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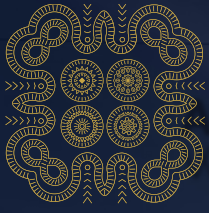
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# **The State of South African Energy** 2023

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**The State of  
South African Energy**  
2023



# The State of South African Energy 2023

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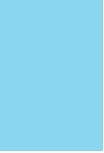
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## Key Highlights

- South Africa is gripped by extreme power outages due to high dependence on ageing coal-fired plants
- Increase in number of breakdowns and need for maintenance on these plants is forcing the already financially stressed state player Eskom into further cash crunch
- The need to raise funds is also resulting in steep increases in electricity tariffs
- 2022 saw the worst ever series of power cuts, losing about 205 days of electricity due to constant breakdowns of the aging coal-fired power plants run by Eskom
- South Africa dealing with stage 3 – stage 4 load shedding for the week January 27 – 30 2023 as per the schedule announced, resulting in 4.5 – 6 hours per day of power outage
- Historical data suggests South Africa’s operational capacity has been an average 90% of installed capacity and demand has been an average 85% of the operational capacity, thus requiring high efficiency from power stations
- Reliance on coal for power generation currently at 80%, expected to reduce to 75% by 2025 and further down to 65% by 2030
- Coal-driven power generation expected to gradually decline to 25% of the total by 2045
- Industries and, commercial and public services remain the main drivers of power demand with residential demand driving one-fifth of the total demand in the short, medium, and long-term
- Successful implementation of the Renewable Energy Independent Power Producer Procurement Program (REIPPPP) in six rounds so far resulted in procurement of almost 9.7 GW capacity from Independent Power Producers (IPPs)
- Just Energy Transition Invest Plan (JET IP) aims at securing public, private, domestic, and international funding to decrease dependency on coal and fossil fuels, and also enhance energy security
- Total budget for this estimated at US\$99 billion over the next five years and power sector is the key focus with 70% of these funds allocated to improve infrastructure and grid integration
- Energy security and lowering of carbon emissions via just energy transition from fossil fuels is the target
- In line with the immense potential, solar PV, and onshore wind – the major sources of renewable energy in South Africa in the long-term
- Overall capacity expected to increase from about 10.6 GW in 2023 to 15.75 GW by 2025 and further to 18 GW by 2030
- Solar PV and onshore expected to drive the growth and 65% of the overall capacity in the long-term
- 45% of the overall capacity currently in operating stage with 20% in post-FID and 35% in pre-FID stage
- Individually 45% and 35% of solar PV and onshore wind capacity respectively, are in either application or concept stage





- Quicker approval and execution of these projects can lead to faster and larger growth of renewables capacity and also drive possibility of more projects being brought into the pipeline
- South Africa domestic natural gas production is diminishing and is expected to follow the trend till the big gas discoveries come online
- Mozambique is the sole exporter of gas to South Africa via the ROMPCO pipeline
- The African Renaissance Pipeline (ARP) Project and any gas finds in the recently successful Orange Basin present further natural gas import opportunities from Mozambique and Namibia respectively
- Up until the success of Brulpadda and Luiperd, South Africa has seen scattered exploration activity and success, especially in the deep waters
- Brulpadda opened up the Paddavissie Fairway and Luiperd further proved the hydrocarbon presence
- Block 11B/12B, where both the discoveries were made, is home to three other prospects in the same Paddavissie play and has unexplored Kloofpadda play further northeast in the block
- South Africa offers competitive tax terms for upstream development
- NERSA approvals mandatory for construction, ownership and operating oil and gas pipelines
- The 2nd Amendment Bill (the Amendment Bill) of the Electricity Regulation Act, 2006 aims at establishing an open market for competitive electricity trading with NERSA holding the authority
- The large gas – condensate finds have the capacity to produce 120,000 barrels of oil equivalent per day (boepd) of gas and 55,000 barrels per day (bpd) of liquids at peak levels
- If integrated into domestic markets, Brulpadda and Luiperd can support energy needs of the country by feeding the power plants and maintaining Mossel Bay GTL plant at capacity
- Climate activists and green groups have often showed strong resistance and ran campaigns against oil and gas activities in the country, making their case for the environment
- While climate advocates are putting their efforts to stop fossil fuel exploration and/or development in the country, oil major TotalEnergies, the operator of Block 11B/12B, has assured that environmental impact assessment and mapping of marine life will be done, and all regulations will be followed
- TotalEnergies also noted transitioning from coal to gas will have a major impact of the emissions
- However, climate activists have raised strong objections to the project and have warned that citizen resistance will be organized against the development
- Another obstacle to South Africa's plans of diverting Brulpadda and Luiperd gas to domestic markets are the gas export aspirations of TotalEnergies as discussions towards signing domestic gas sales agreements with state-owned entities take the best part of a year without any progress.

# 1 POWER CRISIS IN SOUTH AFRICA

## 1.1 Record power outages crippling the country

South Africa's ongoing power struggles are the direct implication of state player Eskom's ageing – overused – constantly breaking down and in need of maintenance fleet of coal-fired power plants. The power outages caused have been crippling the country's economy since the past 14 – 15 years. Fixing this infrastructure and increasing generation capacity to offset the losses from the older power stations was looked at as a solution and led to construction of two of the world's biggest coal-fired plants – Medupi and Kusile, in the Limpopo and Mpumalanga provinces of South Africa. But 15 years after construction started, these plants are only delivering about half of their 9,600 MW combined capacity because of breakdowns, technical defects, completion delays and accidents. Cost overruns at the two mega plants resulted in close to US\$23 billion debt to Eskom, leaving it in a precarious financial position. Electricity theft and non-payment by municipal customers have made matters worse. Despite steep tariff increases for customers, Eskom is still unable to cover its costs.

Meanwhile the annual power outages have been setting new records for the past three years. While previous "best" was 2015's 852 hours (~10% of the year) of annual electricity outage, 2020 – 2021 have

seen new highs or rather lows of 859 hours (~10% of the year) and 1169 hours (~13% of the year) of total annual electricity outage. 2022 saw a steep jump in terms of total duration of power outage with the country having to endure 205 days of rolling blackouts, as the ageing coal-fired power plants broke down and Eskom struggled to find the money to buy diesel for emergency generators. If January 2023 has anything to say, the situation is expected to worsen further from 2022. Eskom saw close to 50% of its total nominal generation capacity of roughly 46,000 MW go offline due to breakdowns and/or maintenance in late December 2022 – early January 2023, whereas South Africa demand in peak times averages between 28,000 MW – 34,000 MW.

Most power stations in the country are owned and operated by Eskom, whose sole shareholder is the Government of the Republic of South Africa, with the shareholder representative being the Minister of Public Enterprises. These plants account for about 95% of all the electricity produced in South Africa. Coal fired power plants account for bulk of this, with 2022 power mix suggesting coal was the energy source behind 80% of the power generated. Relatively more expensive Open Cycle Gas Turbines (OCGTs) like Ankerlig, Gourikwa,

South Africa is gripped by extreme power outages due to high dependence on ageing coal-fired plants

Increase in number of breakdowns and need for maintenance on these plants is forcing the already financially stressed state player Eskom into further cash crunch

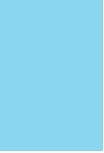
The need to raise funds is also resulting in steep increases in electricity tariffs

2022 saw the worst ever series of power cuts, losing about 205 days of electricity due to constant breakdowns of the aging coal-fired power plants run by Eskom

South Africa dealing with stage 3 – stage 4 load shedding for the week January 27 – 30 2023 as per the schedule announced, resulting in 4.5 – 6 hours per day of power outage

Historical data suggests South Africa's operational capacity has been an average 90% of installed capacity and demand has been an average 85% of the operational capacity, thus requiring high efficiency from power stations





