings
from the NBI Just Transition
Pathways project
Agriculture, Forestry & Other
Land Use sector (AFOLU)
& The Role of Gas

Tuesday, 2 November 2021
10:00-12:00 (SAST)



@NBISA
@BCG
@BusinessUnitySA

#NBJustTransition
#NetZero2050

NBI BUSA BCG
National Business Initiative



Meeting Protocols



Please submit any questions you may have using the Q & A function



Please make sure that your microphone is muted and your video is turned off if you are not speaking



Please note that this session is being recorded



If you have any technical issues, kindly reach out to:

- Nombulelo Ndaba NombuleloN@nbi.org.za
- Justine Alston JustineA@nbi.org.za

Public presentation of key findings – AFOLU sector and the role of gas

| | |
|---|---------------|
| Welcome and Introduction | 10:00 – 10:10 |
| The context of this study | 10:10 – 10:20 |
| South Africa's AFOLU sector - Decarbonising & Building Climate Resilience | 10:20 – 11:00 |
| The role of gas in South Africa's decarbonisation journey | 11:00 – 11:55 |
| Outlook and next steps | 11:55 – 12:00 |

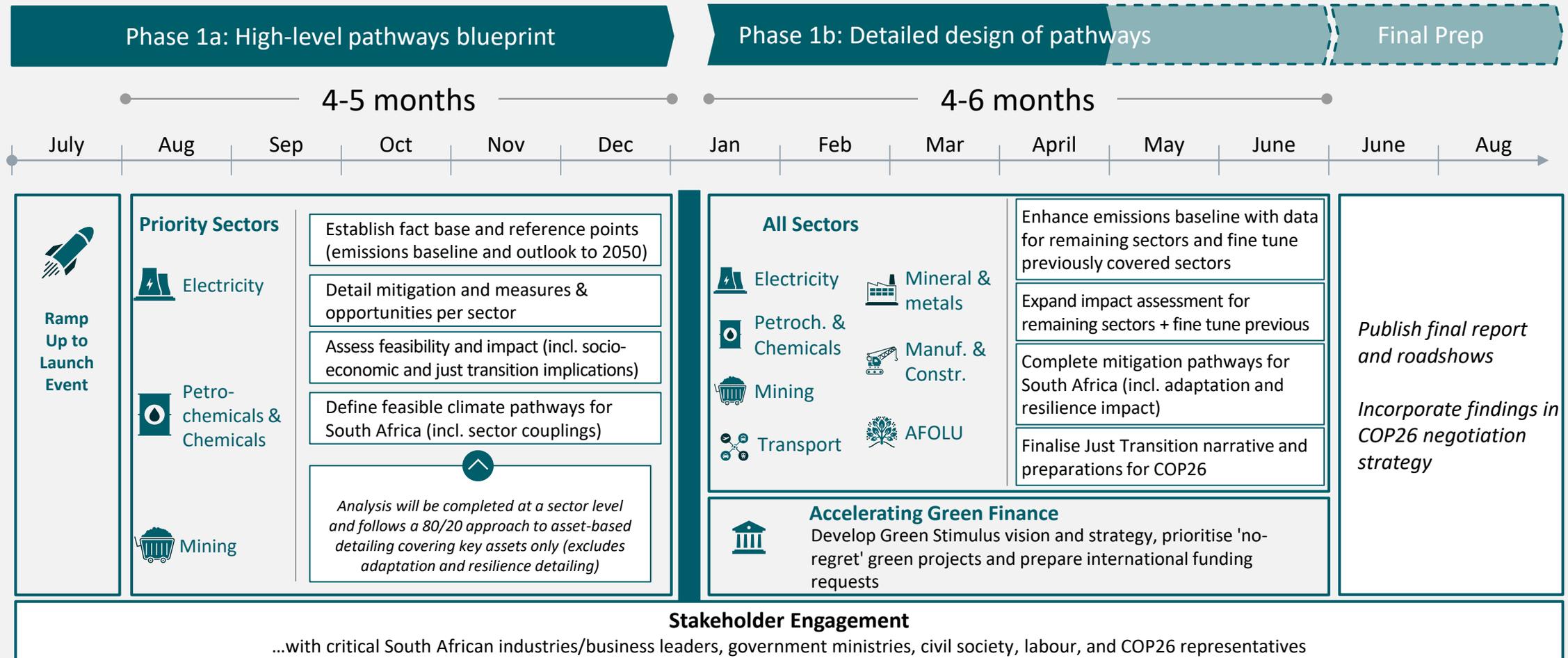
*Welcome and
introduction*



Steve Nicholls

Head of Environment
National Business Initiative

With this study we aim to drive collaboration and create a unified voice of South African business at COP 26 and beyond



What this study aims to achieve

✓ *The questions the study aims to answer*

- What is the cost of inaction for South Africa?
(i.e., of not responding to critical global economic drivers driven by global climate action)
- What would it take for South Africa to get to net-zero emissions?
(Including practical solutions, barriers to overcome, investments and financing to enable the transition)
- What would be the social and economic implications for South Africa to reach net-zero emissions by 2050?

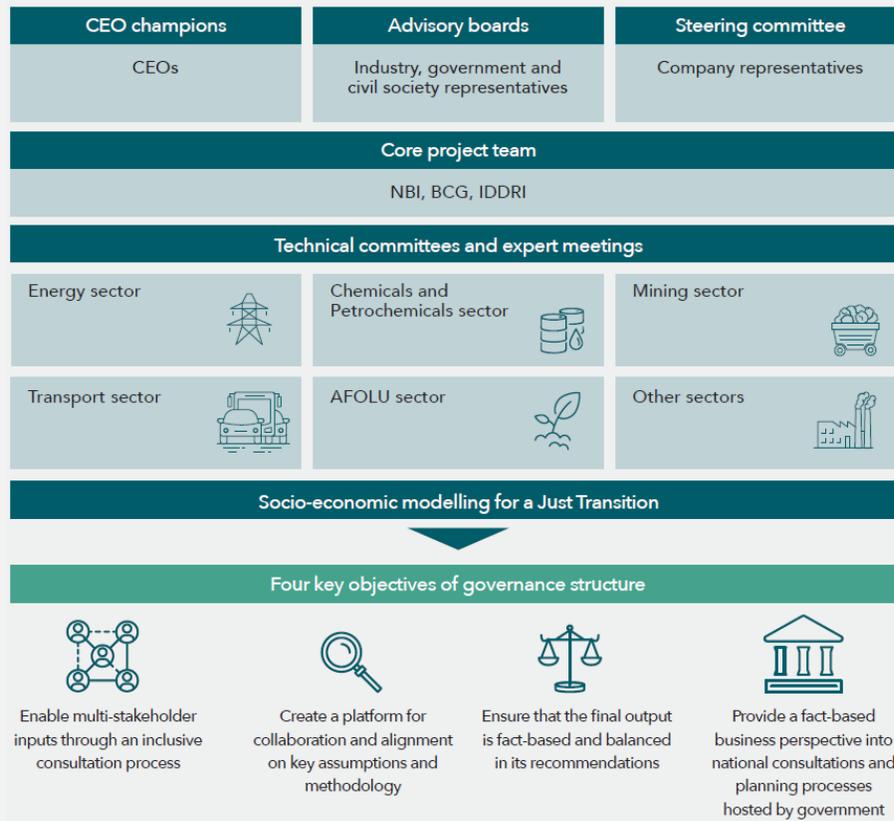
✗ *What the study is NOT aiming for*

- Not setting an ambition for **which level of** national emission reductions South Africa should reach **and when**
- Not prescribing **sector- or company-specific** emission reduction targets



We are creating an analytical fact-base to support decision making and support coordinated effort among national and international key stakeholders

To ensure representative, balanced and fact-based content a comprehensive governance structure is in place



4 Key objectives of governance structure



Enable multi-stakeholder inputs through an inclusive consultation process



Create a platform for collaboration and alignment on key assumptions and methodology



Ensure that final output is fact-based and balanced in its recommendations



Provide a fact-based business perspective into national consultations and planning processes hosted by government



OVERVIEW OF CEO CHAMPIONS

Onboarding of additional CEOs ongoing



Joenne Yawitch
NBI CEO



Cas Coovadia
BUSA CEO



Vivien McMenamin
Mondi SA CEO



Taelo Moajepelo
BP Southern Africa CEO



Roland van Wijnen
PPC Africa CEO



Njombo Lekula
PPC MD SA Cement and Materials



André de Ruyter
Eskom CEO



Fleetwood Grobler
Sasol CEO



Mxolisi Mgojo
Exxaro CEO



Leila Fourie
JSE Group CEO



Gavin Hudson
TongaathHulett CEO



Vikesh Ramsunder
Clicks Group CEO



Nyimpini Mabunda
GE SA CEO



Mark Dytar
AECI CEO



Nolutha Fakude
Anglo American SA Chairperson



Alan Pullinger
FirstRand CEO



Hloniphizwe Mtolo
Shell SA CEO



Portia Derby
Transnet CEO



Alex Thiel
SAPPI CEO



Mohammed Akoojee
CEO Imperial Logistics



Yuse Hassan
Engen MD and CEO



Tshokolo TP Nchocho
IDC CEO



Lungisa Fuzile
Standard Bank South Africa CEO



John Purchase
AgBiz CEO



Paul Henratty
Sanlam CEO



Deidre Penfold
CAIA Exec Director



Stuart McKenzie
Ethos CEO



Merelise van der Westhuizen
Norton Rose Fulbright CEO



Ishmael Poolo
Central Energy Fund CEO



This project finds support across business

We will present and discuss our key findings for the **AFOLU** sector and the role of gas today



Both the **AFOLU** and gas reports will be published later this month



*A note from our
partner BCG*

Lucas Chaumontet

Managing Director & Partner - Regional lead on Climate & Sustainability
Boston Consulting Group

The context of this study

Many countries have already set ambitious net-zero targets

Not exhaustive

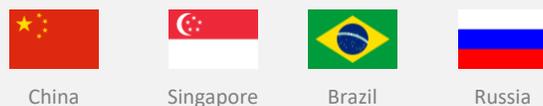
Net-zero before 2050



Net-zero by 2050



Net-zero post 2050



No net-zero commitment



SA committing to ambitious climate action as well

South Africa's Low-Emission Development Strategy 2050 (LEDS) states:

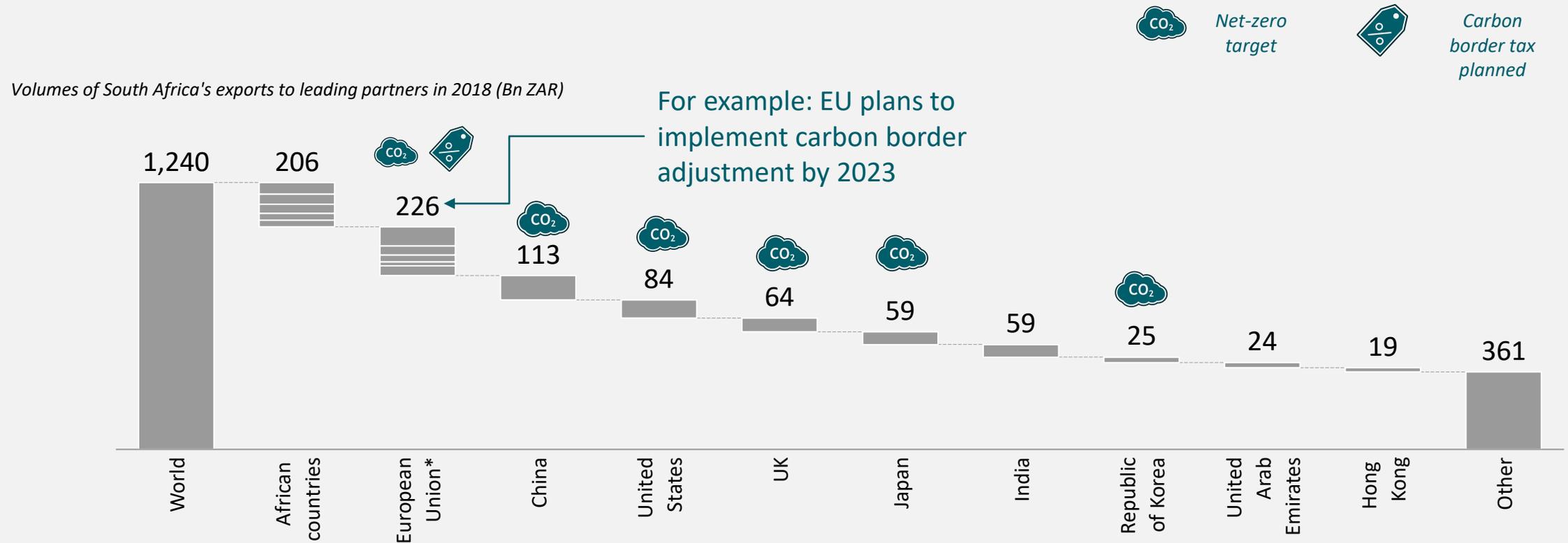
“We thus commit to ultimately moving towards a goal of net-zero carbon emissions by 2050, which will require various interventions to reduce greenhouse gas emissions”

Business Live interview 02-Oct-20

In a discussion on LEDS, DEFF Minister Crecy made several references to South Africa needing to be net carbon neutral by 2050

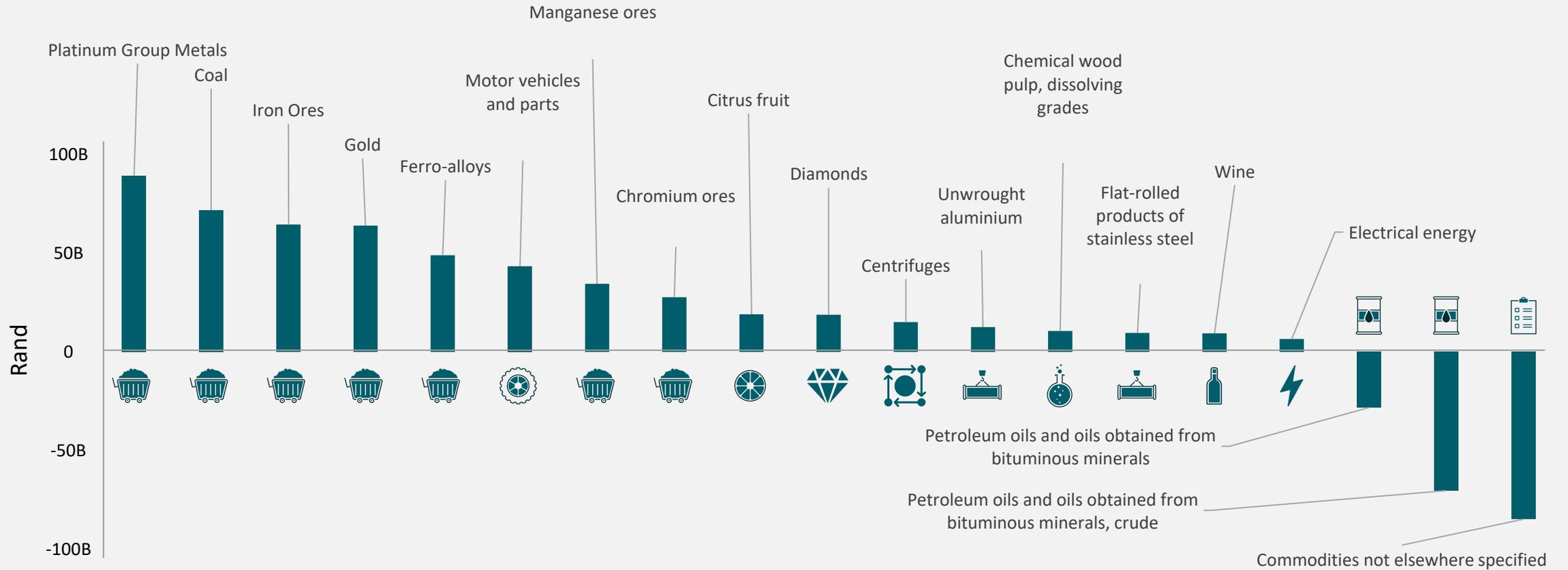
Key export markets like the EU already considering carbon border taxes – others may follow

Top export partners outside Africa have recently announced commitments to net-zero, putting SA exports at risk if carbon border taxes to be implements as planned in the EU – although Border Tax adjustments are currently not within WTO rules

