Southern Africa Oil and Gas Conference

Eskom's position on gas in South Africa

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Greater penetration of renewable energy will require dispatchable generation for balancing the grid

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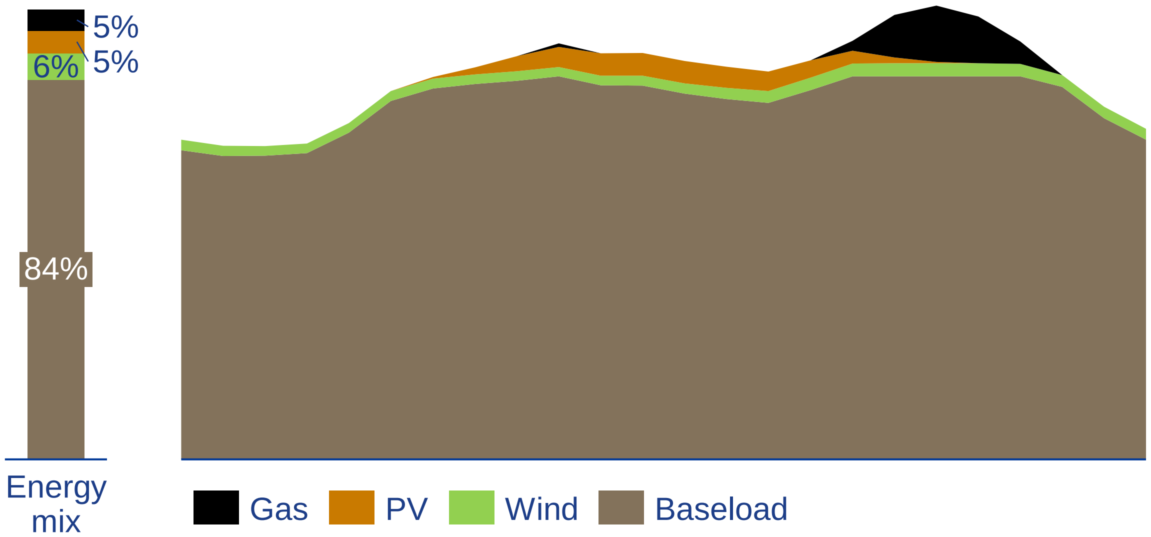
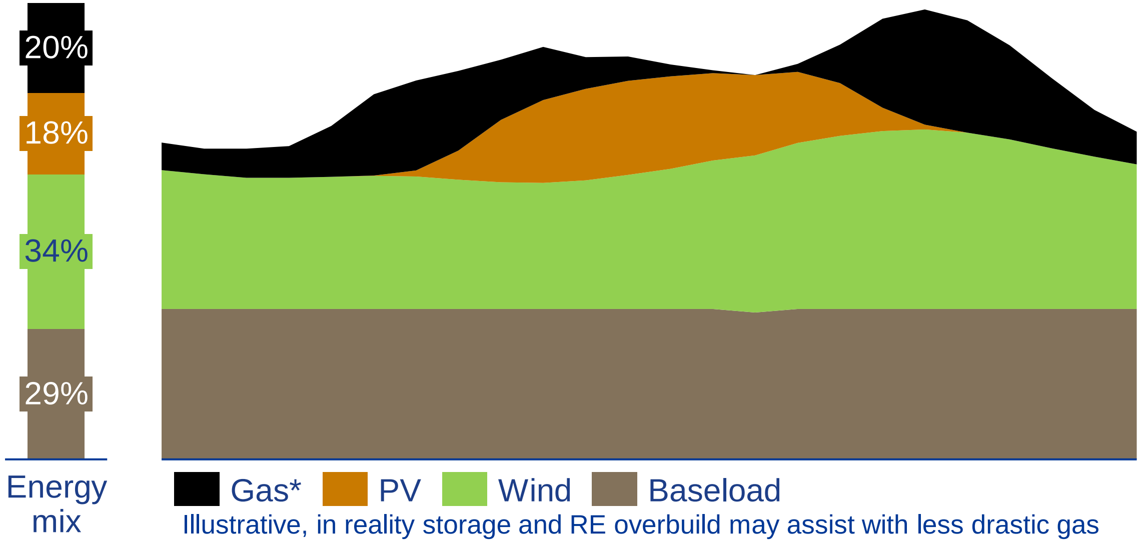
Dispatchable gas generators can be used to fill supply gaps when available dispatchable baseload and variable RE is insufficient