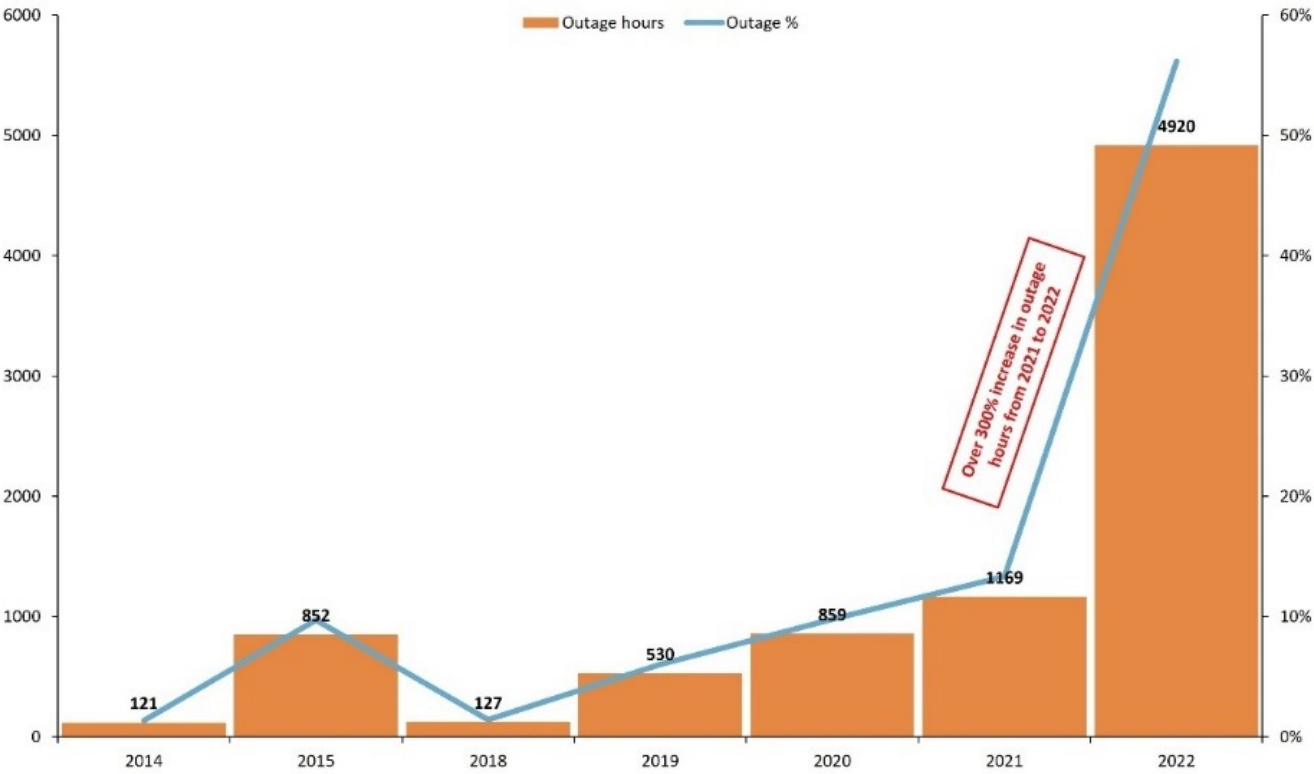
Dedisa and the likes, which use diesel as the primary resource; and renewable energy sources backed power stations also contribute to power generation, but the share is miniscule compared to coal-fired plants. South Africa consumes about 70% of the coal produced domesti-

cally and 80% of all coal consumed domestically goes towards electricity production. Historically, this has given South Africa access to cheap electricity but has led to the issues plaguing the country now – ageing fleet of coal-fired stations consistently breaking down and/or needing extensive

maintenance, additional expenditure on diesel to replenish outages caused by these breakdowns, high CO<sub>2</sub> emissions placing the southern African nation in the world's top 20 emitting countries and most importantly, introduction of load shedding to prevent total blackouts.

### Annual power outages in South Africa

#### Setting new electricity outage records each year for the past three years



Source: Rystad Energy Research and Analysis

## 1.2 Load shedding in South Africa

Since 2007, South Africa has experienced multiple periods of rolling blackouts which are locally referred to as load shedding by Eskom. A rolling blackout, or load shedding in South Africa, is an intentionally engineered electrical power shutdown in which electricity delivery is stopped for non-overlapping periods of time over different parts of the distribution region. Load shedding in South Africa was initially implemented to tackle the demand for electricity exceeding the power supply capability of the network (due to insufficient generation capacity). But as time progressed, the situation worsened due to the aging power infrastructure, poor maintenance and the slow completion of new power plants. The state

utility player has so far defined published eight stages of load shedding, each stage representing the removal of 1000 MW increments of demand by controlled shut down on sections of the supply grid based on a predetermined schedule.

Although South Africa has a national grid, some areas of the country experience more periods of loadshedding than other areas due to differences in local power generation capabilities and difficulties in electrical distribution. The country saw the first load shedding implemented in 2007 and since then has experienced at least five distinct periods of load shedding



## South Africa load shedding woes

### Latest update suggests 4.5 – 6 hours of power outage per day

Load shedding stage	Description	Percentage of grid users without power
Stage 1	<ul style="list-style-type: none"> <li>Allows for up to 1 GW of the national load to be shed</li> <li>Outages implemented 6 hours over a four-day period, or 12 hours over an eight-day period</li> </ul>	~6.00%
Stage 2	<ul style="list-style-type: none"> <li>Allows for up to 2 GW of the national load to be shed</li> <li>Outages implemented 12 hours over a four-day period, or 24 hours over an eight-day period</li> </ul>	~12.50%
Stage 3 (Load shedding schedule for 27 – 30 January 2023)	<ul style="list-style-type: none"> <li>Allows for up to 3 GW of the national load to be shed</li> <li>Outages implemented 18 hours over a four-day period, or 36 hours over an eight-day period</li> </ul>	~19.00%
Stage 4 (Load shedding schedule for 27 – 30 January 2023)	<ul style="list-style-type: none"> <li>Allows for up to 4 GW of the national load to be shed</li> <li>Outages implemented 24 hours over a four-day period, or 48 hours over an eight-day period</li> </ul>	~25.00%
Stage 5	<ul style="list-style-type: none"> <li>Allows for up to 5 GW of the national load to be shed</li> <li>Outages implemented 30 hours over a four-day period, or 60 hours over an eight-day period</li> </ul>	~31.00%
Stage 6	<ul style="list-style-type: none"> <li>Allows for up to 6 GW of the national load to be shed</li> <li>Outages implemented 36 hours over a four-day period, or 72 hours over an eight-day period</li> </ul>	~37.00%
Stage 7	<ul style="list-style-type: none"> <li>Allows for up to 7 GW of the national load to be shed</li> <li>Outages implemented 42 hours over a four-day period, or 84 hours over an eight-day period</li> </ul>	~44.00%
Stage 8	<ul style="list-style-type: none"> <li>Allows for up to 8 GW of the national load to be shed</li> <li>Outages implemented 48 hours over a four-day period, or 96 hours over an eight-day period</li> </ul>	~50.00%