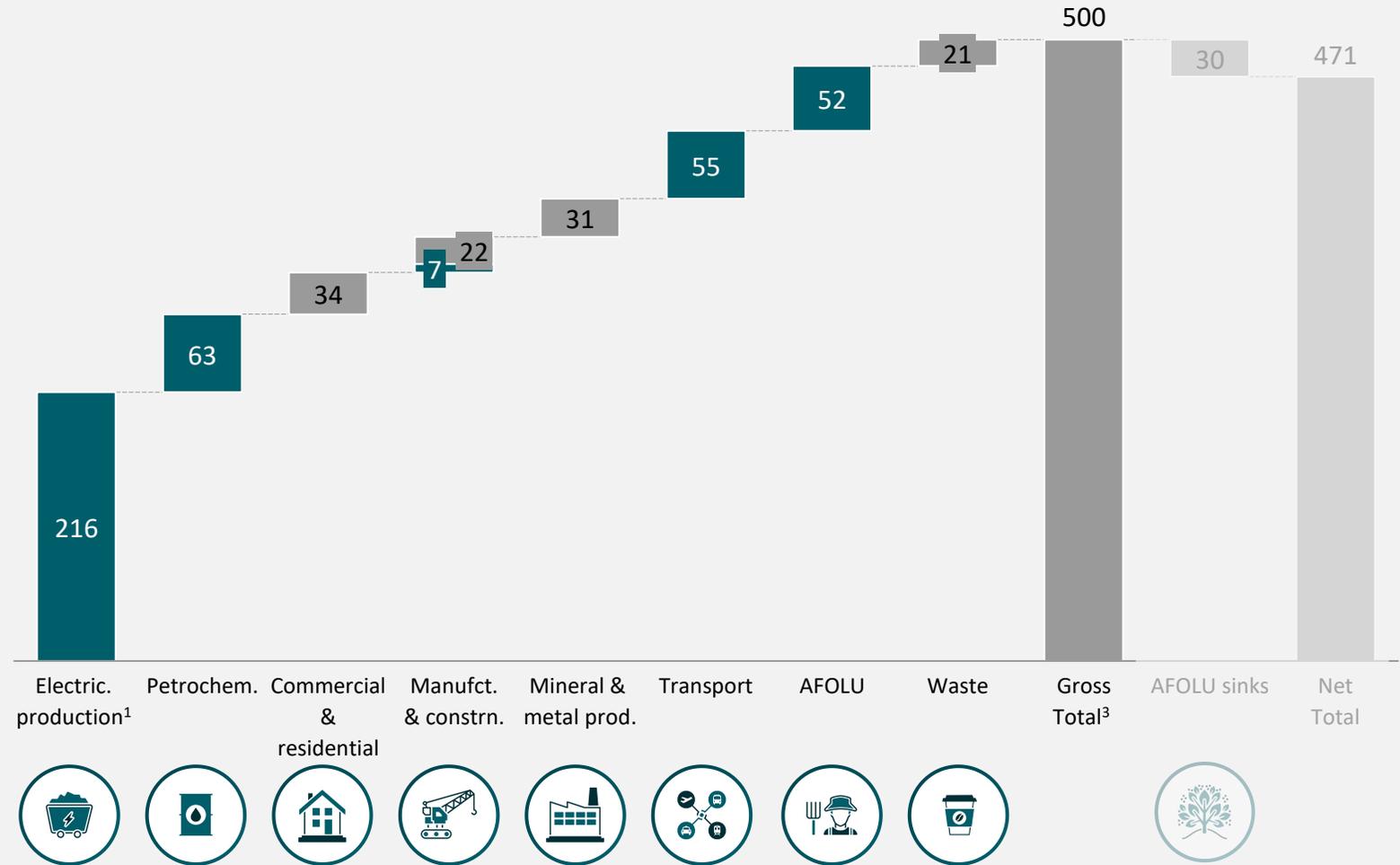


* Top 4 trade partners within EU are Germany, Netherlands & Belgium, and among those with most aggressive targets. Note: Exchange rate based in 2018 average = R 13:24/US\$ | Source: World Integrated Trade Solution 2018; Press research

South Africa's trade vulnerability is particularly acute, commodity trade balance open to transition risk



Emissions updated in line with latest (2021) iteration of DFFE⁴ 2017 GHG baseline

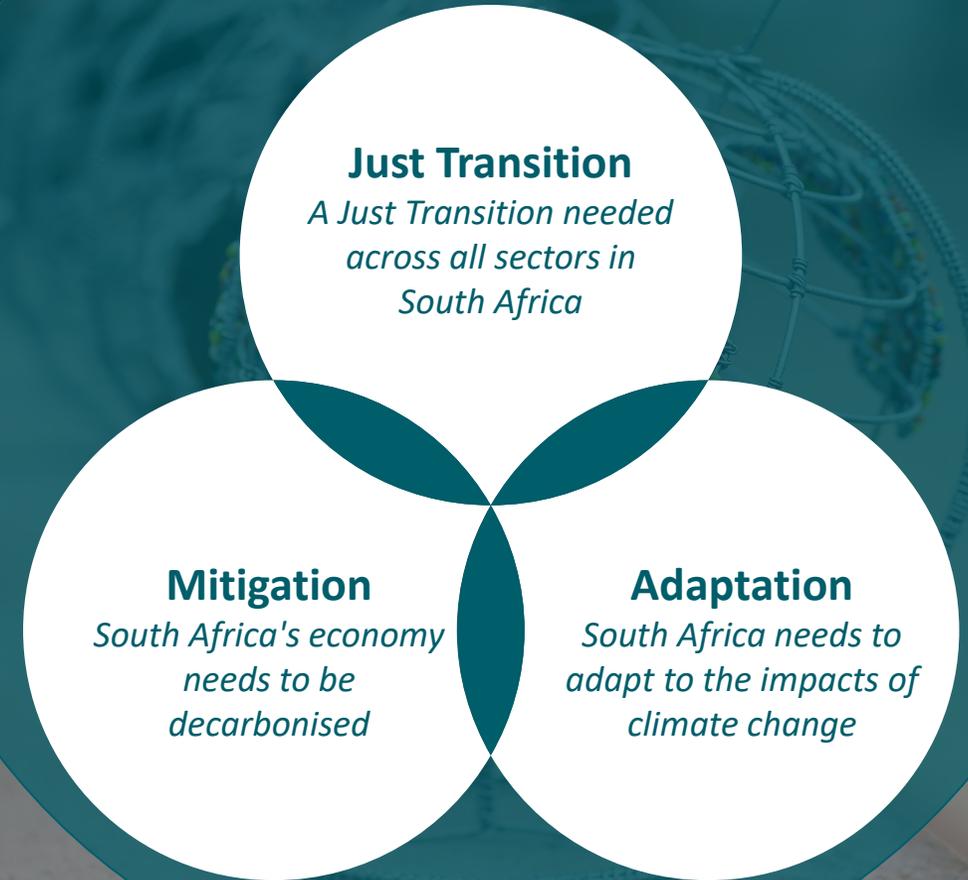


Sectors addressed so far account for ~80% of national emissions and are key to ensuring a Just Transition

1. Emission figures based on view of Electricity & Heat Production of which electricity production contributes >97% of emission 2. GHGI does not explicitly state estimate for mining emissions so this has been estimated. Assumed scope 1 emissions share of top 12 companies is same as their market share (80%) and use this to gross up to 100%. To be validated with CDP data 3. Gross total excludes categories 1A5 as it is not linked to any sectors and 1B1 to avoid the double counting of fugitive emissions from coal mining which are included in the mining sector emissions approximation. Agriculture emissions: Agriculture (~51Mt, labelled as 'AFOLU excl. FOLU' in GHGI) + energy emissions in Agriculture/Forestry/Fishing (~4Mt). AFOLU sinks: FOLU (labelled as 'Land' in GHGI) + Other ('harvested wood products') from GHGI 4. According to DFFE (formerly DEFF) – however, revisions still to be published | Source: GHGI (2017), IEA (2015), WEO (2019), CDP (2015), GHGI (2015), CAT

South Africa is at significant risk from climate change, creating a need not just to decarbonise, but more importantly to adapt and ensure a just transition

Financing as critical enabler



Decisions taken now are critical

For example, South Africa must:

- Avoid infrastructure lock-in that will hinder long term competitiveness
- Recognise global shift in commodity value pools, plays to its strengths and invest in skills and technologies of the future, and drive international exchange of expertise and technology
- Pursue 'Green' sources of funds and preferential trade agreements to finance a Just Transition



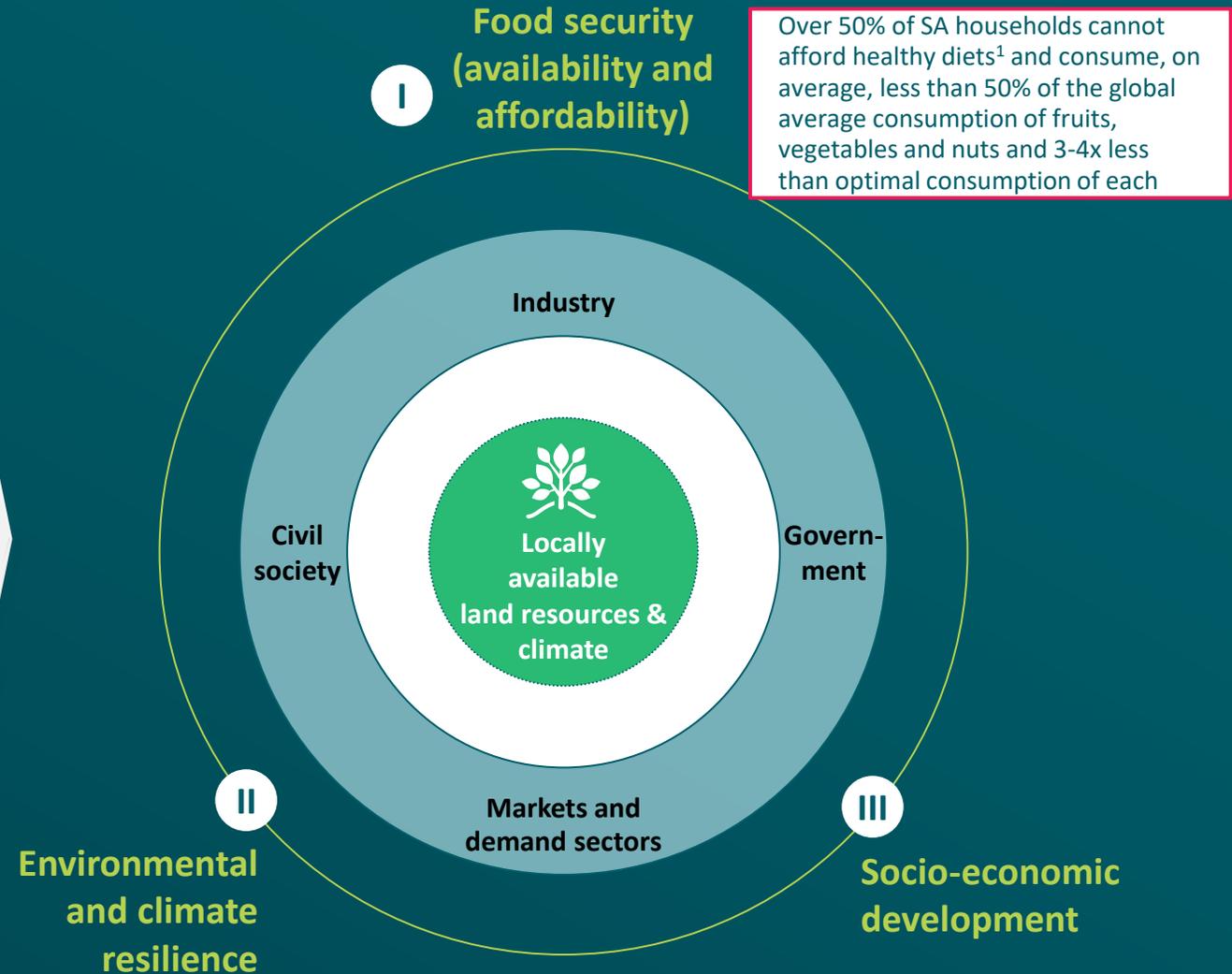
South Africa's Agriculture,
forestry and other land use
sector - Decarbonising and
building climate-resilience



Pathways towards SA's future AFOLU sector will need to meet objectives across dimensions

SA's future AFOLU sector needs to ensure food security, contribute to economic growth and socio-economic development

This, by sustainably leveraging SA's natural resources without harming the environment and climate



1. Assuming 35% of household income is dedicated to food expenditure
Source: Stats SA "Living Conditions Survey"; Global Nutrition Report; BCG analysis

Key questions to address in AFOLU sector analysis

- 1 **How will AFOLU demand change?** *Changes in demand for SA's agricultural and bio-based products, given changing demographics and new demand sources for biomass*
- 2 **What are the risks to the AFOLU sector?** *Physical risks imposed on and created by SA's AFOLU sector and vulnerability of SA's agricultural sector*
- 3 **What are net-zero pathways for the AFOLU supply base?** *Key decarbonisation and adaptation levers for AFOLU in SA*
- 4 **What are the socio-economic implications?** *Risks, opportunities and socioeconomic impact (jobs, GDP etc.) of the AFOLU net-zero pathways*
- 5 **How to enable the optimal pathway?** *Address key challenges and enablers, and critical sector interdependencies*



The future of South Africa's AFOLU sector

1

The South African AFOLU sector is at significant climate risk – ensuring food security and sustainable and healthy diets for all South Africans, and maintaining the sector's socio-economic contribution requires the **development of a climate-resilient AFOLU sector**

2

Global climate change could impact South Africa significantly: In low and moderate mitigation scenarios, South Africa's average inland temperature could rise **2–4 °C** by 2050, **~2 times the average global temperature increase**, and average rainfall could decrease **>60 mm/annum** in most western and northern regions of the country

3

Export earnings, farmworker and plantation worker livelihoods, and food availability are at risk, particularly in the Western and Northern Cape, which are expected to face the **worst water stress**, but also account for **~95%** of South Africa's deciduous fruit exports, **~25%** of national agricultural earnings, and **~35%** of national agricultural employment

4

On a farm and plantation level, adaptation measures, such as **climate-breed matching**, and **fire and pest prevention systems** can build resilience, production-efficiency, and reduce emissions per unit produced. On a system level, improved **water-use monitoring and transmission infrastructure**, data-backed agricultural and forestry **water allocation**, and **accessible climate event monitoring** will be critical to ensure climate resilience

5

To enable effective adaptation, it will be critical to build capacity and improve and expand agricultural and forestry extension services – this requires a **doubling of AFOLU-related research and development (R&D) spending** in line with NDP targets, roll-out of **demand-side incentives**, such as market access and deployment of **blended finance mechanisms**

6

The AFOLU sector accounts for **~10% of national emissions** – driven by livestock (**75%**), fertiliser use (**18%**) and fuel combustion (**7%**) – and adaptation measures taken in the sector could drive some emission reduction. However, significant emissions remain and to fully decarbonise the sector, dedicated mitigation levers need to be deployed

a In light of a growing population, **food demand will grow by ~50%** by 2050, causing the AFOLU emissions baseline to **grow by ~40%** if current, nutritionally-inadequate diets are maintained, or **shrink by ~37%** if sustainable (low red meat), diverse and nutritionally-balanced diets are adopted

b Regardless of diet progression, ensuring best-practice reduces emissions and builds resilience. Best-practice **livestock health, feed, manure, and breeding management** can eliminate **~19%** of annual emissions, **sustainable land and fertiliser management**, and integration of **renewable energy** to meet energy demand eliminate **17%** and **19%** of annual emissions, respectively

c However, with best practices implemented, by 2050, emissions can only be reduced by **~40%** versus the 2017 baseline, **with current diets**, and by **~70% with sustainable, healthy diets**, leaving **16–39 Mt CO₂e/a** in residual emissions that must be addressed using more disruptive levers, such as hydroponics, and in the more distant future lab-grown meat

7

A sustainable, healthy diet for all could require **>170%** increases in soybean and vegetable production, and **~20%** increase in deciduous fruit production by 2050, even if production for export and livestock is diverted to local food demand. This would require land-use prioritisation for hardier, nutritionally-dense foods and import strategies for starchy staples

8

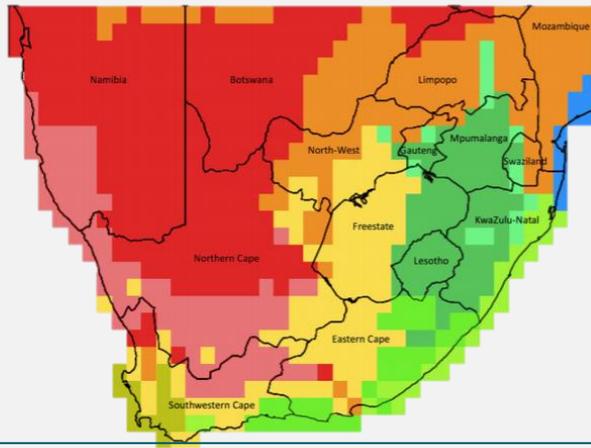
A Just Transition needs to unlock sustainable and healthy diets for all South Africans. However, sustainable, nutritional diets currently cost **~4 times more** than the average, nutritionally-inadequate, local diet, and **~1.5 times more** than the cheapest nutritional, carbon-intensive diet in South Africa. Subsidisation of healthy diets may be funded by reductions in the healthcare burden of obesity, however, measures to build a climate-resilient food supply could further increase production cost – therefore it will be critical to ensure affordability of future food supply

9

To ensure a Just Transition, **small-scale producers** must be supported to increase productivity and gain both agricultural and business skills. This requires improved extension services and climate monitoring, access to finance and off-take incentives for sustainable practices. It may also require tenure reform; **farmworkers** require new work opportunities and **agri-dependent communities** need to be identified and plans made to diversify economic opportunities

Significant increase in hot desert zone and shift from warm to hot temperature zones expected across both scenarios

Koppen Geiger climate zones in SA (1961- 1990)

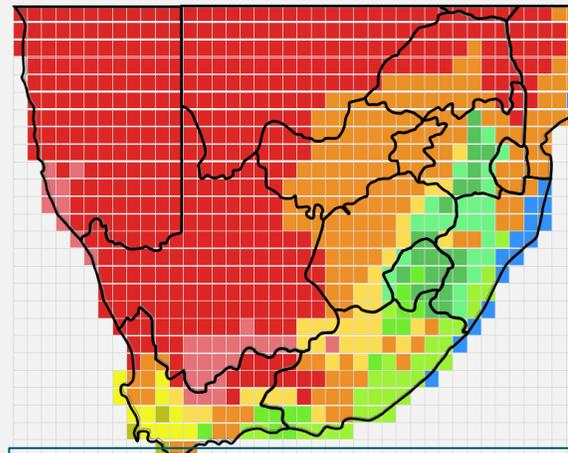


Cold and hot desert in the West

Cold steppe in the center & south-west

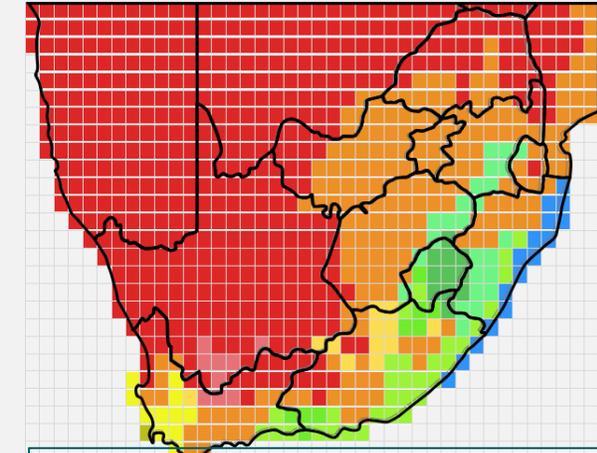
Warm temperature regions in the east & south-east