Illustration of current typical generation over 24 hours (MWh)



2035 illustration of typical generation over 24 hours (MWh)



Illustrative, in reality storage and RE overbuild may assist with less drastic gas

Insights

- Increasing levels of variable renewable energy (RE) in an energy system will result in the increased need for balancing resources to supply energy when self-dispatching RE energy is not available
- **100+ scenarios** run by Eskom system modelling **indicate a need for dispatchable power to achieve operable system**
- Based on current technology, gas generators are viable grid balancing solutions due to their **relatively low capital costs and fast ramp rates**
- Commodity pricing and forex exposure (incl. recent developments such as Russia and Ukraine), present significant risks - price and exchange rate volatility associated with gas (EU gas up >400% y-o-y)
- While the technology developments and decreasing costs of alternative or supplementary resources (BESS) is promising - indigenous gas development will mitigate the risks related to commodity pricing and forex

Notes: BES is included in Gas contribution. Although based on actual modelling, the figures are just for illustrative purposes and the use of gas will be less severe due to overbuilding Wind, PV and adding BES; Source: https://www.reuters.com/business/energy/no-stream-eu-gas-markets-brace-price-surge-after-latest-russia-gas-cut-2022-09-04/

Gas is an optimal dispatchable solution given technical, economic and environmental considerations

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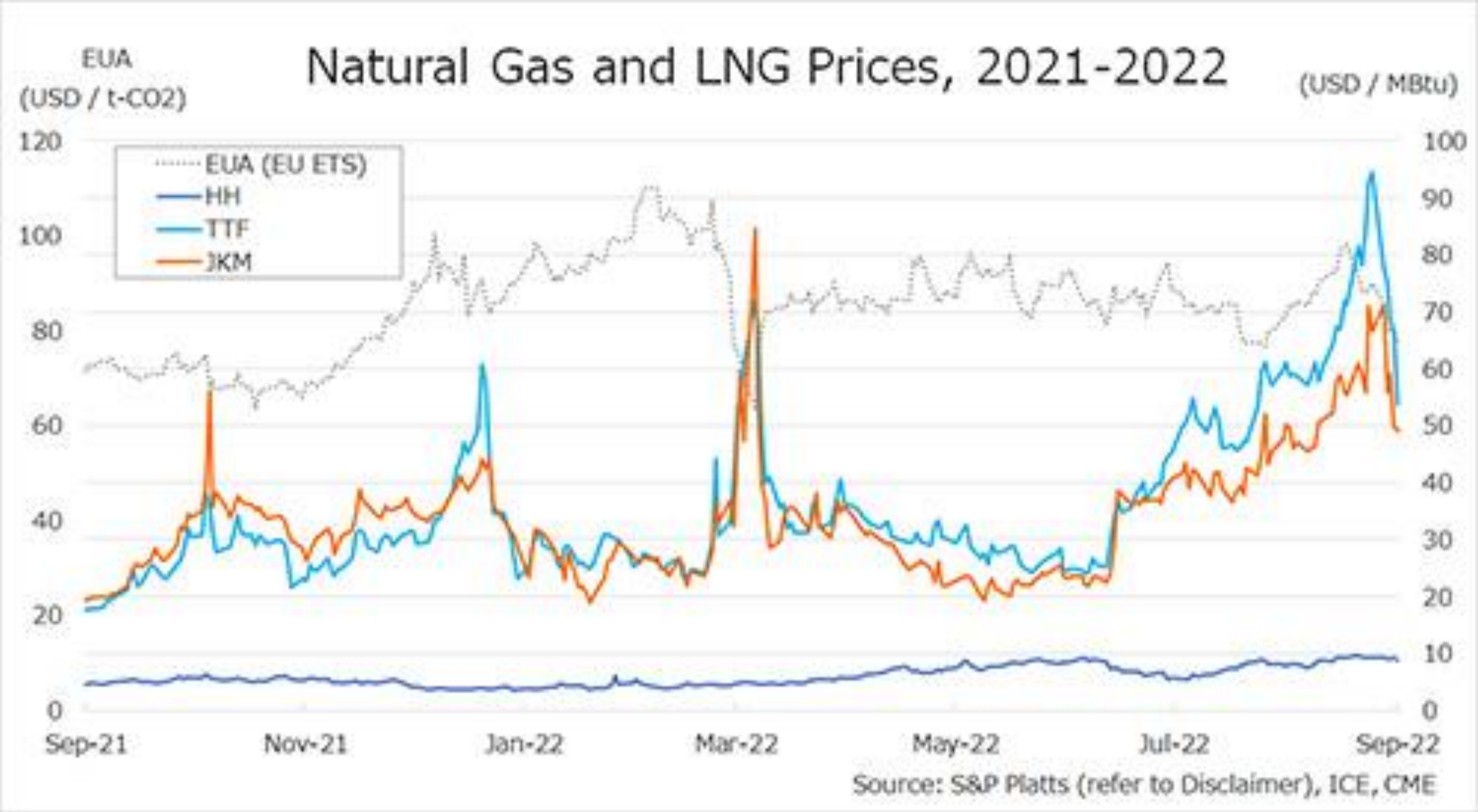
Viability