## South Africa load shedding periods

### Lowest of lows with Stage 6 load shedding implemented multiple times

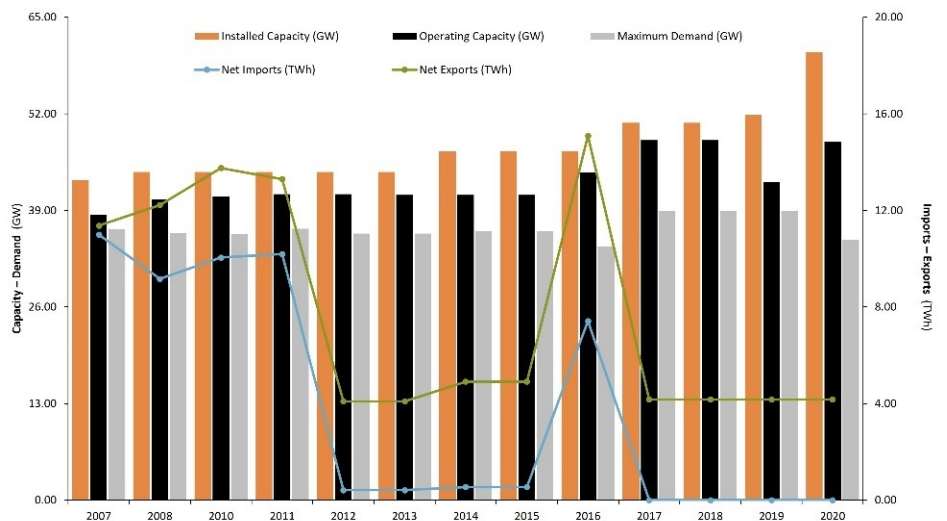
Period	Summary
First period: 2007 – 2008	<ul style="list-style-type: none"> <li>Late 2007 – May 2008</li> <li>Main issues – Supply of coal to the coal-fired power plants leading to electricity supply and increase in electricity demand</li> <li>Daily load shedding occurred for the first time for two weeks in January 2008</li> </ul>
Second period: Late 2014	<ul style="list-style-type: none"> <li>One turbine at Duvha Power Station went out in March 2014</li> <li>Majuba power plant, delivering ~10% of the country's capacity at the time, lost generation capacity after one of the coal storage silos collapsed and a second silo developed a major crack in November 2014</li> <li>November 2014 also saw two of Eskom's power plants shut down due to diesel shortages</li> <li>Palmiet and Drakensberg Pumped Storage Schemes were also experiencing difficulties due to a depletion of water reserve to the Hydro plants</li> <li>Stage three load shedding implemented in December 2014</li> </ul>
Third period: Feb 2019 – Mar 2019	<ul style="list-style-type: none"> <li>Stage four load shedding implemented due to temporary loss of generating capacity</li> </ul>
Fourth period: Dec 2019 – Mar 2020	<ul style="list-style-type: none"> <li>Heavy rains resulting in wet coal and flooding leading to low efficiency from multiple plants, most notably at Medupi power station</li> <li>Allegations of sabotage by Eskom employee; and lack of foresight and neglect from the administration</li> <li><b>Stage six load shedding implemented in December 2019</b></li> <li>Koeberg Nuclear Power Station experienced a fault with one of the sea water cooling pumps in March 2020</li> <li>Stage four load shedding implemented due to this</li> </ul>
Fifth period: Mar 2021 – present	<ul style="list-style-type: none"> <li>Reduced demand for electricity due to the pandemic resulted in load shedding largely suspended</li> <li>Breakdowns in multiple power stations and resulted in stage two load shedding in March 2021 and May 2021, before escalating to stage four load shedding by June 2021</li> <li>Planned and unplanned outages led to stage two load shedding in October 2021</li> <li>October 2021 also saw the announcement from Eskom announced that capacity would remain "constrained" through August 2022</li> <li>2021 saw stage 4 load shedding implemented for 3 days from 27 October and recommence on 5 November due to problems in multiple power stations</li> <li>Stage two load shedding came back in February 2022, escalated to stage four in March 2022 due to the breakdowns of in multiple power stations, and was extended over the Easter weekend when roughly half the national grid failed</li> <li>NUMSA and NUM employee strike in June 2022 led to Eskom announcing stage six load shedding</li> <li><b>September 2022 saw big collapse in generating capacity leading to stage four load shedding to begin with and escalating to stage six in a week's time</b></li> <li><b>Stage six load shedding came back in December 2022 due to multiple power station breakdowns yet again and January 2023 saw the same level of power outage</b></li> </ul>

Source: Rystad Energy Research and Analysis

### 1.3 South Africa, SAPP, and the demand – supply – export woes

South Africa is a member of the Southern African Power Pool (SAPP). The SAPP was created in August 1995 at the Southern African Development Community (SADC) and is a cooperation of the national electricity companies in Southern Africa under the auspices of the SADC. The SAPP has twelve member countries represented by their respective electric power utilities where these member nations have created a common power grid between their countries and a common market for electricity in the SADC region to address the regional electric energy problems. As part of these agreements, Eskom sells electricity to Mozambique, Lesotho, Swaziland, Zimbabwe, Namibia and Botswana. The imports include electricity purchases from the Cahorra Bassa Dam and Aggreko’s gas-fired power plant in Mozambique. Eskom also imports electricity from the Ruacana hydro-electric power plant in Namibia. Eskom has had a history of public criticism for exporting electricity to neighboring African states while not having the capacity to meet the country’s domestic demand and implementing load shedding. Although the exports are conditional to domestic demand where exports to Namibia and Botswana could be completely suspended and exports to other countries could be

**South Africa energy situation**  
Peak demand at 85% of operating capacity demanding high efficiency



Source: Southern African Power Pool (SAPP) Annual Reports, Rystad Energy Research and Analysis

cut by 10% if Eskom was in a position where the capacity supply was less than the demand. While these conditions meant net electricity exports in critical domestic market situations were minimal, complete suspension of exports or zero net exports has never been implemented despite the country going through several instances of stage 6 load shedding. Also, SAPP reported installed and operating capacities in South Africa versus the peak demand suggests that operating capacity has been an average

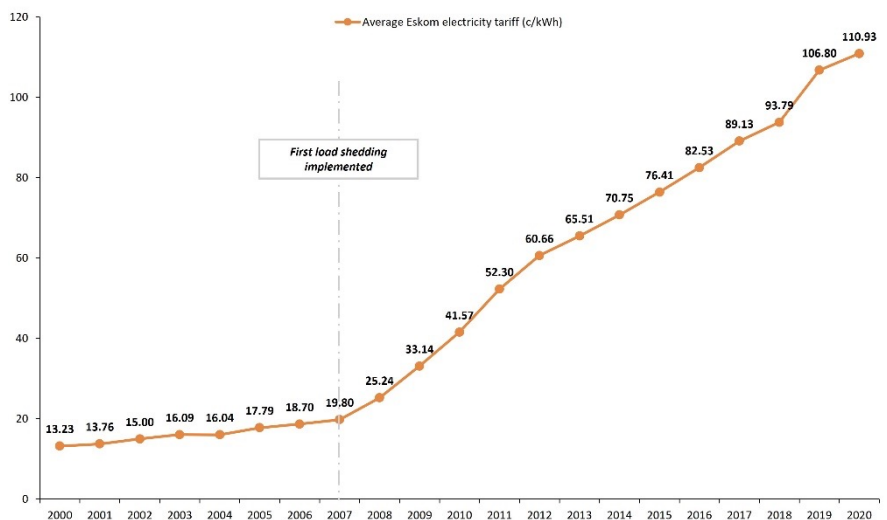
90% of the installed capacity since 2007, the first load shedding year, till 2020. During the same period, peak demand has been an average 85% of the operating capacity or about 80% of the installed capacity. Looking at the multiple breakdowns and maintenance periods of the ageing power stations, it can be inferred that the efficiency levels of the installed capacity is far lesser and hence the required implementation of load shedding to avoid complete black out.

## 1.4 Multiple-fold Impact of power outages – economical, civil, and criminal

Uninterrupted universal access to electricity is one of the key essential factors for the growth of a country. South Africa's electricity supply deficits and load shedding woes have been a major hindrance to economical growth of the country. While the existing businesses are being impacted due to frequent and extended power outages, interest from new external investors' can also reduce due to such a liability. Reports have estimated costs associated with load shedding have resulted in a 1 – 1.3% annual reduction in GDP since 2007. The impact of load shedding is so high that economists have estimated losses between US\$85 – 230 million per day and that South Africa's economy could have been 17% larger than it is today if load shedding never needed to be implemented. As such, the power outages have been a major hindrance to economic betterment of South Africa.

While this has been the larger impact on the wider economy of the country, the expenditure to maintain the aging power plants, to purchase diesel to keep up the power supply and other factors driving huge losses to the national entity Eskom have led to high electricity tariffs on the regular domestic electricity consumer. The period between 2000 – 2007 saw linear

**Impact of power crisis and load shedding**  
Average Eskom electricity tariff ballooned by 460% since 2007



Source: Rystad Energy Research and Analysis

increase in average Eskom electricity tariffs. However, since the first load shedding was implemented in 2007, average Eskom electricity tariff has seen an exponential growth of 460% by 2020. 2020 average tariff was about 110 c/kWh and the same year saw Eskom win a major legal battle where Eskom is allowed to increase average electricity tariff to 128.24 c/kWh under court order, to allow the state player to manage its maountain of debt through increased revenues

via increased tariff. This is an additional blow to domestic businesses along with the revenue losses incurred due to power outages. The regular domestic consumer also has to bear this burden.

The power outages have also reportedly had an adverse impact on both rural and urban as well as commercial and domestic life in South Africa where crime rate seems to be increasing in periods of high levels of load shed-



ding. The year 2022, which saw power outages increase drastically, also saw many increased incidents of crime being reported during those long periods of loadshedding. This included metal thieves using periods of when there is no power to steal equipment from power stations, sub-stations, and transmission lines thereby complicating Eskom's efforts to mitigate the energy crisis and costing the company close to US\$95 million whilst also causing additional difficulties for municipalities. Incidents of metal theft, house breaking and robberies due to a lack of security lighting and alarms had increased in some urban areas of South Africa during the period when level 6 load-

shedding was implemented. As such, load shedding clearly is resulting in micro and thus macro damage to South Africa's social and economical stability.