RCP4.5 (eq.¹) (2040-2060; 2°C MIROC3.2-medres model)



- **~25% increase in size of hot desert**
- **~18% increase in size of hot, arid steppe**
- **Warm temperate partially replaced by hot temperate**

2050 RCP8.5 (eq.²) (2040-2060; 3°C MIROC3.2-medres model)



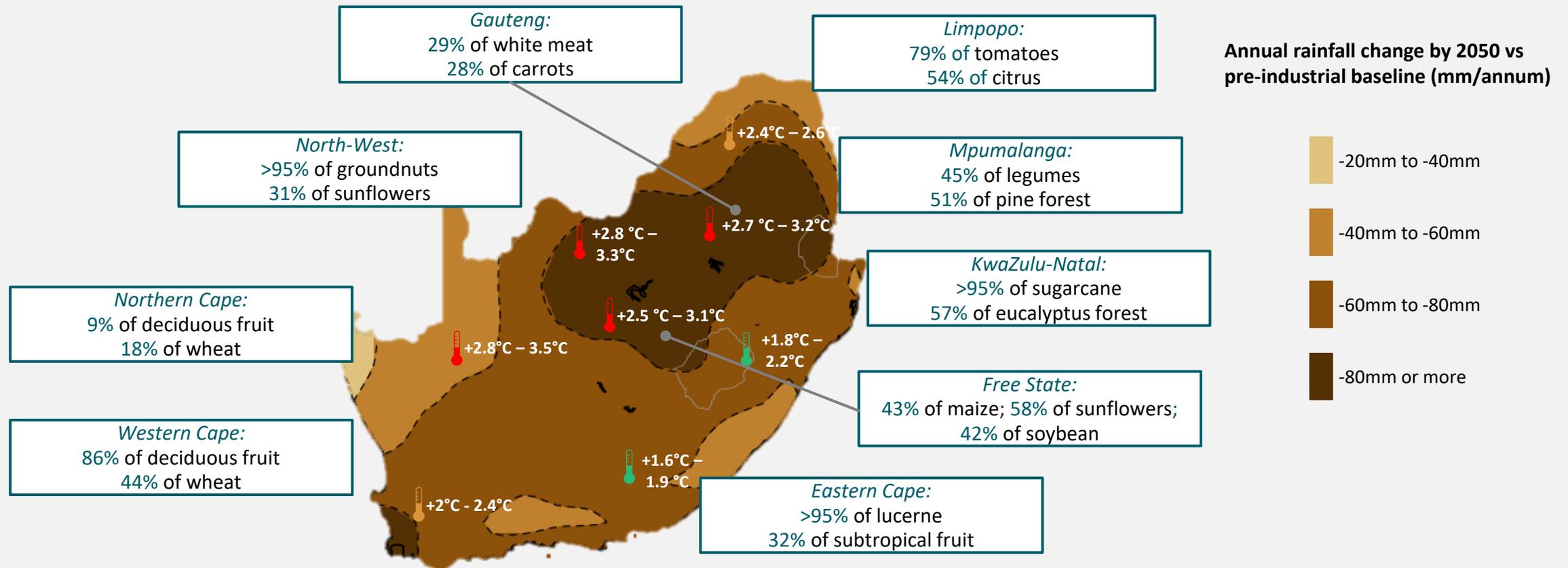
- **~48% increase³ in size of hot desert**
- **~34% increase³ in size of hot, arid steppe**
- **Warm temperate replaced by hot temperate except in Lesotho. ~124% increase³ in size of tropical savannah (east coast)**



1. 2°C global temperature increase 2. 3°C global temperature increase 3. Relative to base period
Source: Theoretical and Applied Climatology (2015); Agricultural Research Council & DAFF; NBI-BCG team

Overall, Western and Northern Cape, with >30% of SA agri. jobs, at highest risk from climate change

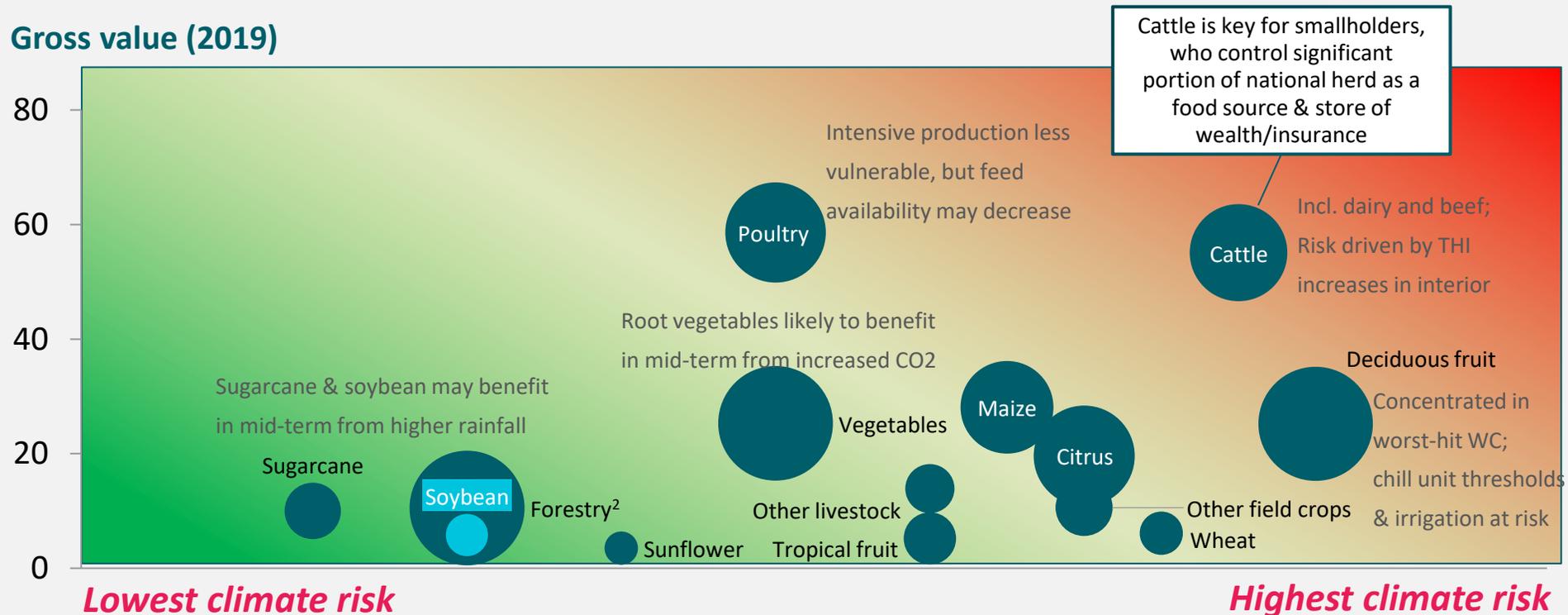
Annual rainfall and temperature change by 2050 (RCP8.5) and key commodities by region (% of national production)



1. Relative to 1961-1990 baseline 2. 'Risk' defined based on relationship between projected climate change impacts on municipalities and the relative economic importance of agriculture to those municipalities | Source: CSIR "Green Book"; Statistics South Africa "Census of Commercial Agriculture 2017"; LTAS Phase I; 3rd National Communication; Green Book; NBI-BCG team

Significant value and jobs at risk due to potential negative climate impact on cattle, deciduous fruits and maize

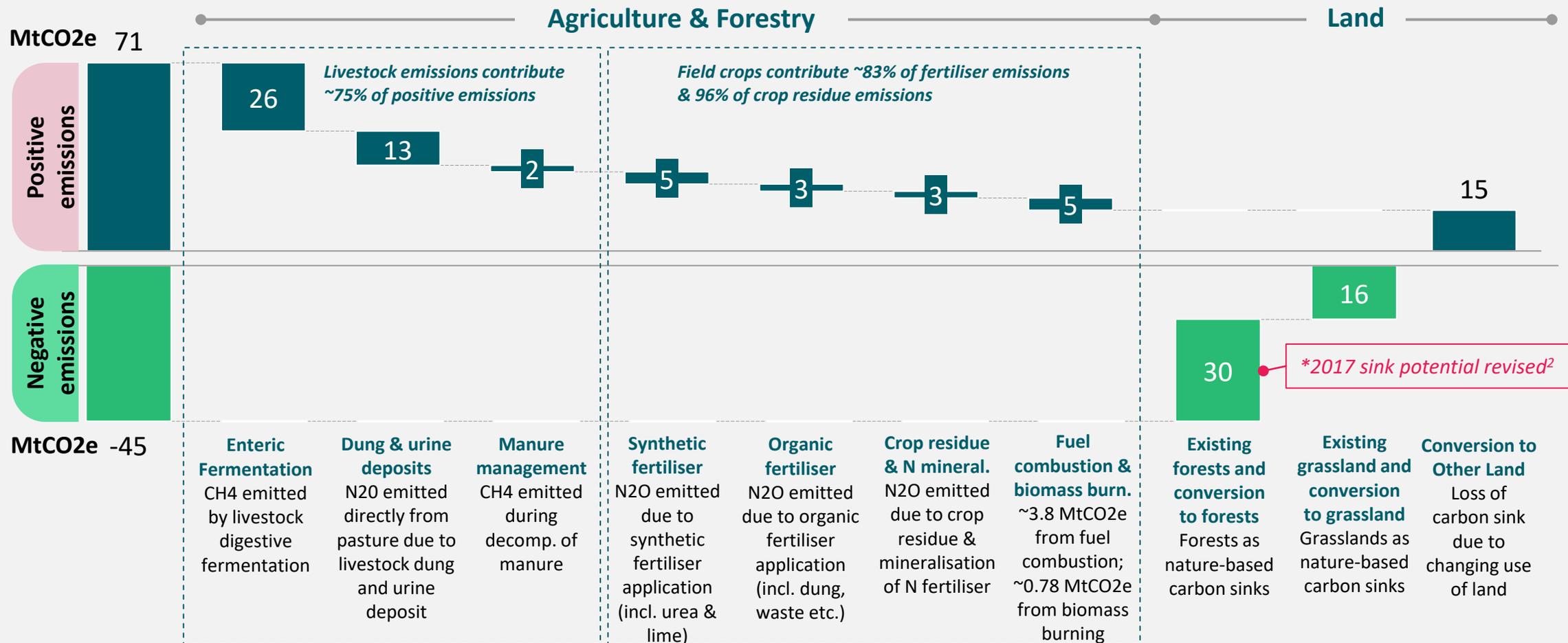
Indicative



● Employment¹

1. Excludes employment in mixed agriculture (~186k jobs) 2. Does not include jobs down the value chain, only primary stage | Note: Gross income and employment statistics only account for primary products (i.e. products that are consumed directly or sold for further processing) | Source: Statistics South Africa "Census of Commercial Agriculture: 2017" ; Statistics South Africa "Abstract of Agricultural Statistics 2020"; Forestry SA

Livestock sector drives ~75% of direct AFOLU emissions; natural carbon sink anchored in forests and grasslands



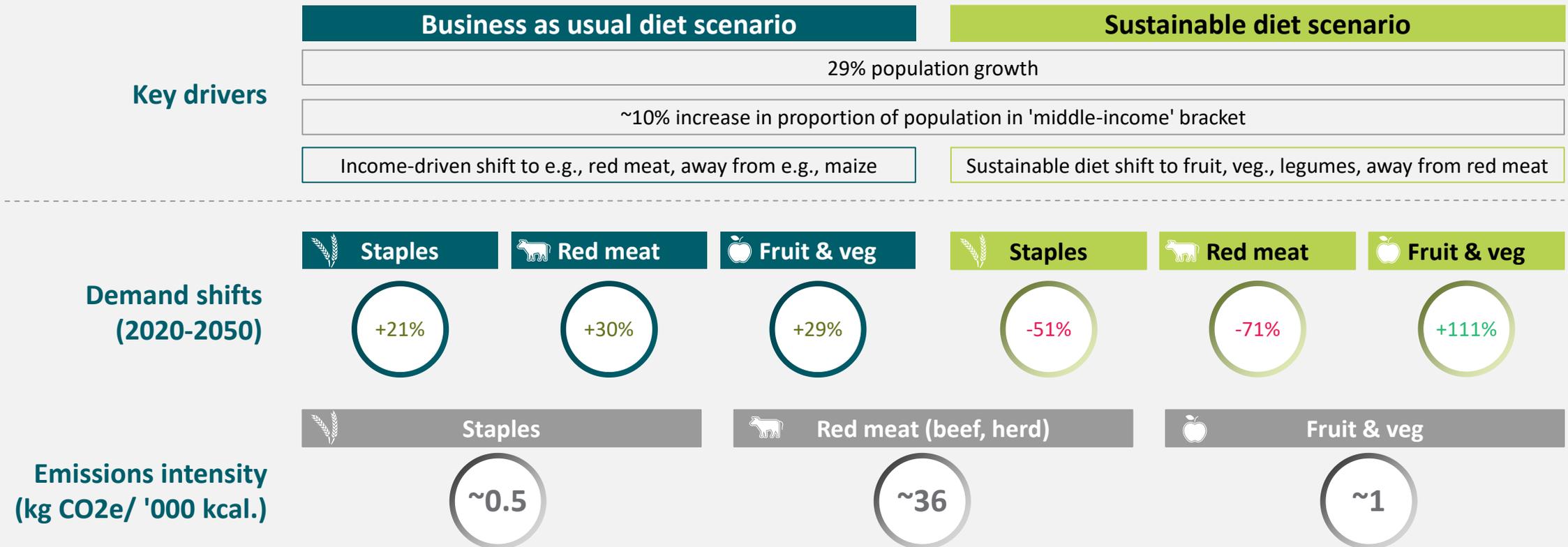
Notes: Synthetic fertiliser emissions split based on crop system emissions estimations by Tongwane et al.

1. Horticulture includes all vegetables & nuts (incl. root vegetables) but not legumes 2. 2021 update to GHGI | Sources: DEFF (GHG Inventory 2000-2017)

Lever implementation timing will be dictated by progression of techno-economic feasibility and degree to which smallholders are supported

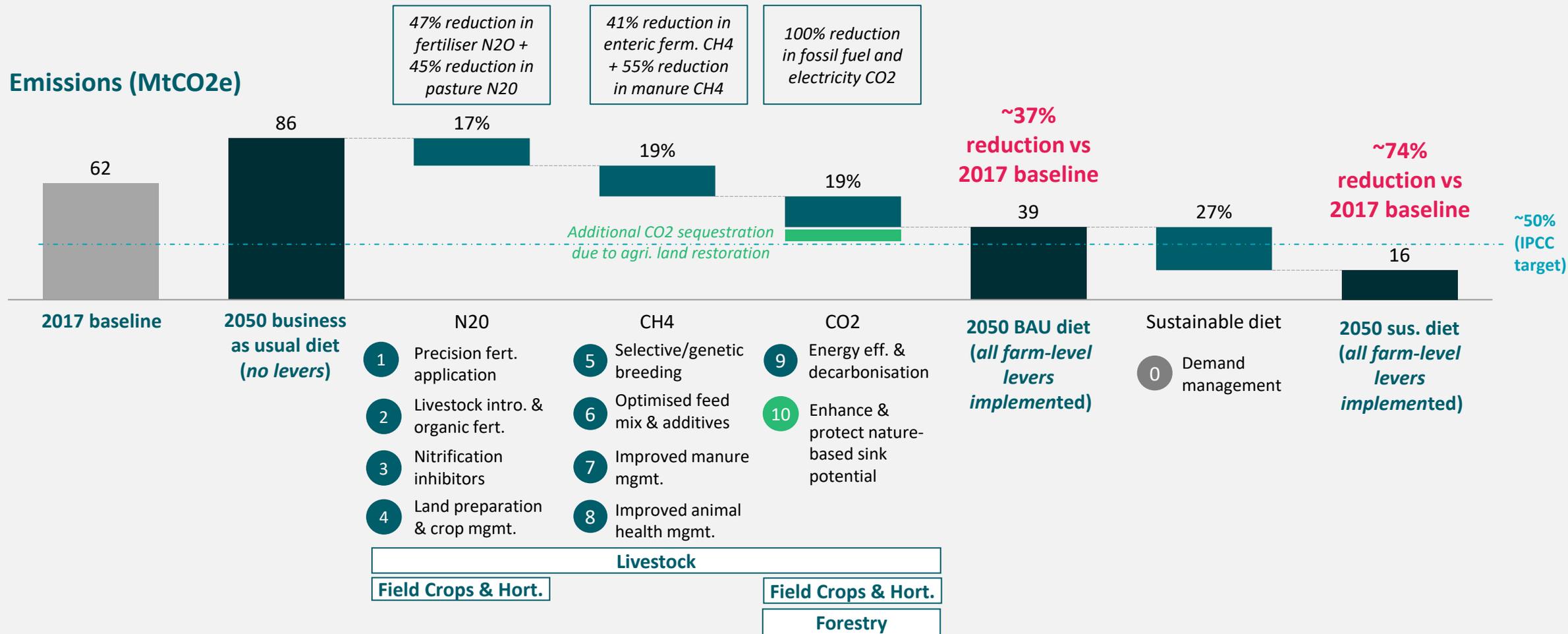
| | | Short-term (within next 24 months) | Mid-term (by 2030) | Long-term (beyond 2030) | |
|-----|-----------------------------------|--|---|-------------------------|--|
| CH4 | N2O Horticulture & Field Crops | 1 Targeted fertiliser application, no-fertiliser zones | | Introduce green ammonia | |
| | | 2 Introduce livestock to existing systems | Provide broader access to organic fertiliser | | |
| | | 3 Scale-up use of nitrification inhibitors | Lower cost, more efficient inhibitors | | |
| | | 4 Introduce crop cycling, cover cropping, lower till | Fully implement no-till cultivation | | |
| | Livestock | 5 Selective breeding & culling | Genetic selection of specimens with lower emissions intensity | | |
| | | 6 Young forage, more maize silage | Tannin forage, finer processing | | |
| | | 7 Anaerobic manure digestors, nitrif. inhibitors | Sophisticated manure storage & use systems | | |
| | | 8 Regular checks, vaccination, parasite control | Matching genotypes to biomes | Methanogen vaccines | |
| CO2 | All AFOLU | 9 Increased energy efficiency & switching to own production | Replacement of existing electricity supply with RE, begin machinery electrification | Full fuel switch to RE | |
| | | 10 Improving soil carbon sequestration potential on croplands and grazing pastures, polyculture forestry, maintaining plantations in growing phase to maximise 'carbon pump' | | | |