Technology	Capital cost	LCOE[1]	Build time	Build	Own	Operate	CO_2 Emissions
Gas	**925-1300 $/kW**	7.1 – 10 US$c/kWh for SA @US$7/mmBTU[2] LNG spot @ ~US$57	24-60 months	✓	✓	✓	0.32-0.52 Mt/MWh
BES	**1947[3] $/kW**	25.23 US$ c/kWh	12-24 months	✓	✓	✓	None
Hydro PS	**1727[4] $/kW**	14.35[4] US$ c/kWh	8+ years	✓	✓	✓	None
Nuclear	**12 800 $/KW**	20,4 US$ c/kWh	12-15 years	✗	✗	✓	None
New coal	**6 225 $/kW**	15,2 US$ c/kWh	10-12 years	✗	✗	✗	0.83-1.14 Mt/MWh

1. Capital cost includes EPC cost, capital cost during constriction, LCOE – levelized cost of energy; 2. CCGT – peaking is higher at 19.6c/kWh; 3. Calculated from JT35 energy cost assumptions for 100MW 4 hour plants 4. Calculated using JT35 energy modelling assumptions as a base; Higher limits of various sources illustrated where appropriate; Costs converted using R16/USD where appropriate Source: Lazard 2021 costs; Eskom Journey to 2035 assumptions

LNG price volatility exacerbated by USD strength



Assessment of potential gas supply options are driven by pipeline infrastructure and economies of scale