With the 15-years-in-the-making crisis escalating further, on 9 February 2023, South Africa President Cyril Ramaphosa declared a state of disaster to try and deal with the crippling and unprecedented power outage issue. A state of disaster allows the government additional powers to resolve the crisis with less bureaucracy, regulation and extra funds. He said this escalation of the crisis would allow the government to implement practical measures to support businesses and enable ex-

emption of critical infrastructure such as hospitals and water treatment plants from load-shedding. He also said this would allow the government to remove red tape for energy projects and so build them faster. The appointment of a minister of electricity that will oversee all aspects of the electricity crisis response was also announced. This minister is expected to be announced in the coming days, but Kgosietso "Sputla" Ramokgopa, a former ANC mayor of Pretoria and the current head of the presidency's investment and infrastructure office, is being reported as the favourite although some private sector players argue that one of their own should get the job.



## 2 SOUTH AFRICA POWER GENERATION VS DEMAND

Reliance on coal for power generation currently at 80%, expected to reduce to 75% by 2025 and further down to 65% by 2030

Coal-driven power generation expected to gradually decline to 25% of the total by 2045

Industries and, commercial and public services remain the main drivers of power demand with residential demand driving one-fifth of the total demand in the short, medium and long-term

### 2.1 Coal domination in power generation, and business set-ups driving the demand

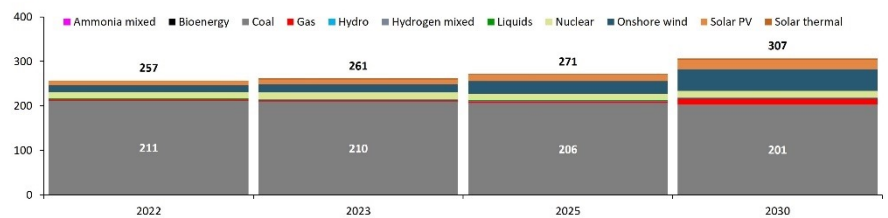
South Africa has been pivotal to the development of the southern region of Africa, especially during the early days of the Southern African Power Pool (SAPP), which was founded in 1995. The country has helped support power demand in neighbouring countries, mainly through coal-fired power generation. Coal continues to play a key role in South Africa with more than 80% of the total power generated through 2022 – 2023. Coal is expected to be the primary source for power generation in the country in the short and medium term. 2025 coal driven power generation is expected to be about 75% of the total and 2030 coal ratio is expected at about 65% of the overall generated power. In stark

contrast, renewables – solar PV, solar thermal, onshore wind, hydro, and bioenergy – made up only about 10% of total generation in 2022. This is expected to gradually change with 2023 – 2025 renewables driven power generation is estimated at 13% – 17% of the total and further increasing to a quarter of the total by 2030. This is in line with South Africa’s aspirations towards just energy transition while assuring energy security and eliminating load shedding woes. The overall power generation capacity of South Africa is expected to marginally increase from about 255TWh – 260TWh in 2022 – 2023 to about 270TWh by 2025 and further grow to over 300TWh by 2030.

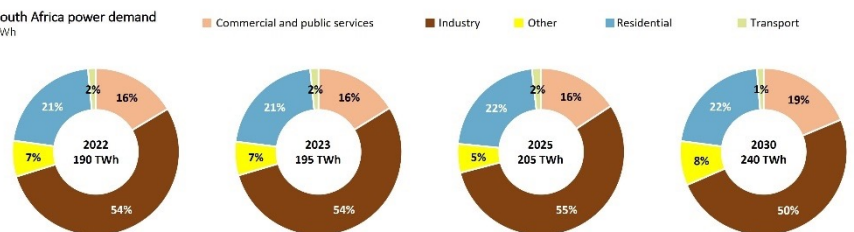
#### South Africa short-term power generation vs demand

Majority power generated using coal and main consumer – industrial sector

South Africa power generation vs demand TWh



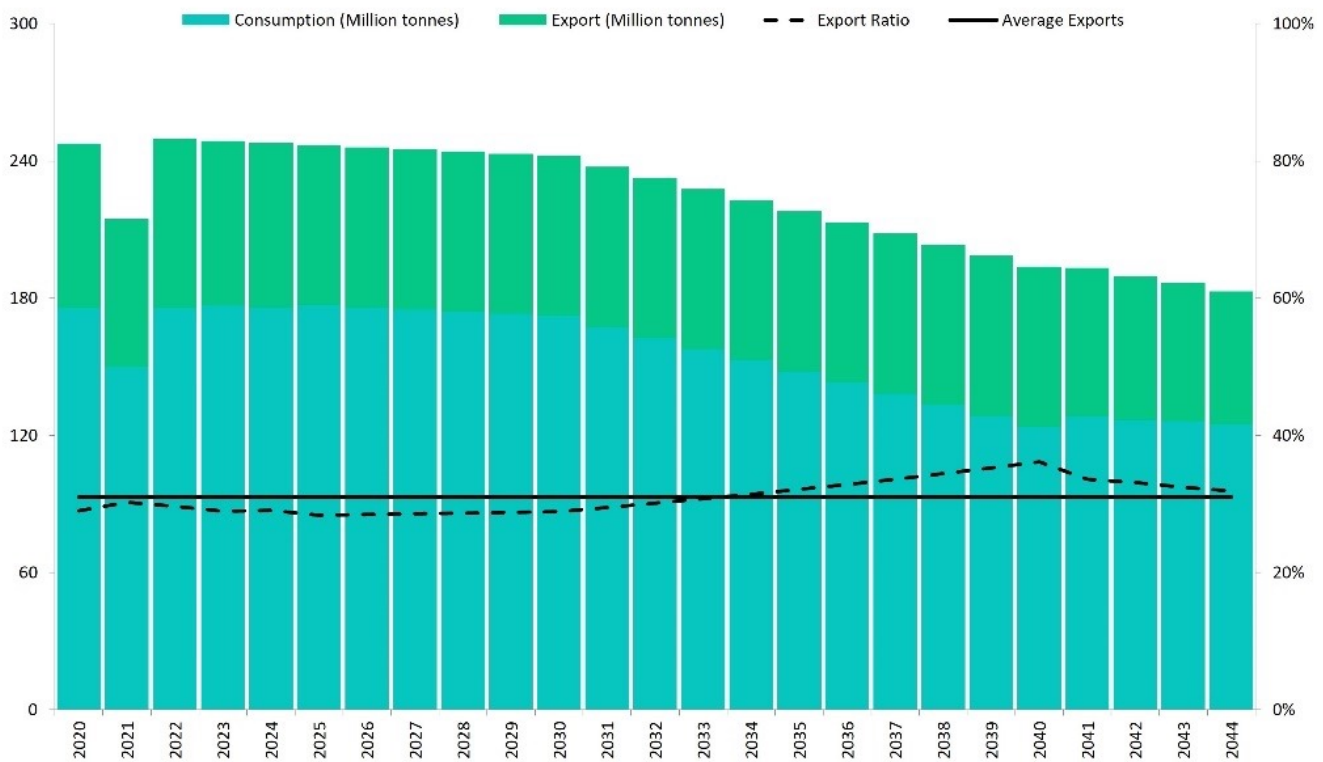
South Africa power demand TWh



Source: Hystad Energy Global Power Mix Analysis

### South Africa coal production

## Production in a gradual decline but exports steady at 30%



Source: Kystad Energy Coal/Cube

When it comes to power consumption, industries, commercial and public services accumulate to about 70% of the overall consumption. This is stable for 2022 – 2023 and is expected to be the same in the short and medium terms. This also suggests power outages due to load shedding have a direct and major impact on industries and, commercial and public service set-ups in the country. Thus, damaging the economic backbone by causing disruptions to the businesses and also disrupting public life due to disturbances to public services. Further 20% power demand in 2022 – 2023 as well as short and medium terms is driven by residential electricity demand. Hence load shedding also impacts daily life due to unstable electricity access to the general public.

As coal is key South Africa’s power generation capacity, coal mining becomes key to maintaining stability in the country’s economy. Five major companies mine about 85% of all South Africa’s coal: Thungela Resources, Exxaro Resources, Sasol Mining, Glencore, and Seriti Resources. Annual production volumes have historically been somewhere near 250 million tonnes (Mt), but slipped to 215 Mt in 2021, the lowest since 2002. 2022 volumes regained the 250Mt mark and this is expected to stay stable in the 240Mt – 250Mt range through the decade. About 30% of the coal is exported and resulted in South Africa being the No. 4 thermal coal exporter globally in 2020/21. Export volumes have dropped in recent years, however, due to slowing coal demand in the Atlantic market and internal trans-

portation issues in South Africa. 2021 exports dropped to 65 Mt and 2022 exports picked back up to 74 Mt, as EU looked to alternate sources to replace coal supplies from Russia after the invasion of Ukraine. 2023 exports estimated at 72 Mt. Coal imports into South Africa are low and are mostly limited to metallurgical coal.