Both BAU and sustainable diet scenarios see similar absolute increases in food consumption, but different diets produce different emissions intensity



1. Using average SSA prices/ adult person, scaled up 3.5x for family of 4
Source: University of Oxford "Our World in Data"; Bureau for Food and Agriculture Policy (BFAP); Lancet Global Health; NBI-BCG team

If business-as-usual diet assumed, ~40% AFOLU emissions reduction by 2050 possible if all farm-level levers implemented



Adaptation and mitigation needs to be pursued together to ensure climate resilience

Initial view - to be discussed

| | Mitigation | Adaptation |
|---------------------|--|---|
| Field crops | <ul style="list-style-type: none"> 1 Drive precision application of fertilisers and deploy green fertilisers in longer term 2 Introduce livestock to leverage organic fertilisers to meet fertiliser demand 3 Application of nitrification inhibitors 4 Ensure adoption of crop cycling, cover cropping, no till | <ul style="list-style-type: none"> 1 Improve metering of water flows and drive more responsible and informed allocation of water reserves 2 Develop and plant temp., drought and pest resilient cultivars 3 Implement pest netting & organic pesticides |
| Horticulture | | |
| Forestry | <ul style="list-style-type: none"> 5 Improved herd management: selective breeding & culling, genetic selection of lower emissions specimens 6 Improved feed management: feed additives, higher quality /young feed & more granular processing 7 Optimised manure management: appropriate collection, storage/covering, use of digestors & nitrification inhibitors for pasture deposits 8 Improved health management: vaccination, pest control, biome-genotype matching | <ul style="list-style-type: none"> 4 Deploy climate and pest resilient hybrids and diversify tree species 5 Implement fire & pest mgmt. practices (e.g. fire breaks, trimming and use of alien biomass, active forest health monitoring) 6 Sustainable intensification 7 Improved herd management: selective breeding & culling, genetic selection of lower emissions specimens, switching to harder breeds/animals 8 Improved health management: Deploy parasite control, vaccinations, improved feed 9 Explore and deploy alternative protein sources/new production methods (e.g., lab meat, fish protein, etc.) |
| Livestock | | |

Furthermore, ensuring water availability and enabling farmers to implement levers relies on investment in water monitoring , research and extension services

Non-exhaustive - to be discussed



Treasury estimates **R670Bn** needed in the **next 10 years** to restore and upgrade national water systems¹

- Agriculture accounts for ~60% of national water consumption
- Increasing demand must be met with better **management of agricultural water reserves (e.g., dams)** and more **accurate metering of water usage**
- Etc.



Funding for a unified **climate monitoring and adaptation research** effort required

- Climate research in SA largely siloed, affecting uniformity of approaches and results
- Funding of a **virtual centre of excellence** for climate research in agriculture needed
- Etc.



Investment and deployment of specialists required to **rehabilitate extension services**

- Extension services managed on a provincial level and dysfunctional in many regions
- **Robust extension services** crucial to both lever implementation and ensuring success of land redistribution
- Etc.

1. Department of Water and Environmental Affairs estimate
Source: Department of Water and Environmental Affairs; Expert interviews

Replacement of cheap staples and increased consumption of fruit and veg., legumes, nuts and oils results in higher cost of sustainable diet

Average monthly household cost of different food baskets in SA

Stats SA Living Conditions Survey (LCS)

R1027 /month

- Real average household food expenditure in South Africa (2014/15)
- Based on survey of ~28 000 households

BFAP Thrifty Healthy Food Basket

R2900 /month

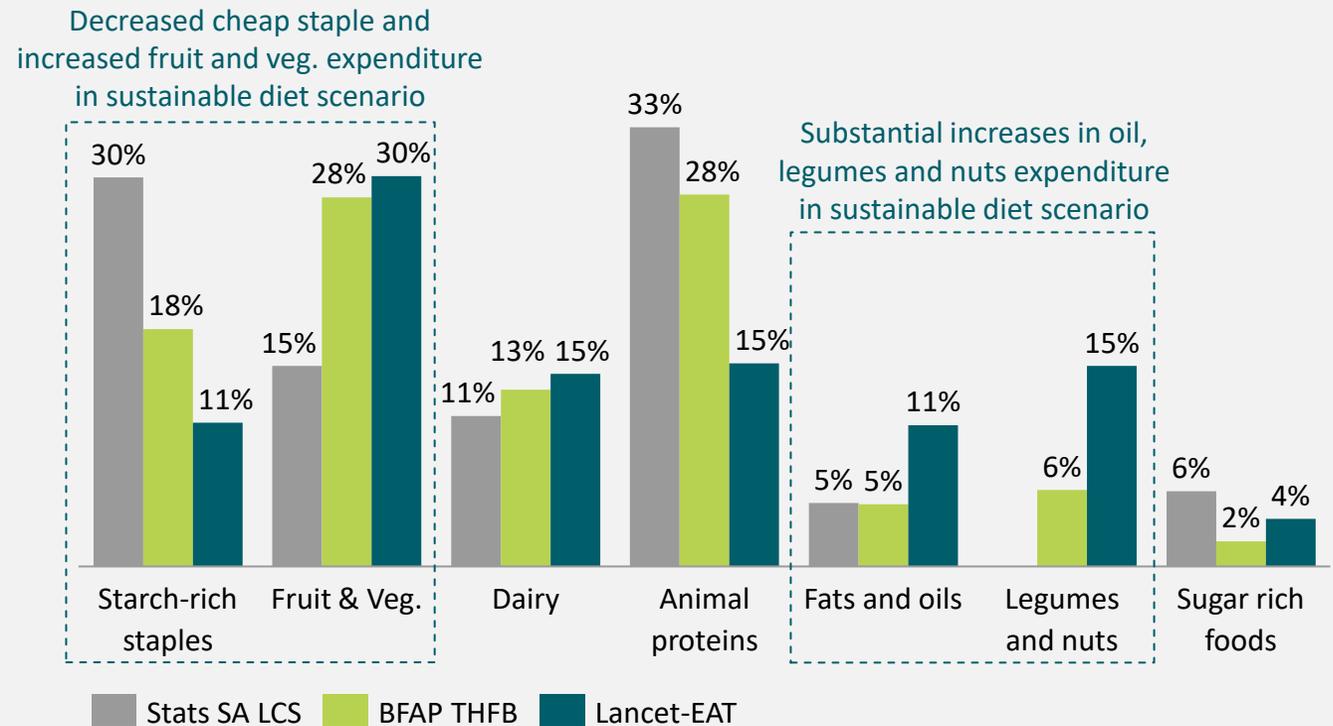
- Lowest cost SA food basket that meets full macro nutrient requirements (aligned with DoH Dietary Guidelines)
- Affordable for ~50% of SA households¹

Lancet EAT sustainable healthy diet

R4300 /month

- Healthy diet, optimised to minimise carbon intensity of basket
- Affordable for ~20-30% of SA households¹

Average % household food expenditure for different food baskets



1. Assuming 35% of household income is dedicated to food expenditure
Source: Hirvonen et al "Cost and Affordability of the Lancet-EAT Diet"; BFAP 2020 Baseline; Stats SA Living Conditions Survey

A sustainable diet scenario certain to put pressure on local fruit, vegetable and legumes production – potentially impacting export earnings

Non-exhaustive

Soyabeans (ktonnes/a)

Demand to shift from animal to human food – potentially requiring imports

Apple (ktonnes/a)

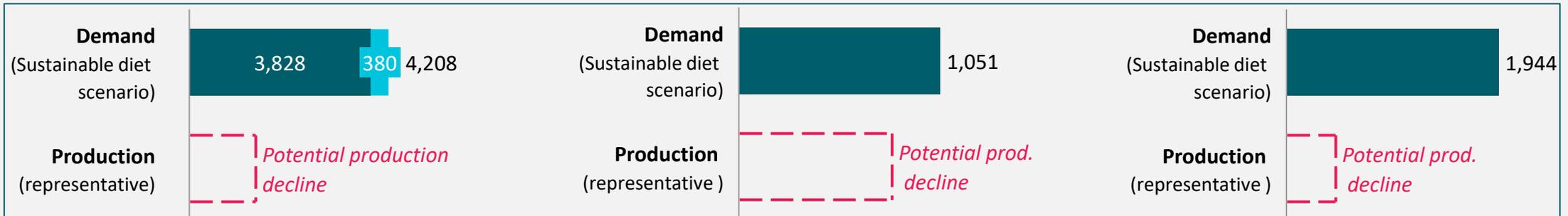
Excess prod. for export to diminish with increased fruit consumption

Tomato (ktonnes/a)

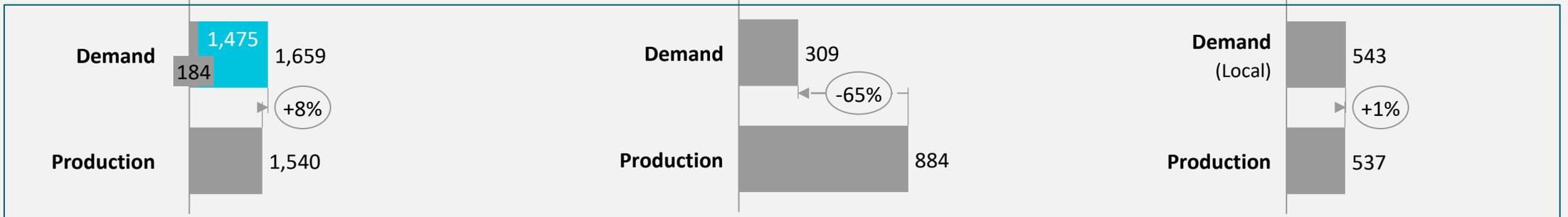
Imports likely required given strong demand increase

Feed

2050



2020

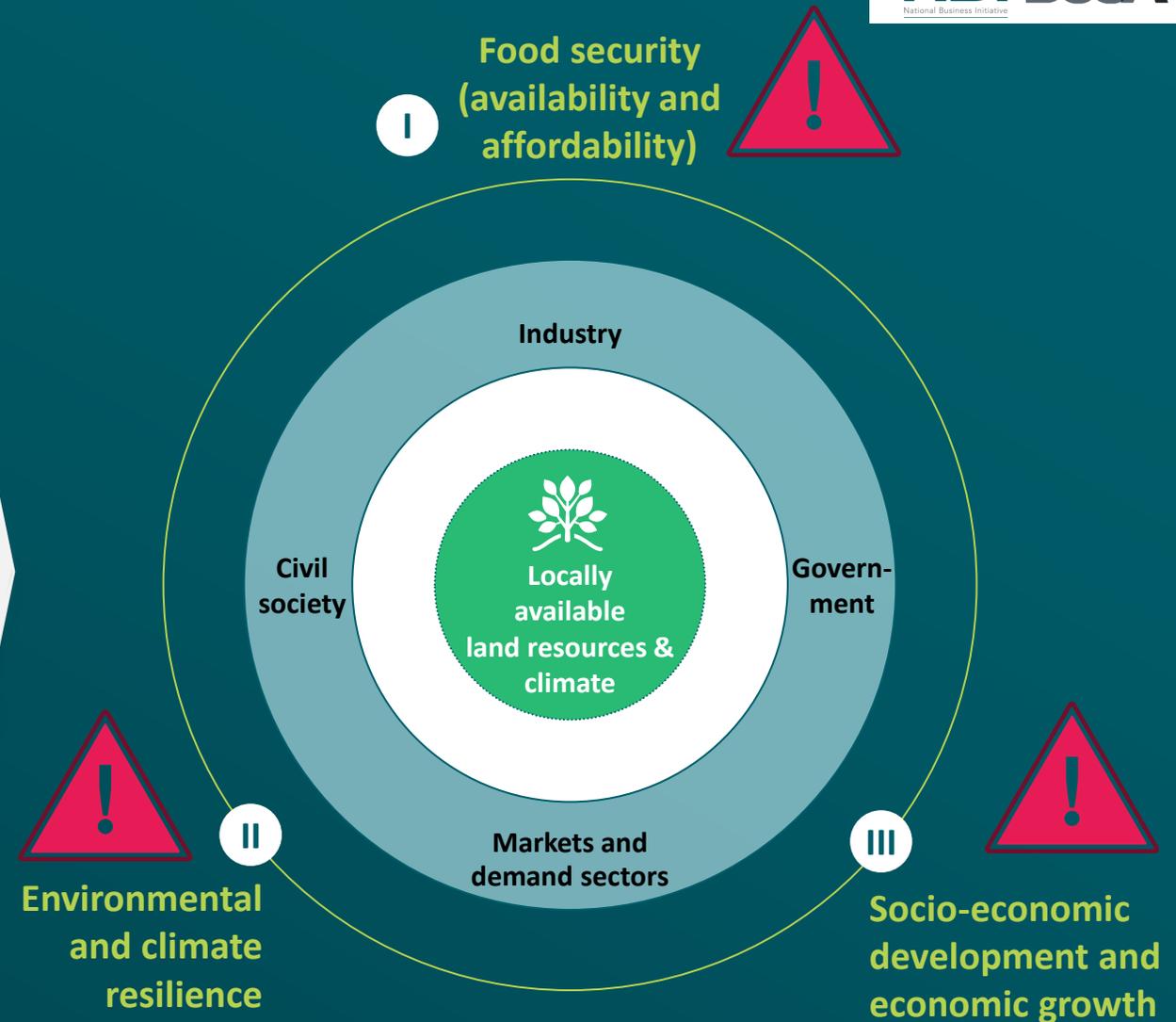


AFOLU at risk from climate change across all dimensions

In particular, food security at risk by potentially increasing food prices:

- **Sustainable, healthy diets** need to be adopted to enable adaptation and mitigation
- But those diets could cost **~4x more than** the average food spend in SA today, and **~1.5x more than** the cheapest healthy, but non-sustainable local diet today

Need to ensure affordability of supply via both avoiding significant cost increases and ensuring socio-economic development



Key actions to ensure effective lever implementation and maximise food security, environmental, and socio-economic benefits

| | Short-term (Within next 3-4 years) | Long term (after 2030) – significant climate impact |
|--------------------------------|---|--|
| Sector-wide | <ul style="list-style-type: none"> • Incentivise sustainable practices: Deploy certification schemes, rollout user-pays irrigation and develop granular monitoring of irrigation flows • Enhance farmer capacity to implement: Grant title deeds and promote cooperative formation for smallholders, implement DAFF extension strategy, develop a centre of agri. research excellence to ensure consistent messaging • Align financing options to AFOLU challenges: Deploy blended finance mechanisms, index-based insurance products and water-risk filters in agri. financing | <ul style="list-style-type: none"> • Drive demand shifts: Tax to incentivise more diverse, locally grown foods and subsidise healthy, sustainable diets using savings in healthcare sector • Develop regional land-use prioritization hierarchies: Develop clear hierarchies, prioritising high value, hardier foods • Diversify employment opportunities and income sources: Develop agro-industrial value chains around emerging farmer cooperatives and build strategies to transition livestock farmers to alternate roles |
| Livestock | <ul style="list-style-type: none"> • Develop local knowledge: Fund breeding programmes and development of local breed database to inform targeted extension deployment • Develop demand-side decarbonisation incentives: Deploy mobile auction sites | <ul style="list-style-type: none"> • Drive breed shifts: Promote switches from cattle to hardier and lower emissions goat and sheep, drive demand changes using taxation |
| Field Crops & Hort. | <ul style="list-style-type: none"> • Improve contribution of emerging farmers: Roll out crop aggregation platforms, giving smallholders access to medium-to-large retail markets • Drive innovative solutions: Double national spending on local research to develop more resilient cultivars and drive pilot green NH3 projects in commercial sector to provide off-takes for green chemicals production | <ul style="list-style-type: none"> • Enable emerging farmer commercialisation: Develop legal and policy framework to develop smallholder cooperatives that produce resilient cash crops (e.g., olives or dates, millet) |
| Forestry | <ul style="list-style-type: none"> • Develop viable 2nd gen. biomass economy: Fund conclusive study of usable biomass availability in SA; Use biomass collection to provide employment and pilot biomass hubs to facilitate commercialisation with petrochemicals sector | <ul style="list-style-type: none"> • Enable expansion: Review water-licensing process to expand biomass, sequestration and sustainable timber availability in SA |
| Land use | <ul style="list-style-type: none"> • Demand-side incentives for sustainable land management: Develop a carbon crediting market and ecosystem services incentivisation framework and increase carbon taxes to increase carbon credit value • Increase funding to LandCare programmes | <ul style="list-style-type: none"> • Secure international green financing: Leverage appetite for international biodiversity finance to drive integrated land rehabilitation and agriculture decarbonisation and adaptation programmes |