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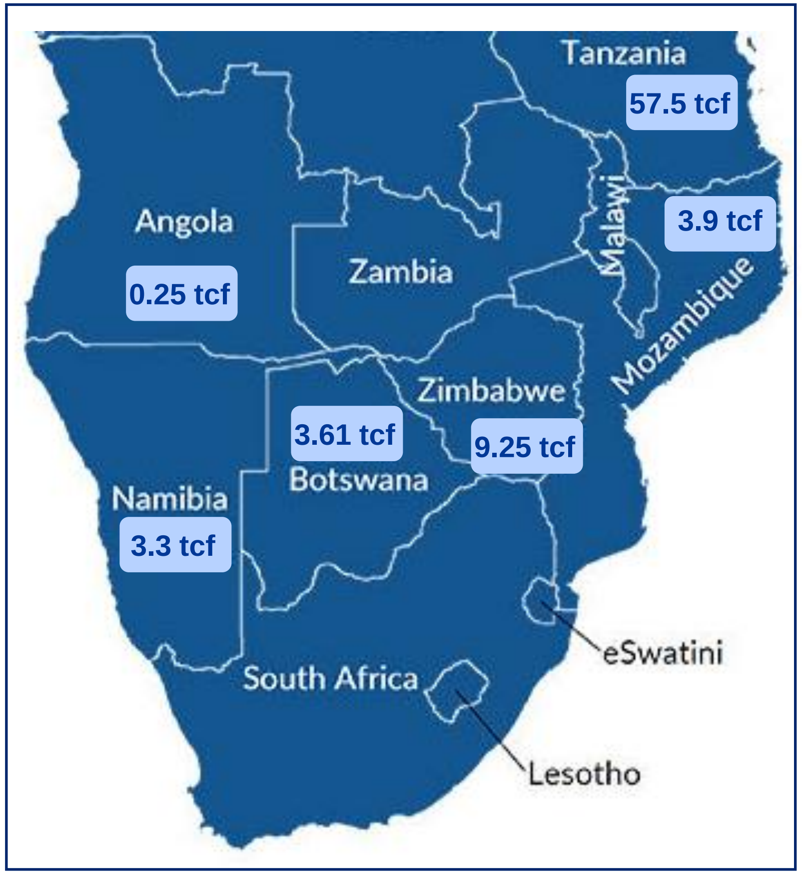
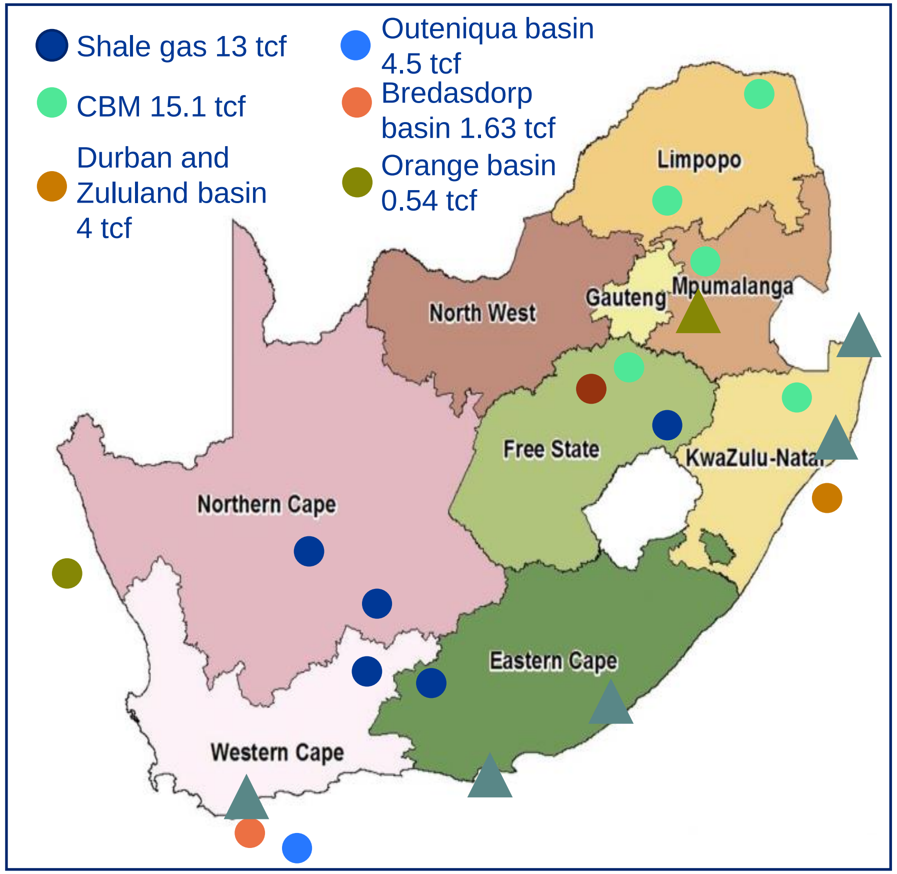
Potential SADC gas supply



SADC has potential reserves of 77.81 tcf

Potential local gas supply



South Africa has potential reserves of 38.77 tcf

Insights

South Africa consumes 180 PJ/Annum with a forecast increase to 211PJ/Annum.

Gas supply options in the short - medium term:

- LNG imports through Floating Storage Regasification Units (FSRU) including LNG imports from Mozambique, 12-17 $/GJ, range 5-110 PJ/a
- Gas pipeline from Mozambique 12-17 $/GJ, range 50-150 PJ/a

- Lower and upper indicative costs based on consumption. High portion of cost related to fixed infrastructure costs associated with importing LNG through Floating Storage Regasification Unit (FSRU) or gas pipelines.
- This means market aggregation through economies of scale will achieve greater volumes to ultimately decrease delivered costs

Source: Gas Utilisation Master Plan (2022); African International Advisors report from May 2022; Meridian: A Vital Ambition report; Meridian: The role of gas-fired power in SA; Lazard 2021 LCOE report; International Institute for Sustainable Development; USAID POWER AFRICA NATURAL GAS ROADMAP FOR SOUTHERN AFRICA report