The dependence on coal, declining coal output, Eskom’s struggles to purchase diesel as a substitute to generate power – can act as a triple whammy further crippling the country and South Africa needs alternate sources to generate power and grid integration to distribute this power generated via alternate sources to the end business as well as domestic consumer – both domestic and if possible, foreign.



## 2.2 Renewables and natural gas to play a larger role in the long-term

Long-term power generation in South Africa is expected to gradually take a shift to natural gas and renewables in line with Africa's pledge at the COP27. With the integration of renewables already in progress and gas-to-power aspirations in discussion, South Africa is looking to transition from high emission source like coal to "transition fuel" – natural gas and renewable sources like onshore wind and photovoltaic power generation. While power generation from coal as primary energy source is

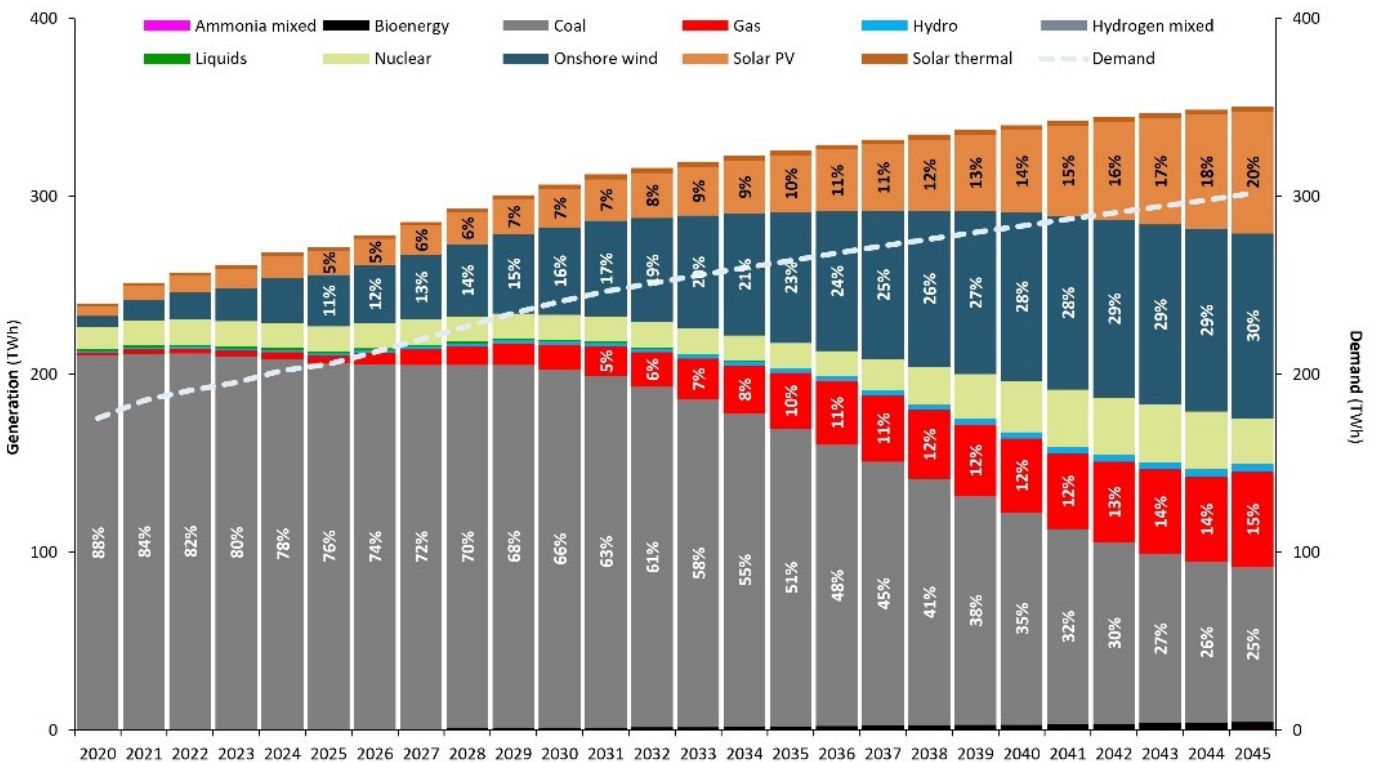
currently at 80% of the overall power generated and is expected to decrease down to 65% by the end of this decade, growth from natural gas and renewable sources is expected to kick off from around the same time. 2031 share of natural gas, onshore wind and solar PV is expected to be 5%, 17% and 7% respectively, accounting to a total of about 30% of the overall power generated. In the long term, this ratio from natural gas, onshore wind and solar PV is expected to increase to 15%, 30% and

20% respectively, totalling to 65% of the total power generation. Coal is expected to be still in play contributing to one-fourth of the total capacity. It can be noted that the power generated is higher than the demand, but this is at capacity. Any disruptions as being caused due to breakdowns, maintenances and other issues with the coal-fired power plants lead to outages and power generation dropping down below the demand.

The long-term power demand situation

### South Africa long-term power generation

#### Solar, wind, gas and nuclear driven energy to drive supply

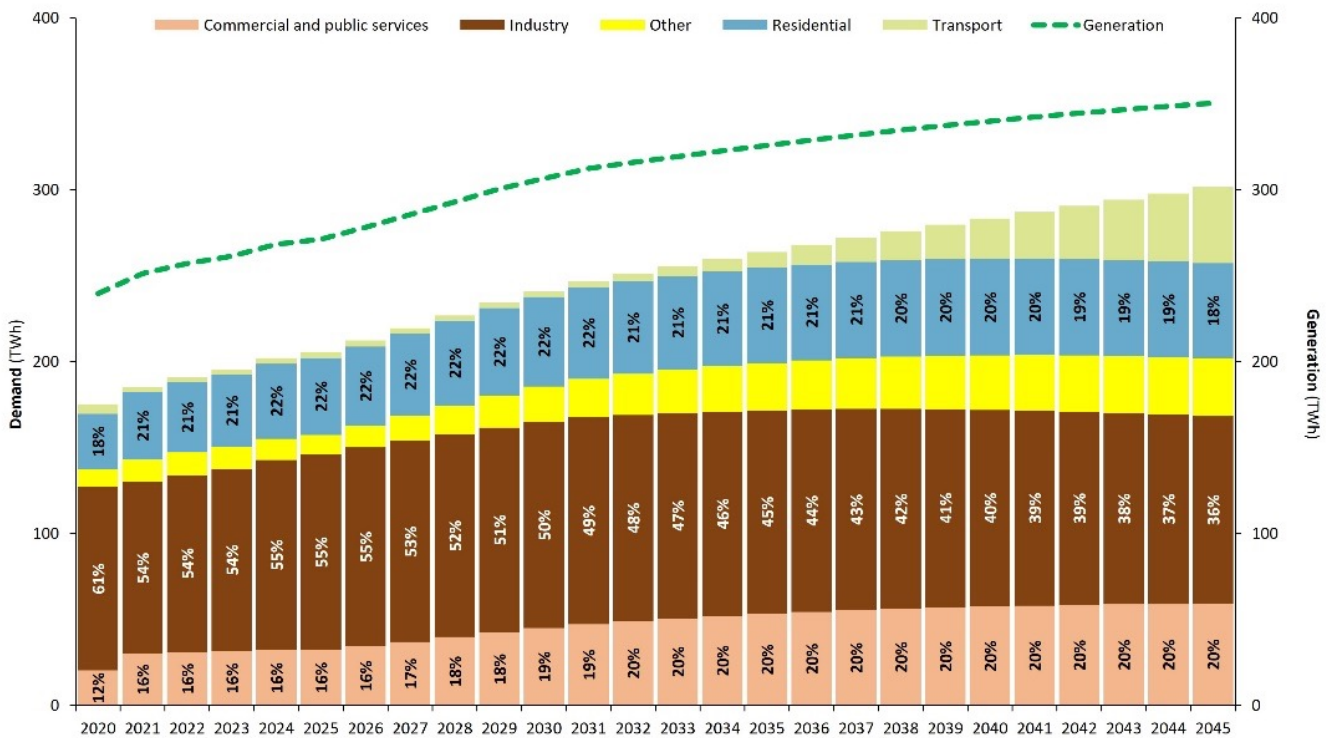


Source: Rystad Energy Global Power Mix Analysis

in South Africa is expected to stay the same as the current, short-term and medium-term sector-driven demand. Industries are expected to drive the maximum demand with 2031 at 50% of the overall demand, gradually declining down to about 35% by 2045. Commercial and public services, and residential sectors are expected to drive a 20% each of the total demand from 2031 through 2045. The sector that is expected to increase demand is the transport sector as the country eventually moves towards increased usage of electric vehicles (EVs) from Internal Combustion Engines (ICE).