Q&A

Please post your questions in the chat

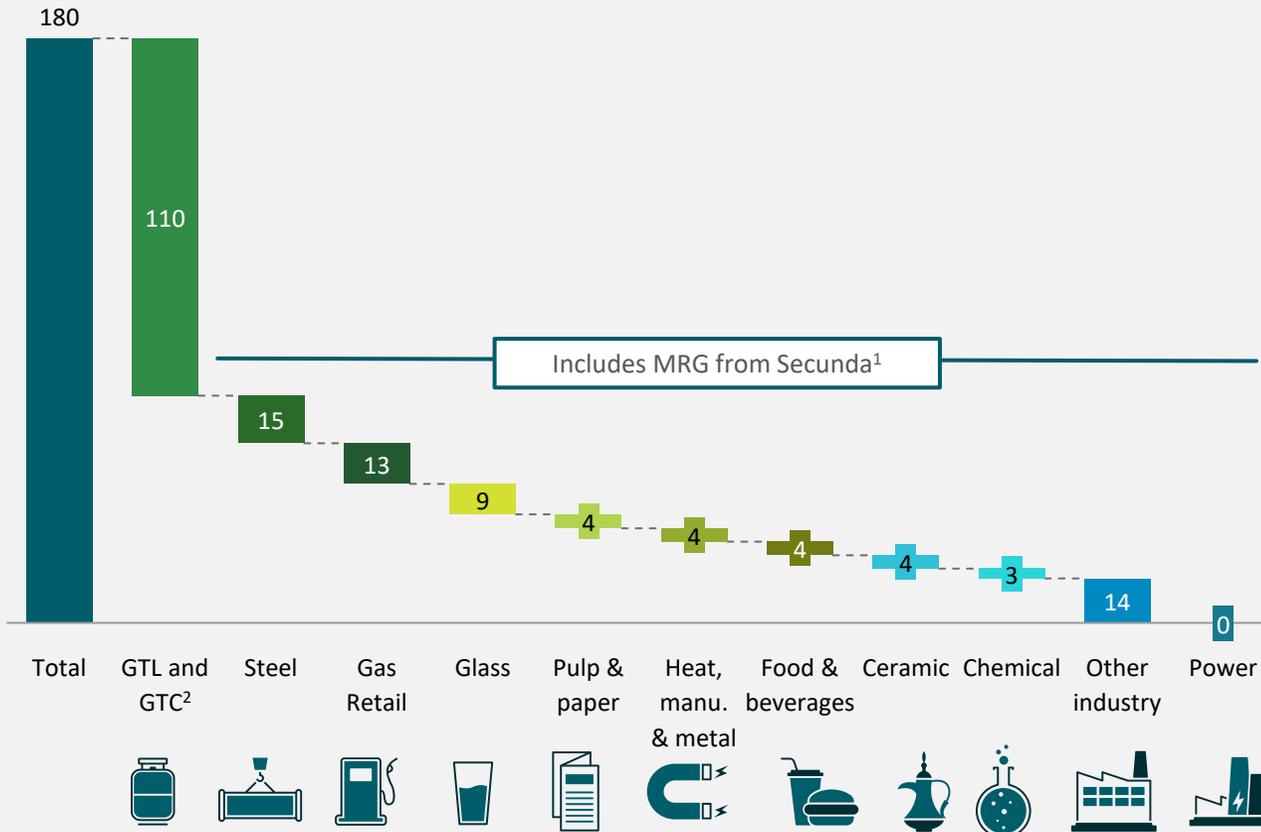
The role of gas in South Africa – towards a net-zero future for South Africa



SA currently consumes ~180PJ/a of gas, mainly in the synfuels sector...

...and also drives high socioeconomic impact

Gas demand (PJ)¹



1. Excluding any latent unmet demand; Household gas demand negligible (<1PJ/a) and not included 2. Excluding PetroSA | Note: MRG= Methane Rich Gas, GTC= Gas-to-Chemical, GTL= Gas-to-Liquid Source: Quantec baseline SAM; Capital IQ; Sappi annual integrated report 2019; ArcelorMittal audited financial statements 2019; AECI 2019 annual integrated report; Omnia integrated annual report 2019, StatsSA; NBI-BCG project team



~46-56k

Jobs across the gas value chain in South Africa



R150-215Bn

Taxable revenue from the gas value chain

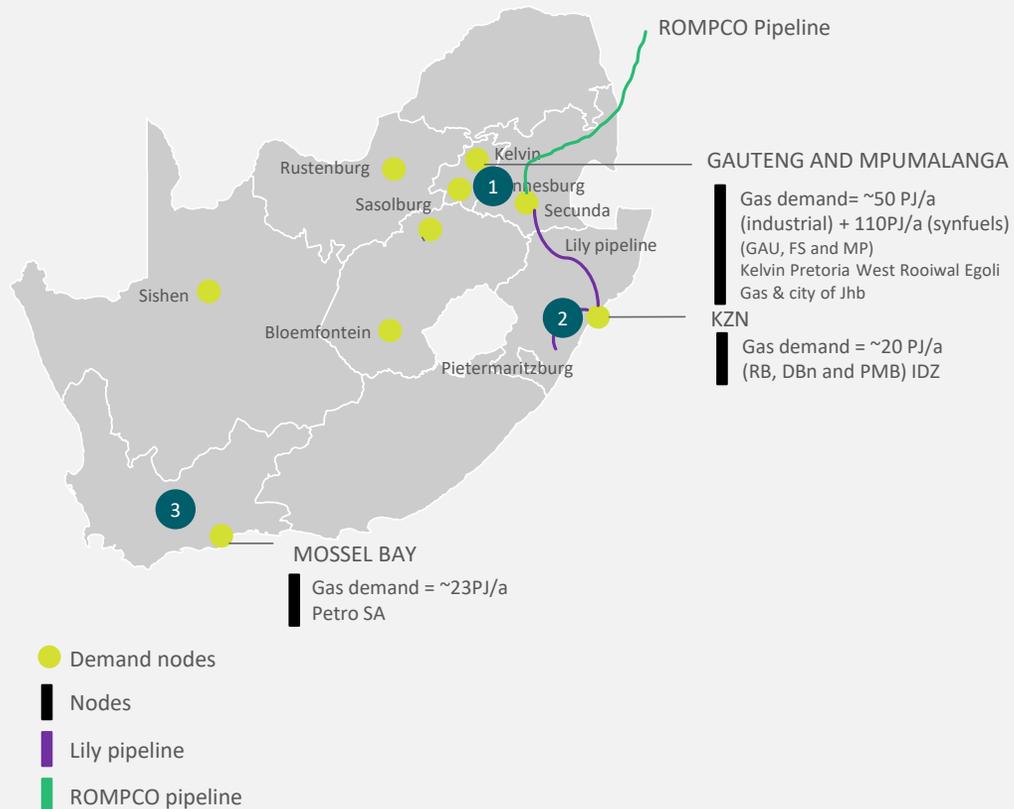


1-2%

Contribution to national GDP from the value chain

Regionally, current gas demand clustered in Gauteng, Mpumalanga and KwaZulu-Natal

Demand is centred around Secunda/Sasolburg and the industrial hub in Richards Bay



- 1 Gauteng and Mpumalanga: ~160 PJ/a
 - Synfuels demand for gas ~110PJ/a supplied via ROMPCO and a transition pipeline
 - Sasol supplies neighbouring facilities to Secunda, namely Egoli gas & Steel industry players (~50PJ/a consumed by inland industrial users)
- 2 KZN: ~20 PJ/a
 - Supported by Lily pipeline which is connected from end terminal of ROMPCO pipeline in Secunda to Richards Bay
 - Line supplies MRG to industrial clients within Richards bay industrial zone mostly focused on Refinery operations
- 3 Western Cape:
 - Supply from Block 9 feeds PetroSA's GTL refinery in Mosel Bay, though this is assumed to be exhausted as of the end of 2020



Pande-Temane is SA's only major gas supply today (via the ROMPCO pipeline)

This supply is at risk with reserves declining from ~2025 – can be supplemented with capital investments on existing assets & LNG

Note: MRG = Methane rich gas; GTL= Gas-to-liquid

Source: IGUA 2020 Annual Report; Sasol Production Reports; Sasol Form 20F 30 June 2021; Expert interviews; NBI-BCG Project Team

Four key sectors will drive future gas demand in SA



Electricity

As outlined in the power report: RE + battery storage + gas is the cheapest option to decarbonise power & ensure security of supply (at least ~150GW RE req. by 2050)

Gas used for mid-merit and mostly peaking capacity across all net-zero power pathways



Synfuels

Coal feedstock substitution the only way to significantly decarbonise sector (currently >90% of sector emissions from CTL)

Affordability of gas supply is critical to unlocking gas demand to phase out coal



Broader Industry

Industry estimates there to be at least ~68PJ/a of latent demand today, on top of 50PJ/a consumed today

Industrial sector could ramp up gas demand to phase out coal as an energy source, pending the affordability of supply



Transport

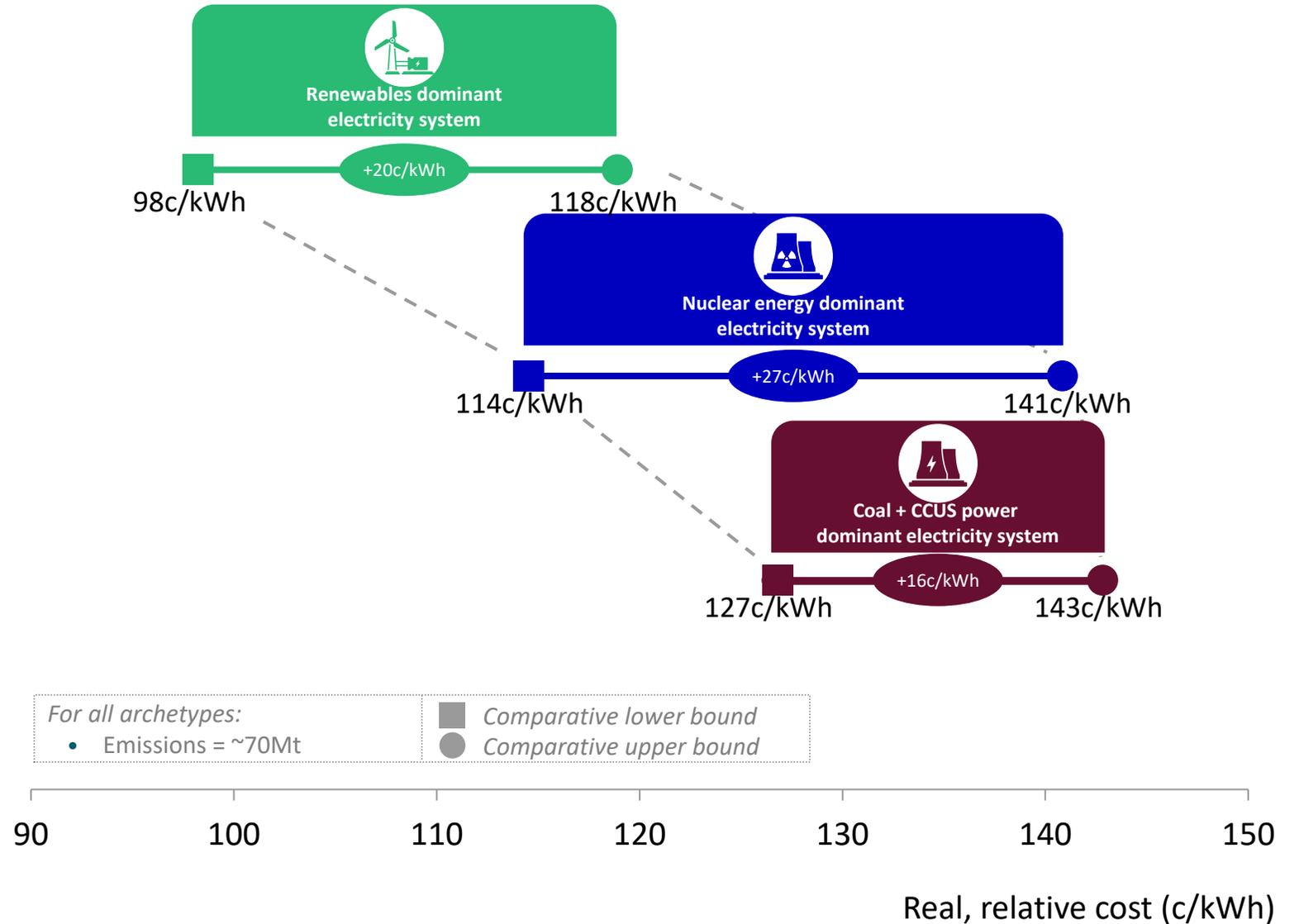
Gas is not expected to play a major role in SA's transport sector, but could play a role in decarbonising in HDVs for freight road transport



RE archetype has lowest cost and relatively narrow risk envelope or variability in cost, even under most unfavourable assumptions

Key sensitivities tested

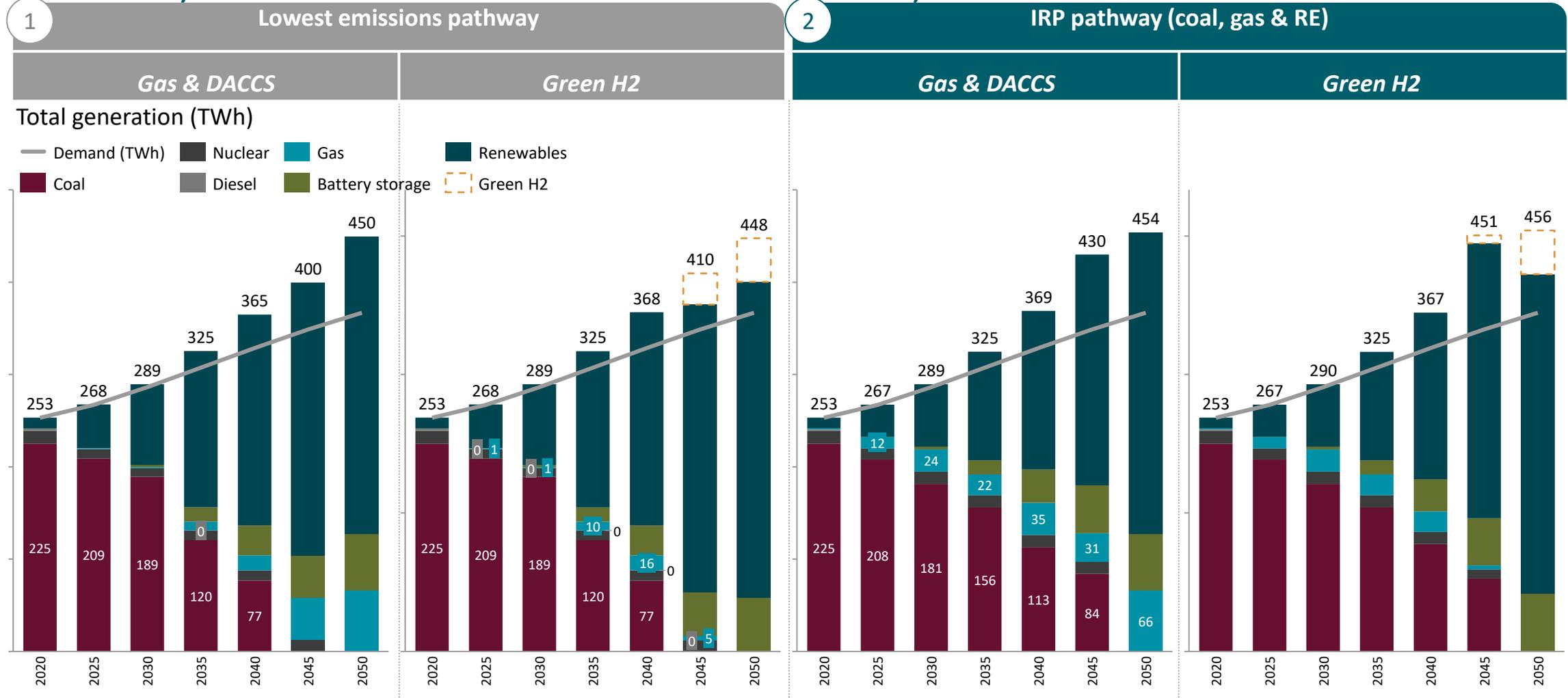
- CO2 price
- Less than optimal RE location
- System Inertia
- Transmission Losses
- Water Use
- Carbon Capture Costs
- WACC



Note: CO2 price of R0/ton used for each archetype
Source: Plexos model, NBI-BCG Project Team

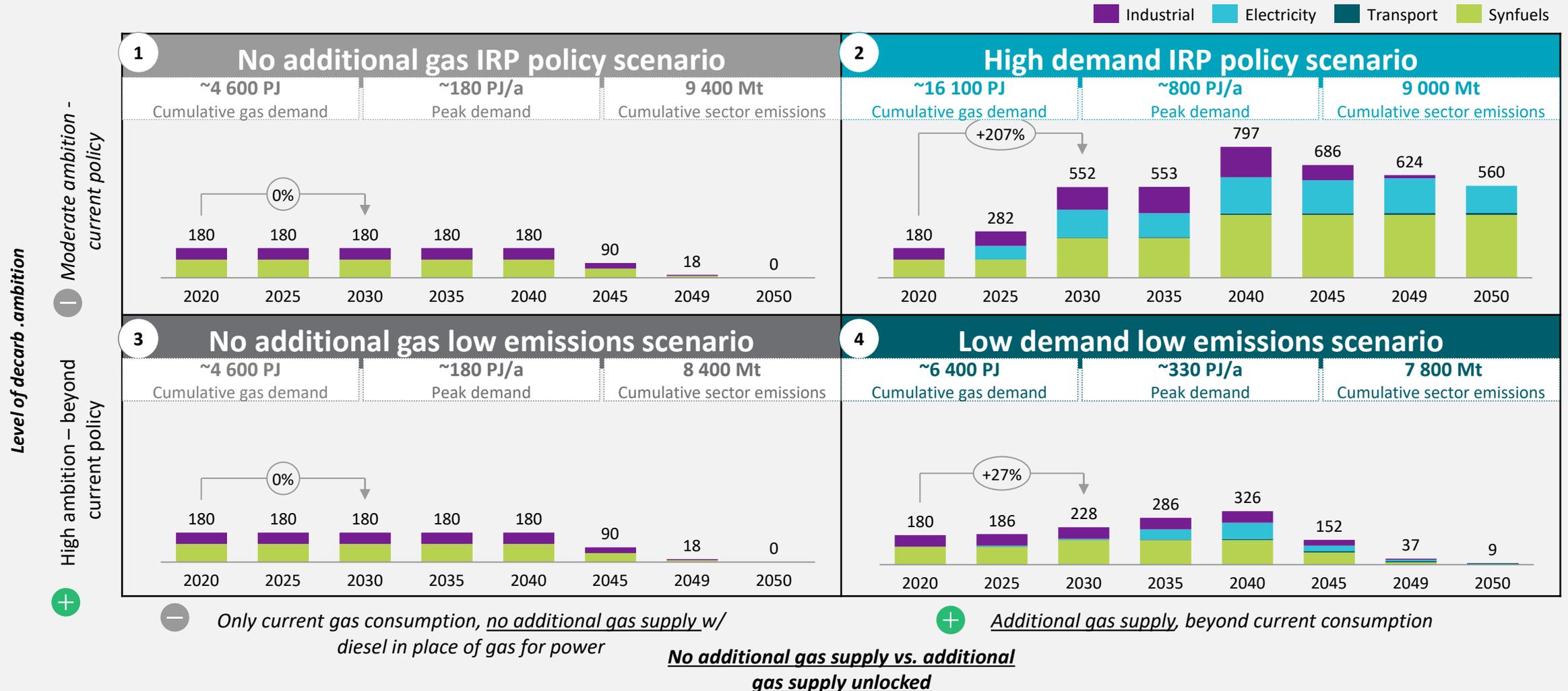


Across power sector pathways, gas is used predominantly for peaking (<10% utilisation) & to a lesser extent for mid-merit (<30%)