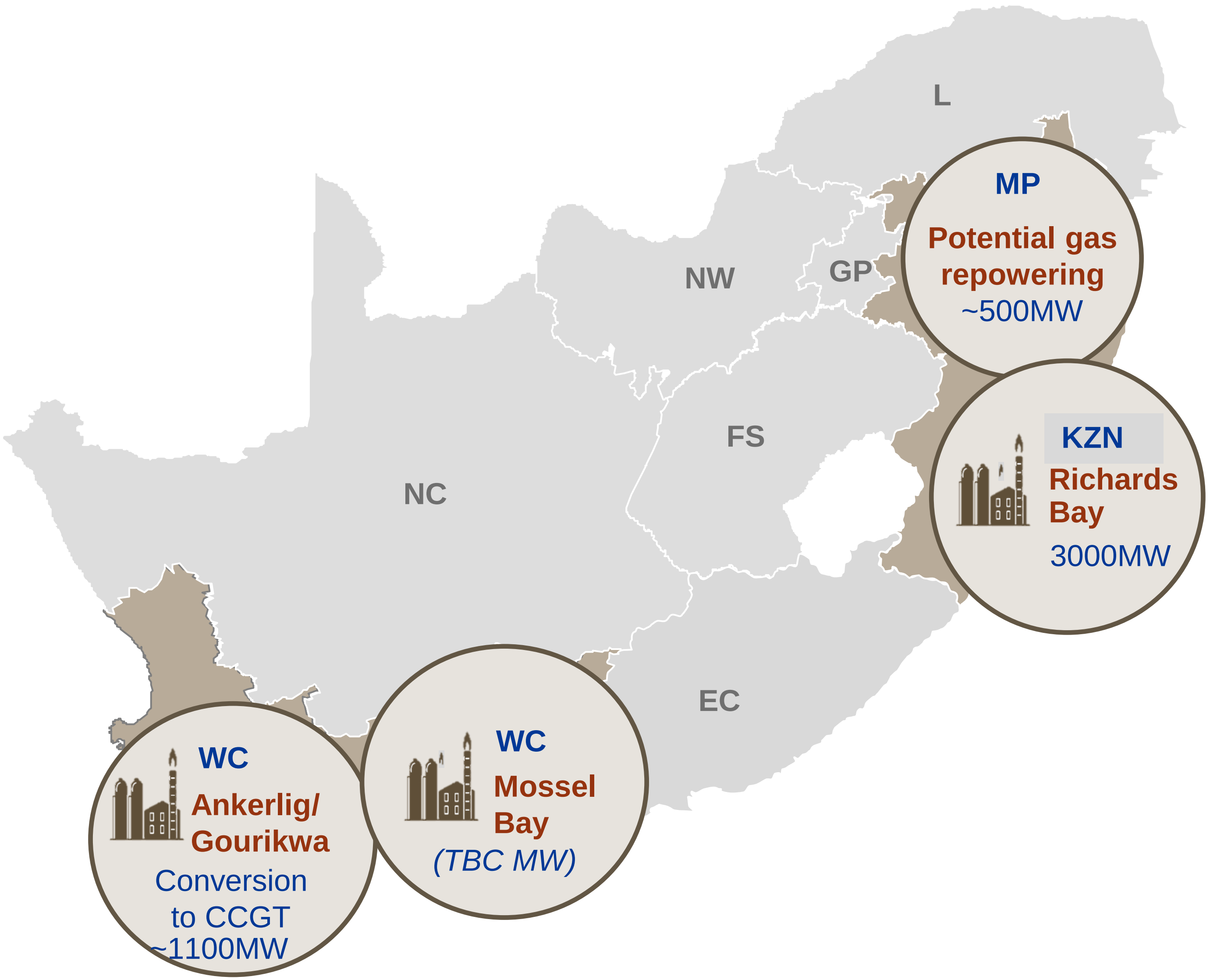
Risks related to the development of the gas industry need to be addressed

Risk	Description
Volatility of commodity	• **Gas cost trajectory** is expected to continue an upward trend given the anticipated demand and limited supply • Russian invasion of Ukraine has triggered energy crisis, and **global commodity price surge** • **Gas is USD denominated** – risk of currency volatility similar to petrol and diesel • **Import parity pricing** creates pass-through risk for electricity consumers