### South Africa long-term demand

#### Steady industrial and residential demand expected in the long-term



Source: Rystad Energy Global Power Mix Analysis



### 3 EFFORTS TO MANAGE THE CRISIS AND JUST ENERGY TRANSITION

Successful implementation of the Renewable Energy Independent Power Producer Procurement Program (REIPPPP) in six rounds so far resulted in procurement of almost 9.7 GW capacity from Independent Power Producers (IPPs)

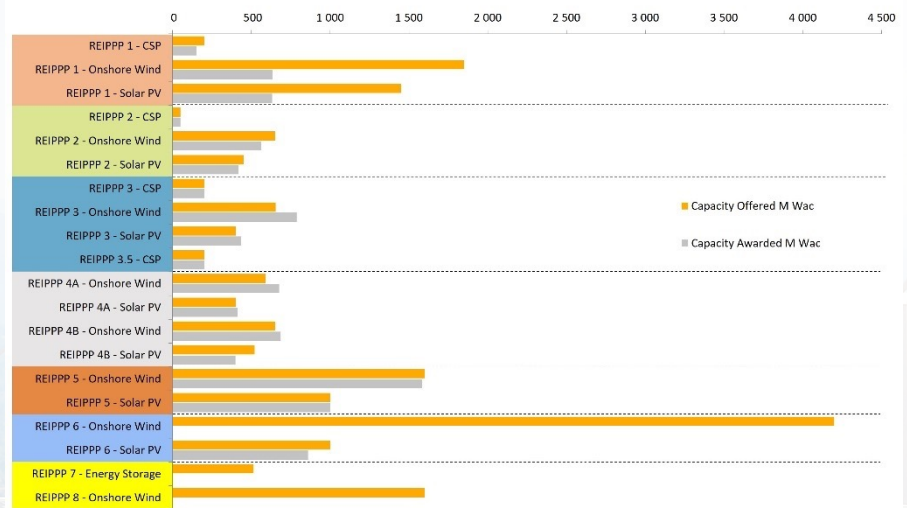
Just Energy Transition Invest Plan (JET IP) aims at securing public, private, domestic and international funding to decrease dependency on coal and fossil fuels, and also enhance energy security

Total budget for this estimated at US\$99 billion over the next five years and power sector is the key focus with 70% of these funds allocated to improve infrastructure and grid integration

Energy security and lowering of carbon emissions via just energy transition from fossil fuels is the target

### 3.1 REIPPPP – adding capacity via procurement from IPPs

South Africa Renewable Energy Independent Power Producer Programme (REIPPPP)  
Awarded capacity at 60% of the overall capacity offered through bid round 6



Source: Rystad Energy RenewablesCube

The South African government is adopting policies to aid the power sector's transition and to take account of climate risks. To help address energy poverty and extend access to clean electricity, the government implemented the Renewable Energy Independent Power Producer Procurement Program (REIPPPP) between 2011 and 2015. This included procuring over 6 GW of renewable generation capacity in four procurement rounds of which 3.47 GW is onshore wind, 2.37 GW solar PV, 0.6 GW solar thermal, 0.08 GW small hydro and 0.07 GW biopower. To boost utility scale renewable capacity, additional procurement rounds have seen nearly 5.2 GW announced. 102 IPP projects

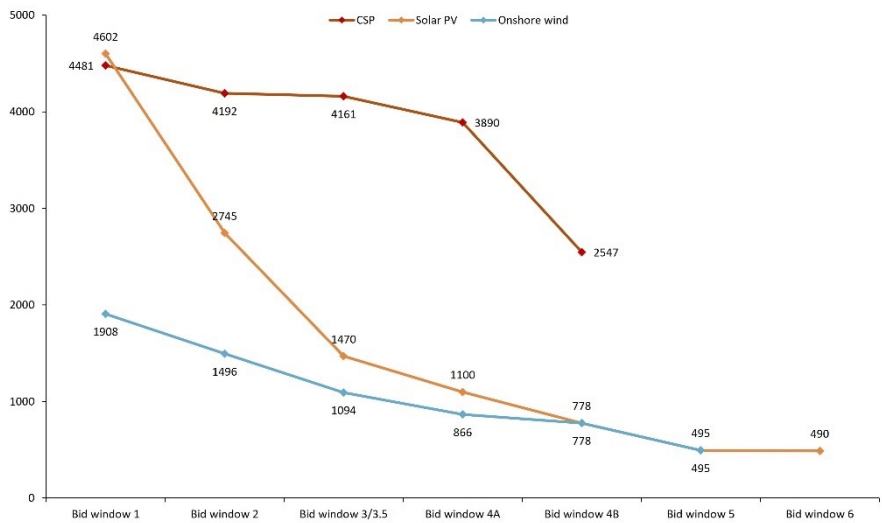
have been awarded under South Africa's REIPPPP with over 6,000 MW of renewable energy capacity spread over four procurement rounds between 2011 and 2015. The program was so successful that it was re-launched as part of the country's 2019 integrated resource plan. Bid window 5 saw 1.608 GW of onshore wind and 0.975 GW of solar PV procured, with bid window 6 lifting doubling the total from 2.6 GW to 5.2 GW. The bid window 6 was oversubscribed with a total of 56 projects bringing in 9.6 GW offers. Of the total, 33 projects represented 5.5 GW solar PV capacity within the range of 50 MW to 240 MW, and onshore wind energy facilities made up the remaining 23 projects offered with



4.1 GW capacity. However, no new wind generation capacity was approved with none of the 23 wind projects submitted being selected, with only six solar projects with a combined capacity of 1000MW selected of which 860 MW was the final awarded capacity. Projects awarded in bid window 5 and 6 will be commissioned around 2024/25.

The main objective of the REIPPPP is to shift the country away from conventional sources of energy to renewables, and also to create jobs, social upliftment, and economic transformation. REIPPPP's triumph has been noticeable over the years, as the offered capacity has increasingly been awarded at a growing success rate. It has successfully channelled substantial private sector expertise and investment into grid-connected renewable energy in South Africa at competitive prices.

PPA tariff (ZAR/MWh) comparison for awarded REIPPPP capacity to date  
Channeling grid-connected renewable energy at competitive prices



Source: Rystad Energy Research and Analysis

### 3.2 South Africa targets a just energy transition from coal to renewables

Despite having one of the most carbon-intensive power sectors on the continent and ongoing load shedding woes, South Africa is aspiring to become a resilient and low-carbon economy under an accelerated schedule that will require up to \$99 billion in funding through 2027. To achieve this, South Africa announced its Just Energy Transition Investment Plan (JET IP) at COP27 in Egypt in November 2022. The plan identifies the investment needed to decarbonize South Africa's economy and transition to clean and secure energy sources over the next five years. It also outlines how South Africa will reduce emissions in line with its Nationally Determined Contribution (NDC). This would see South Africa reduce emissions to 420 million tonnes of carbon dioxide equivalent (Mt CO<sub>2</sub>e) by 2030 to cap global warming at 2°C and to 350 Mt CO<sub>2</sub>e to cap global warming at 1.5°C.