Note: Total generation (TWh) includes curtailed energy (i.e. curtailment not subtracted out); Average battery storage of ~4 hours used in modelling | Source: Plexos model, NBI-BCG project team

SA's 2030 gas demand could range from 180-550PJ/a, higher uncertainty in longer term with 0-560PJ/a in 2050



Back-up: Detailed assumptions per gas demand scenario



Level of decarb. ambition

Moderate ambition - current policy

High ambition - beyond current policy

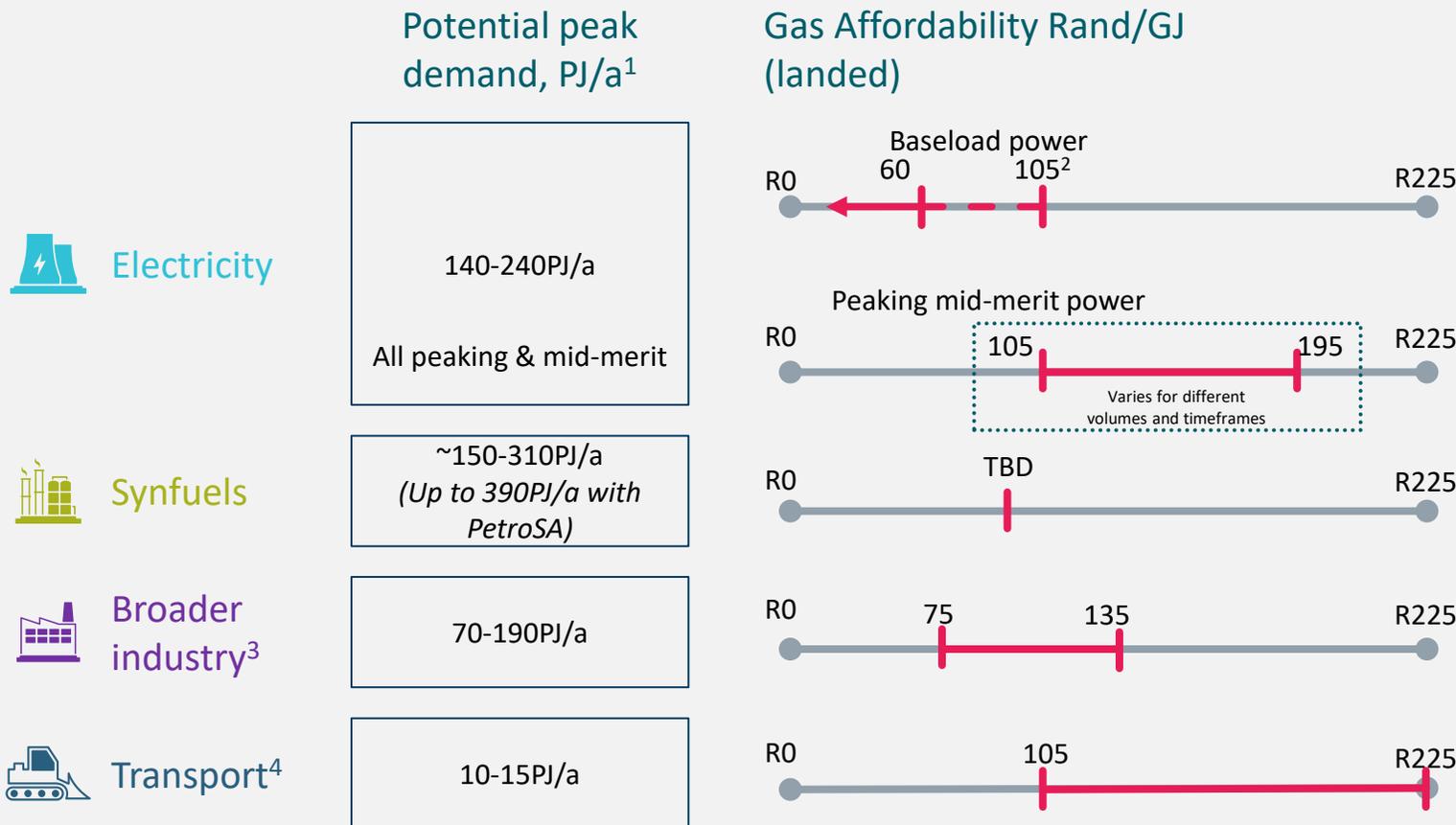
| | 1 No additional gas IRP policy scenario | 2 High demand IRP policy scenario |
|---------------------------------------|---|--|
| Moderate ambition - current policy | <ul style="list-style-type: none"> Mid-merit & peaking needs of system met with diesel, complemented with DACCS post-2040 (IRP gas & DACCS path w/ diesel in place of gas) Gas demand remains flat at current levels (~110PJ/a) to 2040, linearly ramping down to 0PJ/a 2040-2050 Gas demand remains flat at current levels (50PJ/a) to 2040, linearly ramping down to 0PJ/a 2040-2050 Gas demand remains flat at current levels of 0PJ/a | <ul style="list-style-type: none"> Gas demand ramps up with current policy pre-2030¹, add'l OCGT & CCGT capacity post 2030 & DACCS² post-2040 (as per IRP gas & DACCS path) Gas ramps up to ~20% of Secunda feedstock by 2030 (+60PJ/a) and ~40% by 2040 (+ ~140PJ/a); PetroSA revived w/ demand of ~70PJ/a by 2030 Gas avail. affordably, unlocking ~70PJ/a latent demand pre-2030, growing by 3% post 2030 in line with GDP & ramping down to 0PJ by 2050 Gas demand increases to 2PJ/a by 2030 (15PJ/a by 2050)³ |
| High ambition - beyond current policy | <ul style="list-style-type: none"> Mid-merit & peaking needs of system met with diesel, until green H2 avail. from ~2040 (low emissions green H2 path w/ diesel in place of gas) Aligned to the no gas IRP scenario – current consumption to 2040 Aligned to the no gas IRP scenario – current consumption to 2040 Aligned to the no gas IRP scenario – no gas consumption | <ul style="list-style-type: none"> Gas demand peaks ~2035 in line with coal decomm. and is subst. with green H2 from ~2040 (low emissions green H2 path) Gas demand increases by 40PJ/a by 2030, in line ~20% gas feedstock for Secunda, ramping down to 0PJ/a post 2040; Petro SA not revived Aligned to the no gas scenarios Gas demand increases to 2PJ/a by 2030 (10PJ/a by 2050)⁴ |

– Only current gas consumption, no additional gas demand w/ diesel in place of gas for power

+ Additional gas demand, beyond current consumption
No additional gas supply vs. additional gas supply unlocked

1. Pre-2030 gas capacity as per current policy: IRP (3GW) , RMIPPPP (1GW), conversion of existing OCGTS (3.8GW) & latent demand (1.4GW) w/ add'l CCGT & OCGT capacity post 2030 as per Plexos pathways w/ some residual gas capacity in 2050; 2. Direct Air carbon capture & storage; 3. In line w/ IEA Reference Tech Scenario; 4. in line w/ the IEA Sustainable Development Scenario | Note: IRP = Integrated Resource Plan; DACCS = Direct Air Carbon Capture and Storage, OCGT = Open Cycle Gas Turbines; CCGT = Closed Cycle Gas Turbines | Source: NBI-BCG project team

Affordability is critical bridge supply & demand – esp. in synfuels & industry

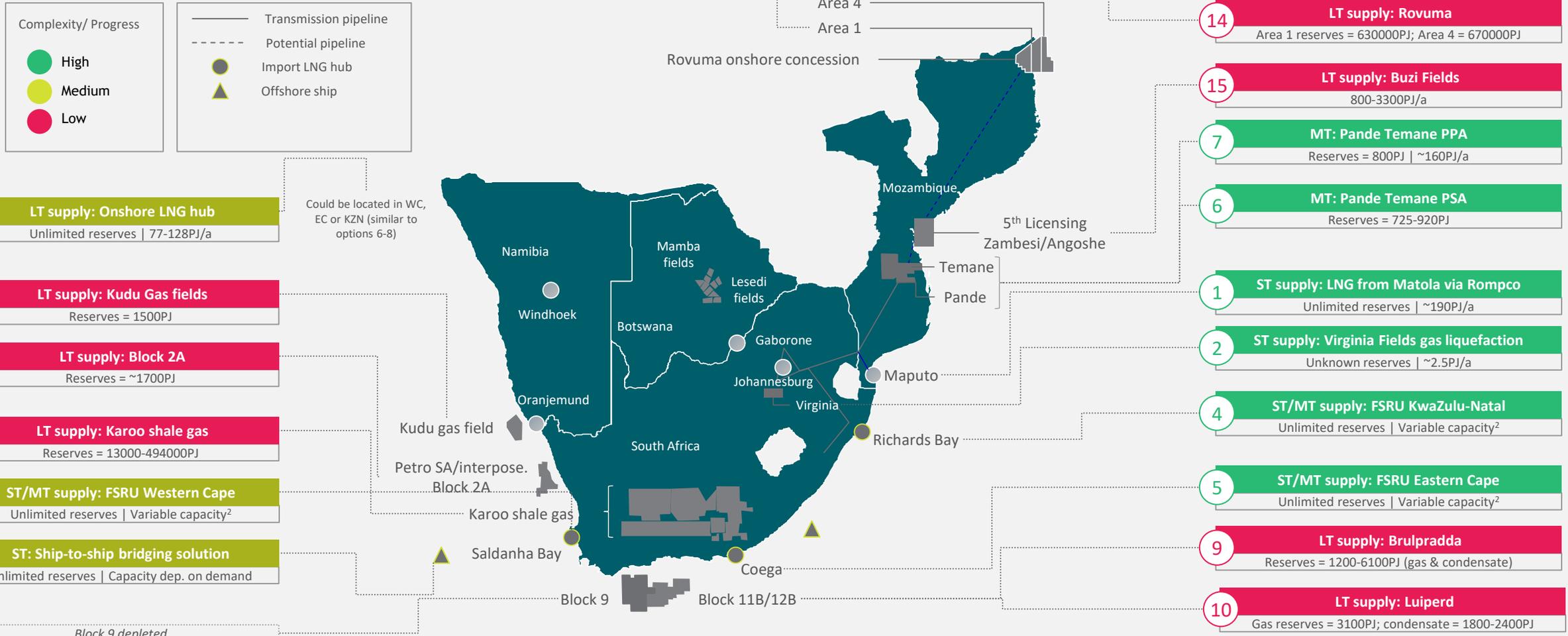


Ensuring the right supply infrastructure play is critical to unlocking demand and meeting affordability thresholds

1. Range based of the low and high demand scenarios; 2. R105/GJ short to mid-term affordability for industrial GTP, R60//GJ for system base load 3. Based on upper limit of current customer affordability range R45-75/GJ (delivered) and NBI Climate Pathways/BUSA GWG assumption of R105-140/GJ for latent Industrial demand 4. Based on US benchmark. Upper bound could be as high as ~R300/GJ based on 2020 average wholesale list price for diesel (0.05%)

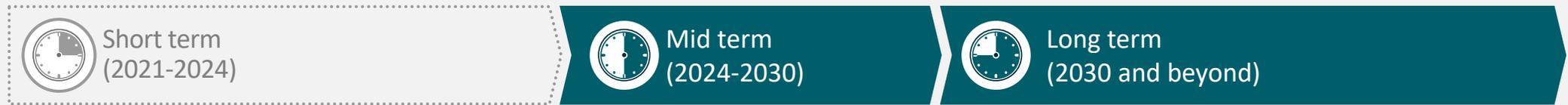
Note: GTP figures are premised on system cost modelling, GTP could have much higher price flexibility once price/commercial considerations are factored in
Source: IGUA Annual Report 2020; NBI-BCG project team

Range of local, regional and international supply options to meet future demand and bridge diminishing supply...



1. Complexity refers to all dimensions: infrastructure overlay, technical and commercial; 2. Potentially similar to annual capacity of option 1 (~190PJ/a) | Note: Options which are greyed out are excluded from scope of view due to small scale and complexity | Source: Local stakeholder interviews; IGUA-SA Annual Report 2020; NBI-BCG Project Team

...With this analysis focusing on the supply options with higher levels of commercial traction



| | FSRU KZN | FSRU EC | FSRU WC | LNG - Matola | PSA gas | PPA Gas | Brulpadda | Luiperd | Onshore hubs | Rovuma + other Moz fields ³ |
|-----------------------------------|---|---|--|--|---|---------------------------|---|---|--|--|
| Total reserves | Unlimited | Unlimited | Unlimited | Unlimited (global LNG market) | Tbc - ~440k undeveloped net acres | ~530PJ ² | 1200-6100PJ | Gas: 3100PJ C: 1800-2400PJ | Unlimited | Area 1: 63000PJ Area 4: 67000PJ |
| Annual capacity | Variable ¹ | Variable ¹ | Variable ¹ | ~190PJ/a (SA only) | - | - | - | - | 77-128PJ/a | |
| Commercial operation date | Tbc | Tbc | Tbc | TBC – FiD initially planned for Q4 2021 (at the earliest) – likely delayed given uncertainty on minimum demand | FiD already taken on PSA – pending outcome of further upstream exploration activities | Tbc | Tbc | Tbc | Tbc | 2025 |
| Must-believes to supply SA | Demand anchor in KZN large enough to justify investment | Political support is maintained and COEGA industrial development proceeds | Demand anchor in WC large enough to justify investment | GP & MP markets can absorb higher costs of delivered gas relative to today and GTP can anchor demand | Moz. demand insufficient; buy-in from Moz. Gov. obtained and negotiations successful | PTC-5 reserves are viable | Gas can be extracted and piped to shore at low cost | Gas can be extracted and piped to shore at low cost | Brulpadda/Luiperd piped gas option not developed | Sufficient demand at the right affordability level to trigger investment |

1. Dependent on demand; 2. Includes gas and condensate; 2. As per Sasol Form 20F - ~420PJ proved developed reserves + ~110PJ proved undeveloped reserves; 3. Other Mozambique fields = Buzi Fields & Zambezi basin | Note: FSRU = Floating storage regasification unit; LNG = Liquefied Natural Gas; KZN = KwaZulu-Natal; WC = Western Cape; EC = Eastern Cape; PSA = Production Sharing Agreement; PPA = Petroleum Production Agreement | Source: Local stakeholder interviews; Sasol Form 20F; NBI-BCG project team

Key guiding principles to identify & assess optimal strategic gas infrastructure play for SA

1

Optimise socio-economic impact - job creation, trade impact and the impact on adjacent sectors in the value chain
Integrated Just Transition report to be released later in the report series

2

Ensure cost-optimal gas prices - the delivered price of gas (factoring in the upstream molecule cost, mid-stream costs, complexity and impact on SA's bargaining power)

3

Minimise climate and environmental impact – emissions impact and broader environmental impact (e.g., degradation of land)

4

Avoid (where possible) and manage the risk of stranded assets & carbon lock-in, ensuring all supply investments are resilient to demand uncertainty & allow for optionality for alternatives to gas pre-2050 (e.g., green H2)

5 long term strategic gas infrastructure plays

Highly contingent on timing of LNG options (Coega, RB, WC, Matola)

| | 1 No Additional Gas play | 2 Rovuma + Brulpadda play (piped gas & expl. play) | 3 Rovuma play (piped gas play) | 4 Brulpadda play (exploration play) | 5 LNG play |
|--|---|--|--|--|---|
| Long-term supply landscape (post-2030) | | | | | |
| Supply | <ul style="list-style-type: none"> Supply ramps down to OPJ from 2040 | <ul style="list-style-type: none"> FSRU in KZN or LNG from Matola FSRU in WC & EC | <ul style="list-style-type: none"> Rovuma pipeline for Gauteng & Mpumalanga | <ul style="list-style-type: none"> Brulpadda to supply Western Cape and connect Western Cape & Eastern Cape demand | <ul style="list-style-type: none"> Pipeline to connect FSRU KwaZulu-Natal to Gauteng & Mpumalanga |
| Demand | <ul style="list-style-type: none"> Inland: Inland synfuels & industry demand ramp down to OPJ/a 2040-2050 | <ul style="list-style-type: none"> Enables gas pathway for synfuels post 2030, enables conversion of Eskom CFPs post 2030 | <ul style="list-style-type: none"> Enables gas pathway for synfuels post 2030, enables conversion of Eskom CFPs post 2030 | <ul style="list-style-type: none"> Gas pathway for synfuels challenged, limited potential to convert Eskom CFPs post 2030 | <ul style="list-style-type: none"> Potential to enable gas pathway for synfuels and conversion of Eskom CFPs post-2030 |
| | <ul style="list-style-type: none"> Coastal: KZN industry demand ramps down to OPJ/a 2040-2050 | <ul style="list-style-type: none"> Pre-2030 GTP demand is coastal (shift to inland post-2030), enables unlocking of latent industry demand, potential to revive PetroSA¹ | <ul style="list-style-type: none"> PetroSA not revived | <ul style="list-style-type: none"> Potential to revive PetroSA¹, all GTP demand coastal | <ul style="list-style-type: none"> PetroSA not revived, potential to unlock latent industry demand |