Infrastructure availability	• RSA does not have sufficient gas infrastructure
	• **Investment in transmission grid infrastructure** is required
	    • Offshore platforms, or if onshore, drilling rigs and field development
	    • Unconventional gas requires development of a new industry in SA
	    • LNG import terminals or Floating Storage and Regassification Units (FSRU)
	    • Transmission pipelines, pressure reducing stations, downstream industrial markets

Policy certainty	• **Gas Masterplan** (GUMP) is still work in progress, affecting **potential development and funding required for gas projects** • NERSA determination on the **cost recovery process and mechanism submitted** by Eskom is still to be confirmed (currently for Richards Bay project, but may impact future projects) • NERSA gas **pricing methodology uncertain** and potentially volatile
Technical	• **Lower efficiencies related to locating gas plant at altitude** (~1600m above sea level) - 20% drop in power output in the case of repowering Eskom plants

Eskom is currently investigating a number of gas to power projects



Mpumalanga gas repowering

- RFI[1] issued for Komati
- Opportunity for repowering old Eskom coal stations[2]
- Near ROMPCO line
- High cost of LNG imports, Gas turbine 20% inefficient at altitude
- Alternative is to import “electrons” rather than gas

Richards Bay (CCGT[3]) power plant

- Designs developed for the proposed plant
- Eskom has applied for a Section 34 determination
- Potential source: LNG import through the harbour
- Available transmission capacity

Mossel Bay gas plant opportunity

- Investigations on feasibility in process
- Eskom Gourikwa, new generation, PetroSA
- Limited exposure to gas price and currency changes

Ankerlig and Gourikwa conversion to CCGT

- Dual fuel burners installed
- Investigating diesel to gas conversion with future possibility of converting OGCT to CCGT
- Close to source: Imports through Saldanha and Mossel Bay

Note: Eskom also looking at possible imports from Southern Africa including 2000MW CCGT plant

1. Request for information 2.Including Hendrina, Grootvlei and Camden 3. Liquefied natural gas combined cycle gas turbine

Importing the electrons may be better than importing the gas for supporting the grid

Supply options from Mozambique – inland gas to power

Import gas

- ROMPCO pipeline passes in close proximity to the repowering sites (Komati, Hendrina etc.) with and an estimated capacity of ±210 PJ pa (160-180 PJ pa of this is used in the South African market)
- Indications are that there is ±40 PJ pa (enough for 1000MW of CCGT), though the market is quickly changing
- However, existing gas field[1] supplying ROMPCO line is reaching end-of-life, however, LNG imports through the Matola are anticipated)

Import electrons

- **Import the electrons,** i.e. generate closer to gas source and make relatively small investment on the grid, given**:**
- Gas transport cost to repowering sites in excess of 12% of total gas delivered cost vs. Transmission cost of 3-4% of total energy delivered
- 20% loss of capacity for gas turbines at altitude (Mpumalanga) vs. 3-3.5% Transmission line losses[2]
- Existing electricity transmission infrastructure can be modified to accept electricity imports

Price considerations

- The price of gas is a key determinant in the development of a business case for gas-to-power generation
- Imported LNG is expensive and pricing is exposed to international gas prices and currency fluctuations

Technical considerations

- Gas Turbines are heavily impacted by changes in altitude in line with drops in ambient pressure
- Gas Engines are impacted less than gas turbines when operated at altitude, but less suitable to utility-scale Gx

Initial investigations show that importing 'electrons' rather than gas, to the repowering sites, is more viable

Footnotes: 1 Pande and Temane gas fields 2 Dependent on a number of assumptions including capacity, load factor, gas price, electricity price, gas price make-up, transmission tariff etc

Source: Eskom Clean Energy Unit

Summary of Eskom’s position

- Gas has a role to play in the future energy mix as evidenced by many studies – more specifically as a transition fuel to reduce emissions
- It is a proven technology and the risk of stranded assets is limited given time frames
- Eskom will explore implementation of gas technologies through various models where deemed feasible
- Utility-scale generation based on imported LNG has significant commercial risks – where diesel is alternative (OCGT) risk is comparable
- A rand-denominated, domestic reserve supply not linked to export market is preferable, hence domestic gas supply essential for development
- Gas Utilisation Master Plan, once finalised, will guide coordinated implementation
- Eskom will not be involved in gas field development or midstream infrastructure, and will not be a market aggregator or a reseller
- Eskom will buy gas “over the fence” at a price, volume and pressure required for power generation
- Unlocking gas as a regional power source may bring additional business development opportunities