#### IPG's \$8.5 billion offer to serve as a catalyst

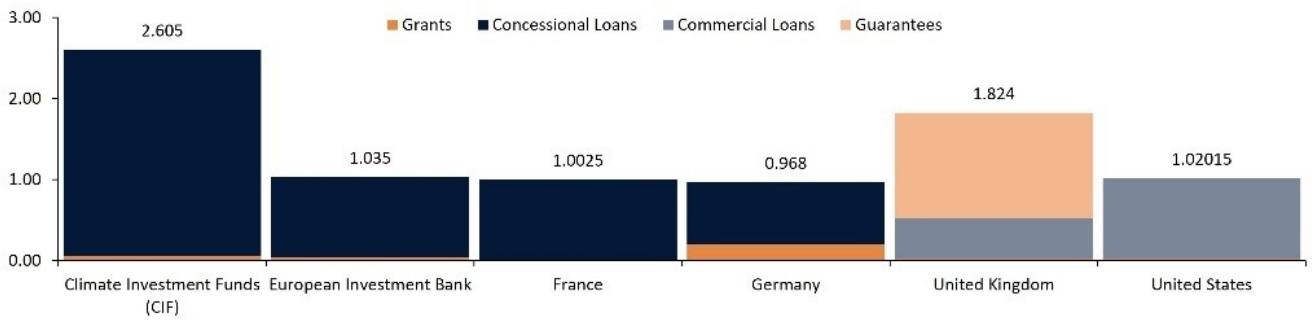
As announced at COP26 in Glasgow in 2021, South Africa's JET IP involves an initial \$8.5 billion in financing over the next 3-5 years through the Just Energy Transition Partnership (JETP) with the multinational International Partners Group (IPG) which comprises France, Germany, the UK, the US and the European Union. In general, JETPs are a nascent funding vehicle aimed at assisting emerging economies that are dependent on coal, to transition away from the fossil fuels while addressing associated social consequences. South Africa's \$8.5 billion funding is the first such JETP globally and aims to support the country in transitioning to a low carbon and climate-resilient economy by accelerating the transi-

tion process and decarbonizing the domestic power and transportation sectors through the uptake of green hydrogen and electric vehicles. The funding is intended to be the catalyst to leverage more funds from private and public players, with the donor pool having been expanded to include multilateral development banks and development finance agencies, to completely support South Africa's JETIP needs and transition over the long term. This initial funding tranche for South Africa comprises grants, guarantees and loans, both concessional and commercial. It is primarily directed to replacing coal-fired power plants with renewables and energy storage capacity while also upgrading transmission and distribution networks to accommodate renewable power. As a result, 80% of the \$8.5 billion package is allocated to development of power infrastructure.

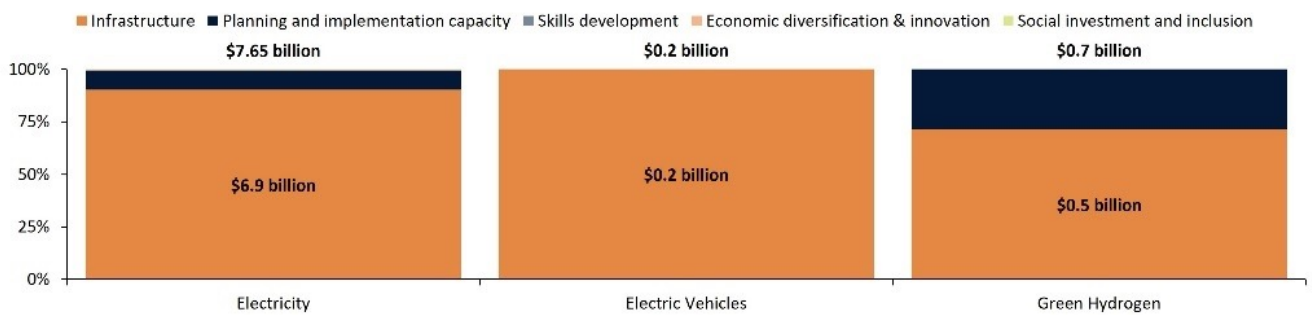
### IPG funding to South Africa JET IP and allocation across sectors

Majority funding in concessional loans and infrastructure construction taking the lion's share of the funding

International Partners Group (IPG) members and their contribution to South Africa JET IP  
Billion USD

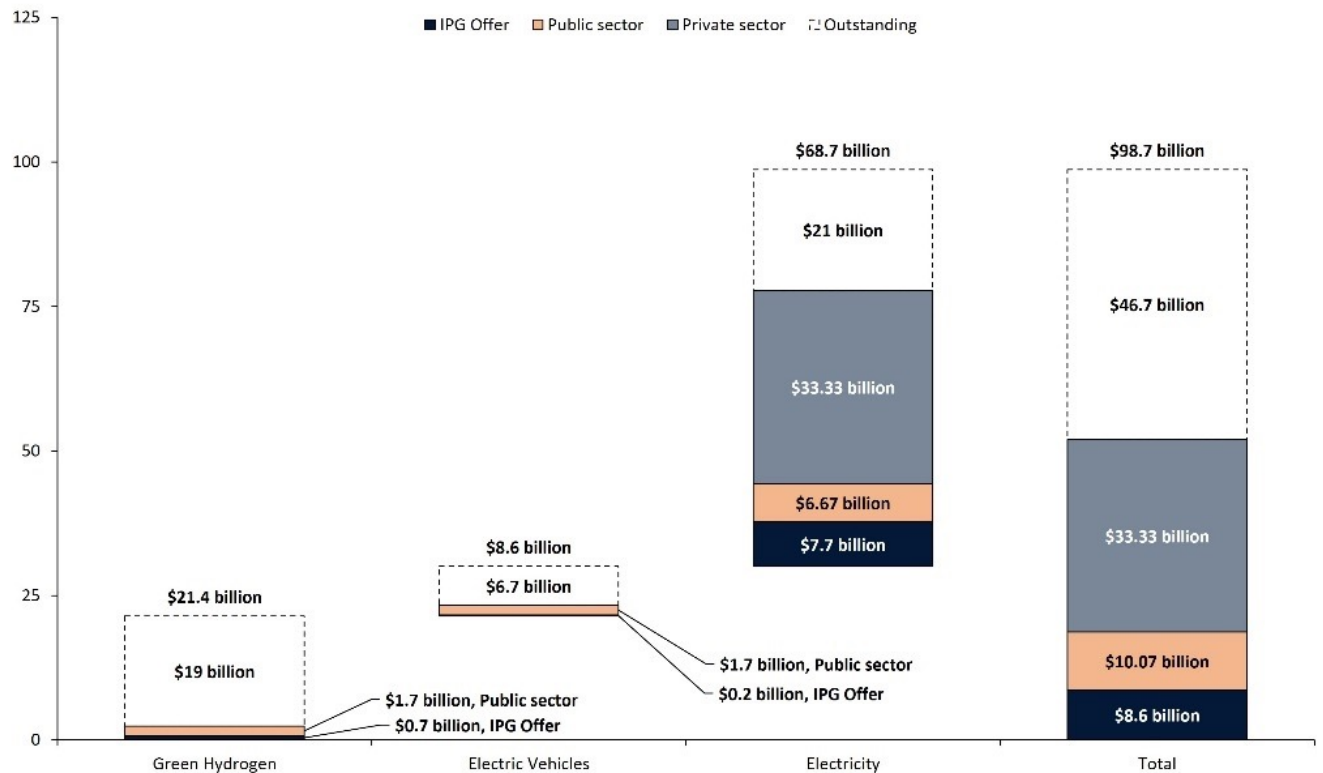


Planned allocation of IPG funding across sectors  
Billion USD



### South Africa JET IP 2023 – 2027 financing needs by sector

Electricity the prime focus with majority funding requirement from private sector



Source: Rystad Energy Power Solution, South Africa's Just Energy Transition Investment Plan (JET IP) 2023 – 2027

## \$99 billion required for a just energy transition

South Africa estimates that it will require total investment of \$98.7 billion over the next five years to enable a just transition to a low-carbon economy. Approximately 70% of the estimated total would be allocated to the power sector, with the green hydrogen and EV sectors receiving the remaining 22% and 8% respectively. IPG’s \$8.5 billion pledge in combination with \$33 billion from the private sector and \$10 billion from the public sector, comprising development finance institutions and multilateral development banks, has helped South Africa secure over half the required investment for its just transition plan. To make up the balance of the JET IP

funding target, South Africa is seeking investment from private players (domestic and international) and funding in the form of grants, guarantees and concessional loans.

In the power sector, South African electricity public utility Eskom’s coal fleet has an average plant life of about 40 years. To aid the decommissioning and repurposing of coal-fired power plants, increase the deployment of renewables and upgrade existing transmission and distribution networks to facilitate the integration of renewables, South Africa will direct 95% of the estimated \$69 billion of the JET IP funds allocated to the power sector on infrastructure development. This will include closing the final 125-megawatt (MW) Unit 9 at the Komati

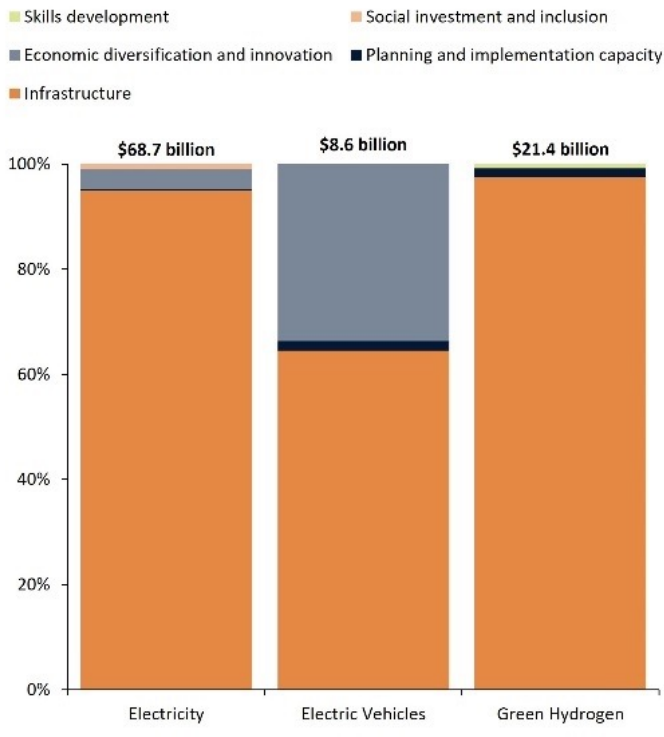
Coal Power Station, which will be converted to a renewable power generation site housing 150 MW of solar PV, 70 MW of onshore wind and 150 MW of battery storage. Investment will also be required in transmission networks to exploit solar and wind potential in South Africa’s northern, western, and eastern cape provinces and in the grid in Mpumalanga province.