1. Revival of PetroSA via Brulpadda gas highly dependent on final cost of gas from Brulpadda | Note: CFPs = Coal Fired Power Stations; KZN = KwaZulu-Natal; GTP = Gas to power | Source: NBI-BCG project team



Short- to mid-term (pre-2030)



Long-term (post-2030)

LNG play preferred for SA in the long term

| | | No additional gas play | Rovuma + Brulpadda play (piped gas & expl. play) | Rovuma play (piped gas play) | Brulpadda play (exploration play) | LNG play |
|-------------------------------------|--|--|---|--|---|--|
| 1 Minimise adverse SE impacts | Trade impact ¹ (Rand Bn) | ZAR 10-15 Bn imports for SA ³ | ZAR 140-370 Bn imports for SA ⁴ | ZAR 180-610 Bn imports for SA ⁵ | +ZAR 0 relative to other plays | ZAR 130-550 Bn imports for SA ⁶ |
| | Broader socio-econ. impact | Competitiveness & license to operate of synfuels sector challenged, potential high costs associated with carbon tax etc. | Potential PetroSA revival, inland synfuels sustained, conversion of Eskom coal stations | Conversion of Eskom coal stations, inland synfuels sustained, industrial demand unlocked | Potential PetroSA revival, but SE impact of decomm coal plants and mostly coastal GTP | Conversion of Eskom coal stations, inland synfuels demand sustained, potential to unlock industrial demand |
| 2 Ensure cost-optimal gas prices | Mid-stream capex required ² (Rand Bn) | n/a | ZAR 70-120 Bn (Rovuma) + ZAR 90-100 Bn (Brulpadda) | ZAR 70-120 Bn | ZAR 90-100 Bn | ZAR 20-50 Bn (FSRU); ZAR 25-50 Bn (inland pipeline) |
| | Complexity (e.g., legal, environ.) | n/a | For Rovuma: high utilisation required; complex stakeholder landscape; risk of insurgency; risk premium | | Significant technical challenges to be overcome w/ offshore location of reserves | Low complexity (legal & beyond) flexible supply option w/ limited additional midstream infra required |
| | Impact on SA's bargaining power | n/a | Rovuma: Moderate bargaining power for SA Inc given that pipeline feasibility anchored on SA demand Brulpadda: Moderate bargaining power for SA Inc due to captive supply set-up (i.e., Brulpadda only feasible if local large scale demand comes online) | | | Potential for higher bargaining power for SA Inc (due to diversified supply, contingent on supply aggregation) |
| 3 Min. climate impact | Cum. Emissions (Mt) | 8400-9400 Mt cumulative emissions across sectors | ~8400 Mt cumulative emissions across sectors since only high demand scenario feasible for piped gas options | | | 7800 – 8400 Mt cumulative emissions across sectors |
| 4 Avoid carbon lock-in risk | Risk of lock-in | Low lock-in risk with no new infra. required in short- to mid-term | High infrastructure & tech lock-in risk due to high capex requirements, long lifetime of infrastructure and long investment lead-times | | | Low infrastructure and tech lock-in risk with low FSRU capex req., limited additional infra. (only inland pipeline) & mostly flexible tech |

Highly contingent on timing of LNG options (Coega, RB, WC, Matola)

Total cost not NPV. Range reflects demand scenarios

Deep dive on value chain emissions to follow

Relative con (red) Relative pro (green) Neutral (grey)

1. Reflects range of molecule costs across all plays, and range in gas demand in piped gas & LNG plays; 2. Range reflects high and low gas demand scenarios with ~700PJ/a and ~200PJ/a respectively – with the high case requiring expansion of existing ROMPCO infra; 3. Low case: all Gau, Mp & KZN gas supplied by RB; high case: all gas supplied by Matola; 4. Assuming Rovuma supplies all inland demand and Brulpadda all coastal demand; 5. Assuming Rovuma supplies all inland and coastal demand; 6. Assuming RB & Coega supplies all inland and coastal demand | Note: Assuming exchange rate of R 15/\$ | Source: NBI-BCG project team

Within LNG play, 3 scenarios considered which vary in the sequencing of supply options across short- to long-term

| | RB, Coega & Saldanha (in parallel) <i>*Assuming FSRU in RB online in short- to mid-term, before Matola, for KZN & inland demand. FSRU in Coega and Saldanha as required</i> | Coega then RB & Saldanha <i>*Assuming only FSRU in Coega in short- to mid-term delaying the FSRU in RB; with RB (and Saldanha as required) in the longer-term</i> | Coega and Matola <i>*Assuming only FSRU in Coega in short- to mid-term delaying RB and with only Matola coming online in longer-term for coastal and KZN demand</i> |
|--|---|--|--|
| Long-term supply landscape (post-2030) |  |  |  |
| Supply | <ul style="list-style-type: none"> FSRU in KwaZulu-Natal or LNG from Matola FSRU Western Cape & Eastern Cape | <ul style="list-style-type: none"> FSRU in Eastern Cape LNG from Matola | <ul style="list-style-type: none"> FSRU Eastern Cape FSRU in Western Cape |
| Demand | <ul style="list-style-type: none"> Inland: Enables gas pathway for synfuels post 2030, enables conversion of Eskom CFPs post 2030 Coastal: Pre-2030 GTP demand is coastal (shift to inland post-2030), enables unlocking of latent industrial demand, PetroSA not revived | <ul style="list-style-type: none"> Gas pathway for synfuels challenged; enables conversion of Eskom CFPs post 2030 All pre-2030 GTP demand is coastal (shift to inland post-2030), challenge unlocking latent industrial demand, PetroSA not revived | <ul style="list-style-type: none"> Gas pathway for synfuels not feasible; limited potential to convert Eskom CFPs post 2030 All GTP demand is coastal, challenge unlocking latent industrial demand, PetroSA not revived |
| |  Short- to mid-term (pre-2030) |  Long-term (post-2030) |  Short- to mid-term (pre-2030)  Long-term (post-2030) |

Developing all 3 South African FSRU's in parallel is the preferred supply scenario for South Africa

| | | RB, Coega & Saldanha (in parallel) | Coega then RB & Saldanha | Coega and Matola |
|---|---|---|--|--|
| 1 | Minimise adverse SE impacts | | | |
| | Trade impact ¹ (Rand Bn) | ZAR 130-460 Bn imports for SA ³ | | ZAR 170-550 Bn imports for SA ⁴ |
| 2 | Broader socio-econ. impact | Conversion of Eskom coal stations, inland synfuels sustained, industrial demand unlocked | Some industrial users at risk of shutting down due to ST increase in price, potential to convert inland Eskom stations only post 2030 | Limited ability to convert inland Eskom stations post 2030, industrial users at risk of shutting down w/ unaffordable supply |
| | Mid-stream capex required ² (Rand Bn) | ZAR 20-50 Bn (FSRU); ZAR 25-30 Bn (inland pipeline from RB) | | ZAR 20-50Bn (FSRU); ZAR 40-50 Bn (Coega-inland pipeline) |
| 3 | Ensure cost-optimal g as prices | Low complexity (legal & beyond) flexible supply option | | No additional midstream infrastructure required in SA |
| | Impact on SA's bargaining power | High bargaining power for SA Inc because it enables large scale gas supply contracts, contingent on aggregation of supply | Moderate bargaining power for SA Inc due to disconnect in timelines for demand-supply; ability to secure large-scale supply contract uncertain | Low bargaining power for SA Inc (due to non-diversified supply) |
| 3 | Min. climate impact | 7800 – 8400 Mt cumulative emissions across sectors | | |
| 4 | Avoid carbon lock-in risk | Moderate infrastructure and tech lock-in risk with RB inland pipeline although low FSRU capex requirement | | Low lock-in risk with no RB inland pipeline and low FSRU capex requirement |

Total cost not NPV. Range reflects demand scenarios

Deep dive on value chain emissions to follow

1. Reflects range of molecule costs across all plays, and range in gas demand in piped gas & LNG plays; 2. Range reflects high and low gas demand scenarios with ~700PJ/a and ~200PJ/a respectively – with the high case requiring expansion of existing ROMPCO infra; 3. Assuming RB supplies inland & Coega supplies coastal demand; 4. Assuming Coega supplies all coastal and Matola all inland demand | Note: Assuming exchange rate of R 15/\$ | Source: NBI-BCG project team

Relative con (Red) Relative pro (Green) Neutral (Grey)



What is a carbon lock-in and how does it occur?

- Tendency for carbon-intensive technological systems (incl. infrastructure) **to persist over time**
- Systems reinforce political, market, and social factors that make it difficult to move away from them, **locking out lower-carbon alternatives**
- As a result, by investing in assets prone to lock-in, **future flexibility could be restricted** and the costs of achieving agreed climate protection goals increased





Leveraging gas could result in a carbon lock-in – however, the key risks of a lock-in can and must be addressed

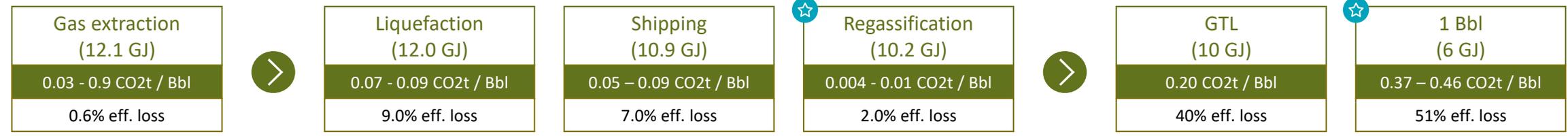
| Type of lock-in | Risk mitig. measure |
|--|--|
|  <p>Infrastructure & tech lock-in e.g.</p> <ul style="list-style-type: none"> • Long life of physical infrastructure • Long lead times with investments made now, payoffs occur later, creating sunk cost | <p><i>Ensure infrastructure is flexible (e.g, can be repurposed)</i></p> <p><i>Ensure financial resilience to long term drops in competitiveness</i></p> |
|  <p>Institutional lock-in, e.g.,</p> <ul style="list-style-type: none"> • Regulatory frameworks • Contracts and economic rules | <p><i>Set phase out targets / limits</i></p> <p><i>Incentivize phase out</i></p> |

For liquid fuels production, total coal value chain emissions (CO2e) are at least 2.2x higher than the upper-bound benchmarks for LNG and piped natural gas

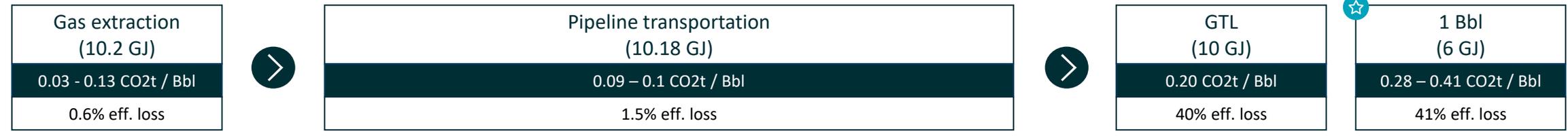
Coal



LNG



Piped gas



- Key assumptions**
- Estimates required to produce 1 Bbl of liquid fuels
 - CO2e emissions reflect the full value chain emissions including both CO2 and CH4 (reflecting a 25x conversion factor for CH4)
 - Regassification and transportation energy efficiency losses adjusted for delivery to inland; Diesel assumed to be delivered via CTL process, rather than import

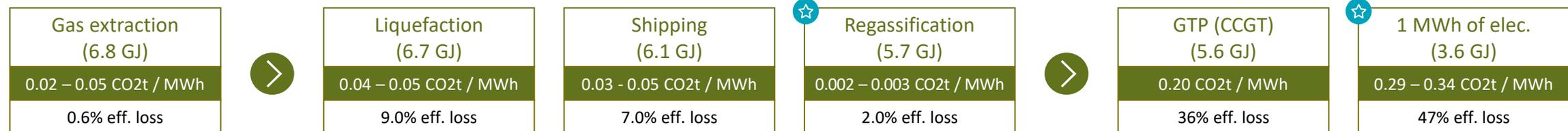
Note: Chinese and Russian benchmarks used as upper bounds for LNG and Piped gas respectively; IEA pipeline emissions estimation method used | Source: NBI-BCG project team; 3rd IPCC assessment report; IEA; Report: Life cycle greenhouse gas perspective on exporting liquefied natural gas from the united states (2019)

For power generation, among local sources, the total LNG value chain emissions are ~20% lower than coal, and piped gas ~30% lower than coal

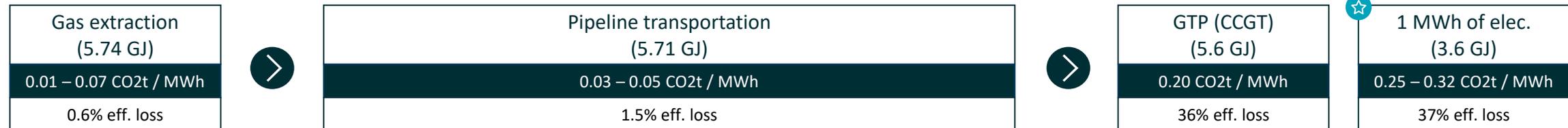
Coal



LNG



Piped gas



- Key assumptions**
- Estimates required to produce 1 MWh of electricity
 - CO2e emissions reflect the full value chain emissions including both CO2 and CH4 (reflecting a 25x conversion factor for CH4)
 - Regassification and transportation energy efficiency losses adjusted for delivery to inland; Diesel assumed to be delivered via CTL process, rather than import

Note: Chinese and Russian benchmarks used as upper bounds for LNG and Piped gas respectively; IEA pipeline emissions estimation method used | Source: NBI-BCG project team; 3rd IPCC assessment report; IEA; Report: Life cycle greenhouse gas perspective on exporting liquefied natural gas from the united states (2019)



4 key questions to answer to assess trade-offs of gas vs. diesel in power...

- 1 What is the operational cost savings of switching to gas pre-2035?
- 2 How much CO2 emissions are avoided?
- 3 What is the cost of converting existing diesel OCGTs to gas?
- 4 What is the cost of the stranded assets (post-2035) for the additional midstream infrastructure required for gas?

...indicating that the switch to gas saves cost and reduces cumulative emissions

+ R14-28bn operational savings (fuel cost + variable opex) pre-2035

☆ *Key assumptions:*

- Gas demand as per the GTP demand in the low demand scenario
- Gas price: R140/GJ, diesel price: R200-300/GJ

+ 10Mt cumulative CO2 emissions pre-2035

☆ *Key assumptions:*

- Emission factors: diesel = 0.27t CO2/MWh, gas = 0.20t CO2/MWh
- Heat rate: diesel CCGT = 49%, diesel OCGT = 31%, gas CCGT = 64%, gas OCGT = 40%

- R3bn capex to convert existing diesel OCGTs to also run off gas – up to R1.8bn of which may already have been spent on Gourikwa & Ankerlig conversion

☆ *Key assumptions:*

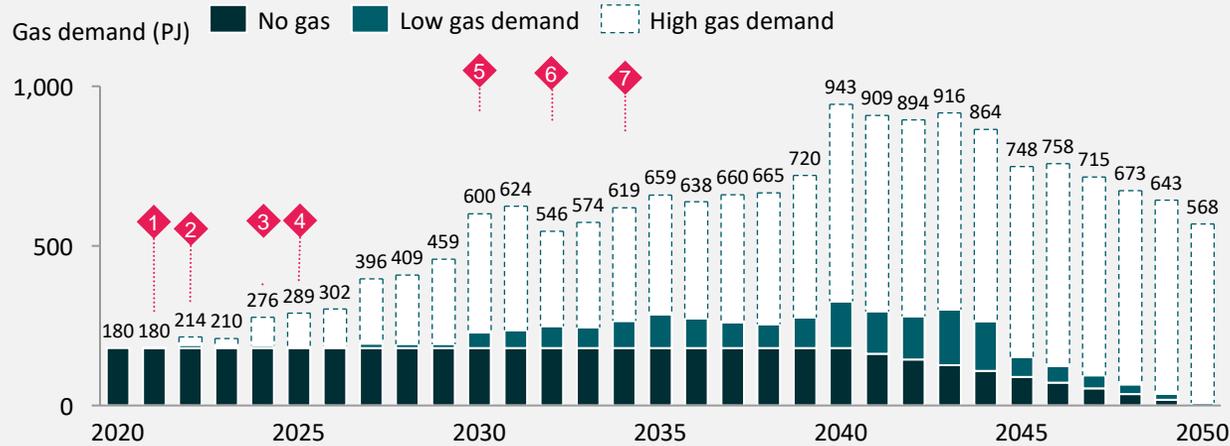
- Conversion cost for OCGTs in line with ~R1.8bn for Gourikwa & Ankerlig

- R7bn residual capex from the R13 bn FSRU inv. remains at 2035 (i.e., capex not yet paid back)

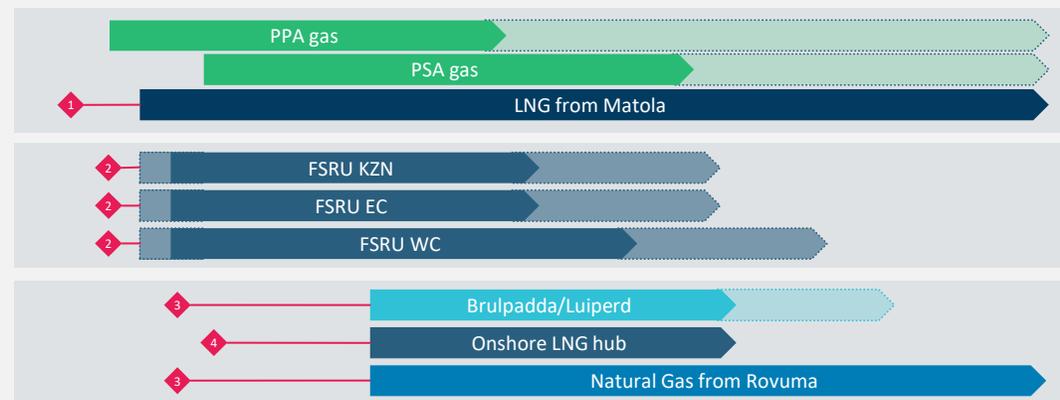
☆ *Key assumptions:*

- FSRU cost: US\$200 mn/mtpa
- Other mid-stream infra. (i.e., the inland pipeline from Richards Bay) not included.
Decision can be taken post-2035 pending clarity on GTP locations

Given uncertainty, SA's approach to gas needs to be flexible and responsive to critical outcomes and decisions



Supply source options and indicative timelines:



Key decisions/outcomes to monitor in the next 15 years

1.
 - Outcome of further upstream exploration activities for PSA
 - Outcome of feasibility study: Kelvin PS¹ conversion

2.
 - FiD on Matola Terminal pending certainty on minimum demand
 - Outcome of Eskom feasibility study for conversion of existing power plants
 - Publication of Gas Master Plan
 - Decision on FSRU in EC
 - Decision on FSRU in KZN
 - Decision on FSRU in WC
 - Outcome of REIPPPP² Round 5

3.
 - Decision on ROMPCO expansion and Richards Bay Pipeline
 - FID Rovuma pipeline

4.
 - Decision on viability and scale of supply from Luiperd/ Brulpadda
 - Decision on shift to onshore hub (Richards Bay, COEGA, Western Cape)

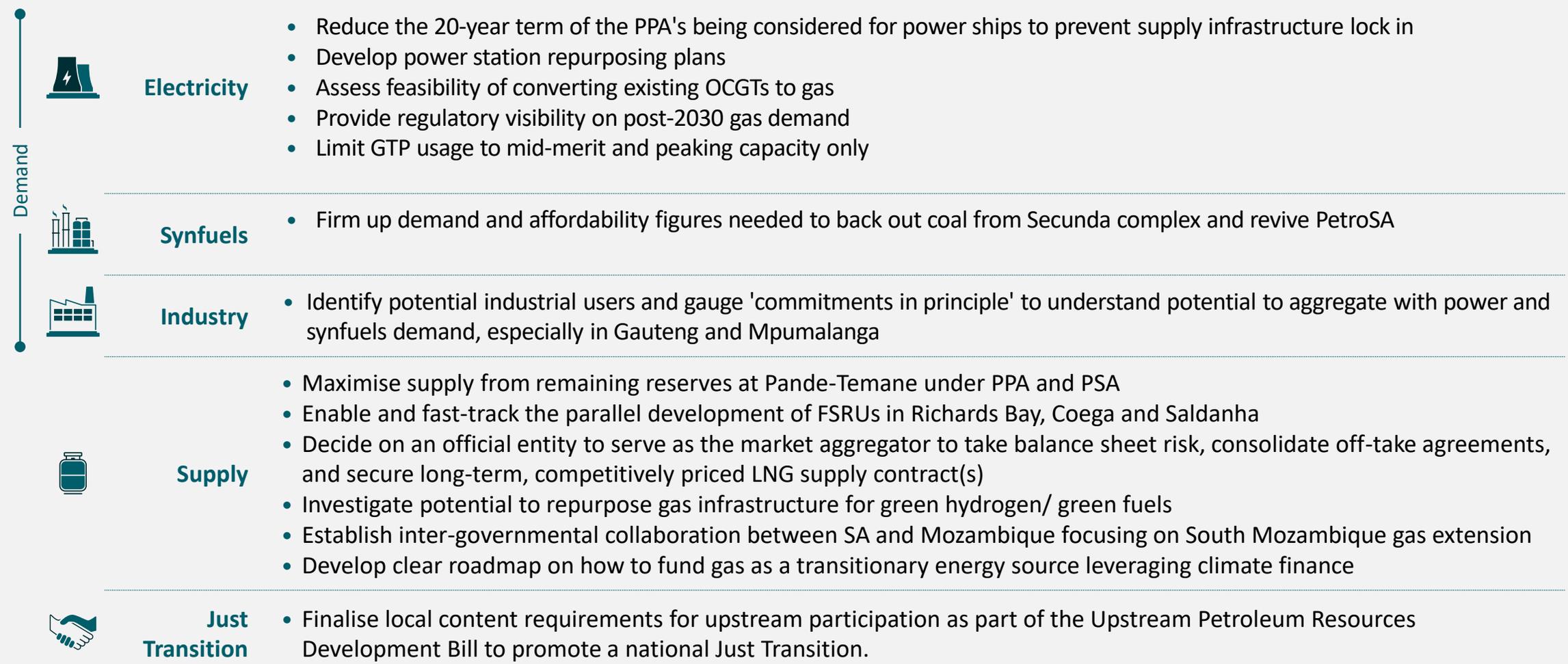
5.
 - Sasol's Secunda complex Conversion

6.
 - Rovuma potentially coming online

7.
 - Viability of Green H2 for industrial and power use

1. PS = Power Station; 2. REIPPPP = Renewable Energy Independent Power Producer Procurement Programme
 Note: Beyond 2022, timelines of key decisions are indicative and could vary. Ongoing investments in PPA to maintain license
 Source: NBI & NBI-BCG project team

Critical no-regret action required across the gas value chain



The role of gas in South Africa's decarbonisation journey (1/2)

- 1 As SA decarbonises its economy, **gas can, if affordably supplied**, play a key transition role by providing flexible capacity in the **power sector** and substituting coal as a lower emission energy source in **industry** and lower emission feedstock in the **synfuels sector** until greener alternatives become commercially viable.
- 2 Today, South Africa consumes **~180 Petajoule per annum (PJ/a) of gas**, predominantly in the synfuels sector (110PJ/a) and industrial sector (70 PJ/a), which supports up to **56k jobs across the value chain**, up to **ZAR 215 bn in taxable revenues** and contributes **~1-2% of GDP**
- 3 All of today's gas demand is located in **Gauteng (50PJ)**, **Mpumalanga (110PJ)** and **KwaZulu-Natal (KZN, 20PJ - MRG)** and supplied by gas from **Pande-Temane located in Mozambique (~160PJ)** and **Methane Rich Gas (~20PJ - MRG)** from Sasol operations via the Lily pipeline.
- 4 The **reserves of the Pande-Temane gas fields, are declining** and **supply is expected to be constrained from ~2025 onwards** presenting a security of supply issue and a risk to the decarbonisation ambitions of key sectors in the SA economy (**a 'no additional gas' demand scenario could lead to more cumulative emissions in the long run** and higher fuel and operational expenditure (OPEX) costs in the power sector in particular)
- 5 South Africa's potential future gas demand could **increase by 30% by 2030**, driven by four key sectors: 1) **Power**: as gas-to-power (GTP) demand picks up (peaking and mid-merit only) to ensure security of supply and provide flexible balancing capacity for renewables; 2) **Synfuels**: as additional gas is brought in as a lower emissions alternative to coal as a feedstock; 3) **Industry**: to phase out higher emitting fossil fuels as energy sources for industrial heat generation and other processes; and 4) **Transport**: as a short-term alternative to diesel (albeit at a small scale)
- 6 The price of delivered gas relative to sector-specific affordability thresholds will drive actual gas demand; **SA's decarbonisation ambition (CO2 Tax and carbon budget) and alternative energy choices are key factors in determining affordability thresholds**: The power sector's affordability threshold for mid-merit and peaking gas and the transport sectors' affordability threshold are the highest given the high price of the diesel alternative; however synfuels and industrial affordability thresholds are much lower given the relatively cheap cost of the coal alternative
- 7 SA's **realised future gas demand is uncertain in the absence of a Gas Masterplan. The realised demand is sensitive to the scale, pace and location of predominantly peaking GTP plants** deployed in the power sector, and the **extent to which the synfuels sector uses gas as a transitional feedstock** (to decarbonise operations – highly dependent on affordability) – with potential **demand in 2030** ranging from **~228–552 PJ/a** in a low vs. high demand scenario, with **peaks of ~326 PJ/a and 797 PJ/a**, respectively. In both scenarios, gas demand would either need to be phased out by 2050 or offset with negative emissions technology, e.g., Direct Air Carbon Capture and Storage (DACCS).
- 8 In both the high and low demand scenarios, **inland gas demand in Gauteng and Mpumalanga could exceed the capacity of the current ROMPCO pipeline with ~277 PJ/a by 2030** in the high scenario (vs. current capacity of ~212 PJ/a), and **221 PJ/a by 2035 in the low scenario**. In both scenarios, **new gas supply infrastructure could be required** with the key swing factor being the location of GTP projects which serve as the enabling demand anchor given the time horizon, scale, and affordability threshold of GTP demand.

The role of gas in South Africa's decarbonisation journey (2/2)

- 8 To achieve the optimal supply setup for South Africa, all new supply options must be assessed against four key guiding principles: **1) Minimising socio-economic impact; 2) Ensuring optimal gas prices; 3) Minimising climate and environmental impact; and 4) Avoiding the risk of stranded assets and carbon lock-in.**
- 9 Supply options vary over the short- (2021–2024), mid- (2024–2030) and long-term (2030+). In the short- to mid-term, key options are **Liquefied Natural Gas (LNG) via Floating Storage Regasification Units (FSRUs), and extending piped gas supply from Pande-Temane** (via technical work on the reserves and **Petroleum Production Agreement (PPA)/Production Sharing Agreement (PSA)**). In the long-term, key supply options are piped gas from Rovuma (+ other Moz. gas fields) and gas from exploration activities in the Brulpadda and Luiperd gas fields.
- 10 Considering these options, five strategic gas infrastructure plays exist for South Africa: **1) No additional gas; 2) Piped gas and exploration (Rovuma and Brulpadda); 3) Piped gas only (Rovuma only); 4) Exploration only (Brulpadda only); and 5) LNG. The LNG play is the preferred option for South Africa.**
 - Play 1: A no additional gas play has the lowest infrastructure lock-in risk, but also the lowest socio-economic benefit and could lead to ~400–600 Megatonne (Mt) higher cumulative emissions in the long-run which could yield higher carbon tax costs for impacted users.
 - Plays 2–4: These are only relevant in a high demand scenario and present a high risk of stranded assets and carbon lock-in, with large capital investments required of ~ZAR70–200 bn. Rovuma piped gas in particular is highly complex with significant political and security risks to be addressed.
 - Play 5: The LNG play is the preferred option for South Africa given the flexibility it provides should demand ramp down post-2040 and the positive socio-economic benefit it brings – although the negative impact on the trade balance will need to be offset by new green export industries (e.g., e-Fuels).
- 12 Within the LNG play, a **multi-hub approach is preferred with FSRUs in Matola, Richards Bay, Coega and Saldanha**. Three scenarios for their deployment are considered: Scenario 1: where all three South African FSRUS are developed in parallel; Scenario 2: where Matola and Coega are developed ahead of Richards Bay and Saldanha; and Scenario 3: where Richards Bay is not developed, but Coega, Saldanha and Matola go ahead.
- 13 Developing all **three South African FSRU's in parallel is the preferred supply scenario, relative to the other scenarios which delay FSRUs in Saldanha and/or Richards Bay**, as it **increases the optionality** for South African consumers and therefore could enable a **more competitive delivered LNG price**. A scenario where Richards Bay is not developed restricts and locks the inland market into supply from Matola and should, therefore, be avoided.
- 14 A **market aggregation mechanism** is critical to **aggregate demand volumes** over time and geographies to ensure the lowest cost of gas for South Africa – larger-scale supply contracts are priced closer to long-run marginal cost of production and are therefore more value accretive than smaller-scale volumes bought at spot market prices.
- 15 **South Africa needs to actively and urgently manage its gas strategy to mitigate the risk of unconstrained demand and ensure all supply infrastructure economics** are resilient to a potential drop in demand 2040–2050, and that the midstream infrastructure can be repurposed for the transport of green fuels and/or green H2 in the future, with solutions to address methane leakage and the repurposing of gas infrastructure requiring significant further research and development.

Q&A

Please post your questions in the chat

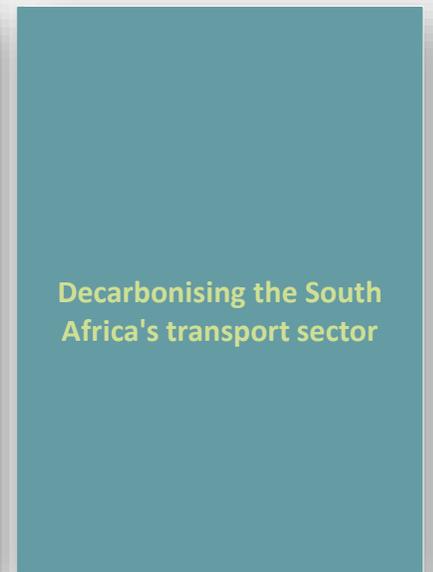
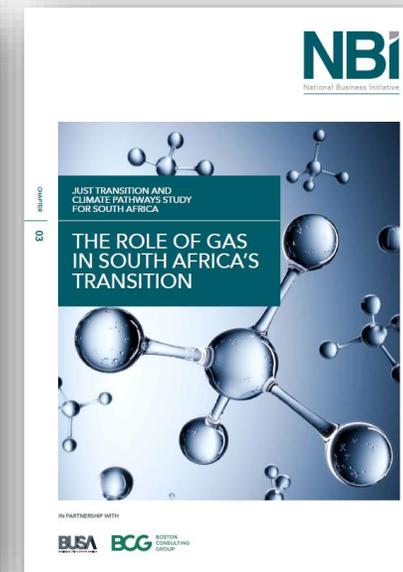
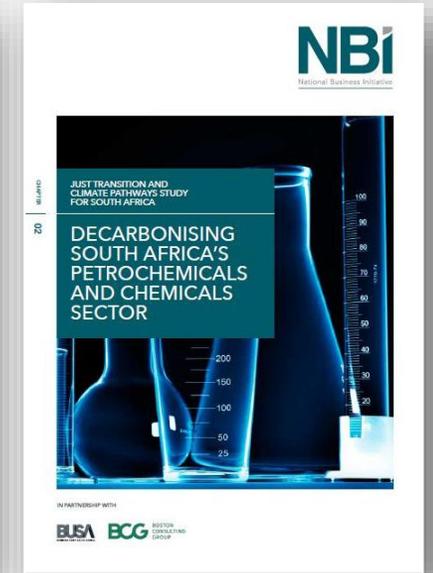
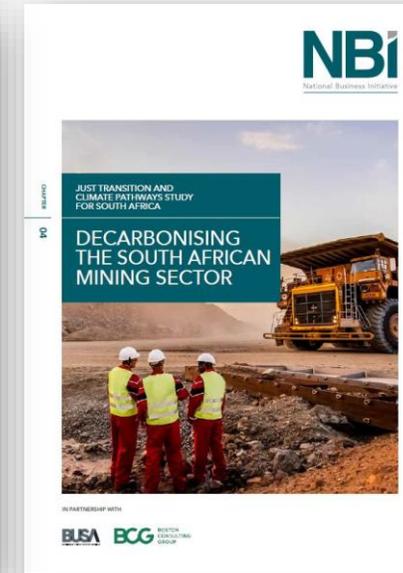
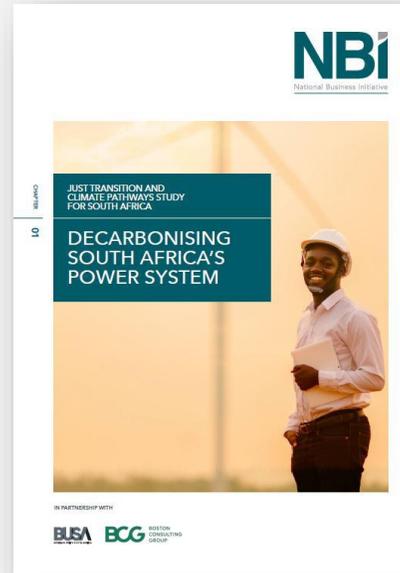
*Outlook and
next steps*



Steve Nicholls

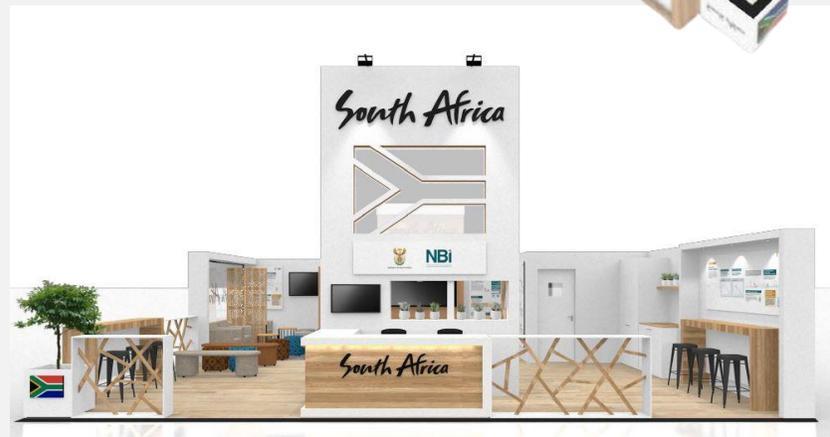
Head of Environment
National Business Initiative

This is our 3rd (of 3)
wave of reports to
be released during
COP26



The COP26 South Africa Pavilion will be jointly hosted by business and government

This is an opportunity for us to showcase the opportunities that have emerged from Just Transition Pathways work on an international platform and position South Africa as a major investment destination to attract finance for our Just Transition to a low carbon, resilient and socially sustainable and inclusive future.



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