Around 5% of the JET IP funding allocated to the power sector will be used to soften the economic and social impacts arising from South Africa’s transition from coal-fired generation to renewables, including links with other sectors such as transport and mining. Phasing out coal generation will impact coal-dependent regions such as the Mpuma-

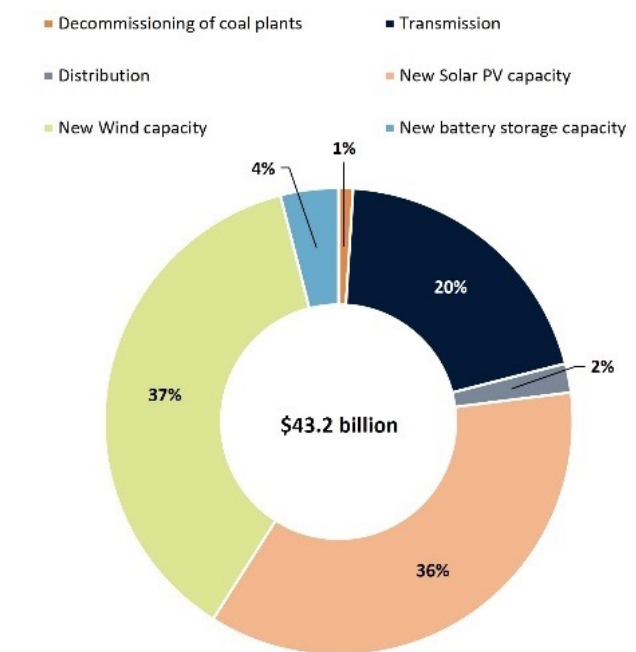
### 2023 – 2027 JET IP allocation and power infrastructure needs

#### Focus on infrastructure and development of new renewables-for-power capacity

2023 – 2027 JET IP allocation across sectors  
Billion USD



Power infrastructure needs  
Billion USD



Source: Hystad Energy Power Solution, South Africa’s Just Energy Transition Investment Plan (JET IP) 2023 – 2027



langa which produced over 80% of the nation's coal in 2022. South Africa will have to create new value chains in such regions, where the economy and communities will be impacted by the transition to a power system based on renewable energy. Other challenges include addressing Eskom's high debt and ensuring the power sector's financial sustainability.

### **Renewables high on the list for transition**

In addition to the capacity secured through the REIPPPP, South Africa has secured over 6 GW of renewable generation capacity in the form of private sector projects by raising the licensing threshold in 2021, from 1 MW to 100 MW under Schedule 2 of the Electricity Regulatory Act. However, it scrapped the 100 MW threshold which would have enabled greater investment in large utility projects. A further 2 GW of renewable capacity could result from the signing of land lease agreements for a period of 25-30 years with independent power producers such as HDF Energy South Africa, Red Rocket, Sola Group and Mainstream Renewable Power Developments South Africa. In addition, Eskom plans to issue new tenders to accelerate investment in renewables. When it comes to deploying rooftop solar, South Africa has yet to act upon plans to introduce feed-in tariffs and an associated tax incentive scheme, which would not only

incentivize the residential and commercial sectors but help mitigate load shedding. To create a more competitive power market, South Africa plans to restructure Eskom into three legally separated entities for generation, transmission, and distribution and to establish an independent transmission system operator, but little progress has been made to date. <sup>2</sup>South Africa also introduced a carbon tax in June 2019 at a base rate of less than \$8 per tonne of carbon dioxide equivalent (tCO<sub>2</sub>e). In January 2022, the tax rate was increased to about \$9/tCO<sub>2</sub>e, which is expected to increase each year by at least \$1/tCO<sub>2</sub>e to reach \$20/tCO<sub>2</sub>e. Larger increases are planned from 2026, with rates reaching \$30/tCO<sub>2</sub>e by 2030 and \$120/tCO<sub>2</sub>e beyond 2050.

As a result of South Africa's efforts, the levelized cost of electricity continues to fall for solar PV and onshore wind compared to coal. Rystad Energy expects South Africa's power generation from coal to fall from nearly 210 terawatt hours (TWh) in 2021 to 73 TWh in 2050, with newer power plants such as Medupi and Kusile being the major contributors. With an average plant life of 40 years, Eskom's coal fleet contributes to nearly half the country's overall emissions. With abundant solar and wind potential, the share of renewables in South Africa's power generation mix increasing, carbon intensity is expected to fall from 829.38 kg CO<sub>2</sub>e/MWh currently to 250 kg CO<sub>2</sub>e/MWh in 2050.



## 4 RENEWABLES

In line with the immense potential, solar PV and onshore wind – the major sources of renewable energy in South Africa in the long-term

Overall capacity expected to increase from about 10.6 GW in 2023 to 15.75 GW by 2025 and further to 18 GW by 2030

Solar PV and onshore expected to drive the growth and 65% of the overall capacity in the long-term

45% of the overall capacity currently in operating stage with 20% in post-FID and 35% in pre-FID stage

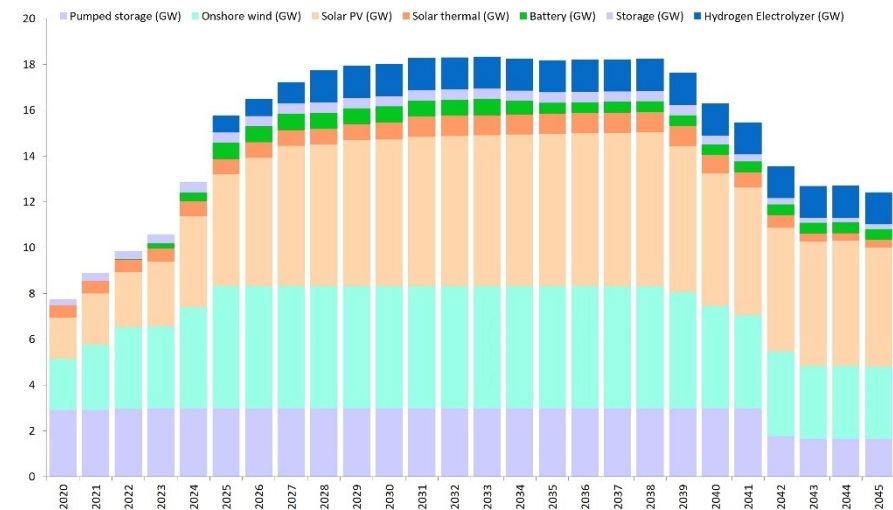
Individually 45% and 35% of solar PV and onshore wind capacity respectively, are in either application or concept stage

Quicker approval and execution of these projects can lead to faster and larger growth of renewables capacity and also drive possibility of more projects being brought into the pipeline

### 4.1 Immense solar and wind potential driving majority renewables capacity

South Africa renewables capacity overview

Solar and wind contribute to majority renewables capacity



Source: Rystad Energy RenewablesCube

A cleaner generation mix could help reduce the frequency of load shedding as the REIPPPP pushes South Africa away from conventional sources of energy towards greener alternatives. The country has immense potential for both solar and wind, with a solar PV potential of 422.4 TWh. The westernmost part of the country has the highest levels of solar radiation, ranging from 2,100 kWh to more than 2,300 kWh per square meter. More than 80% of the country has potential to develop wind power, with a potential of 20 GW at sites with 20% load factor and 10 GW at 30% load factor sites. Cost-wise, renewable development is moving in the right direction: the levelized cost

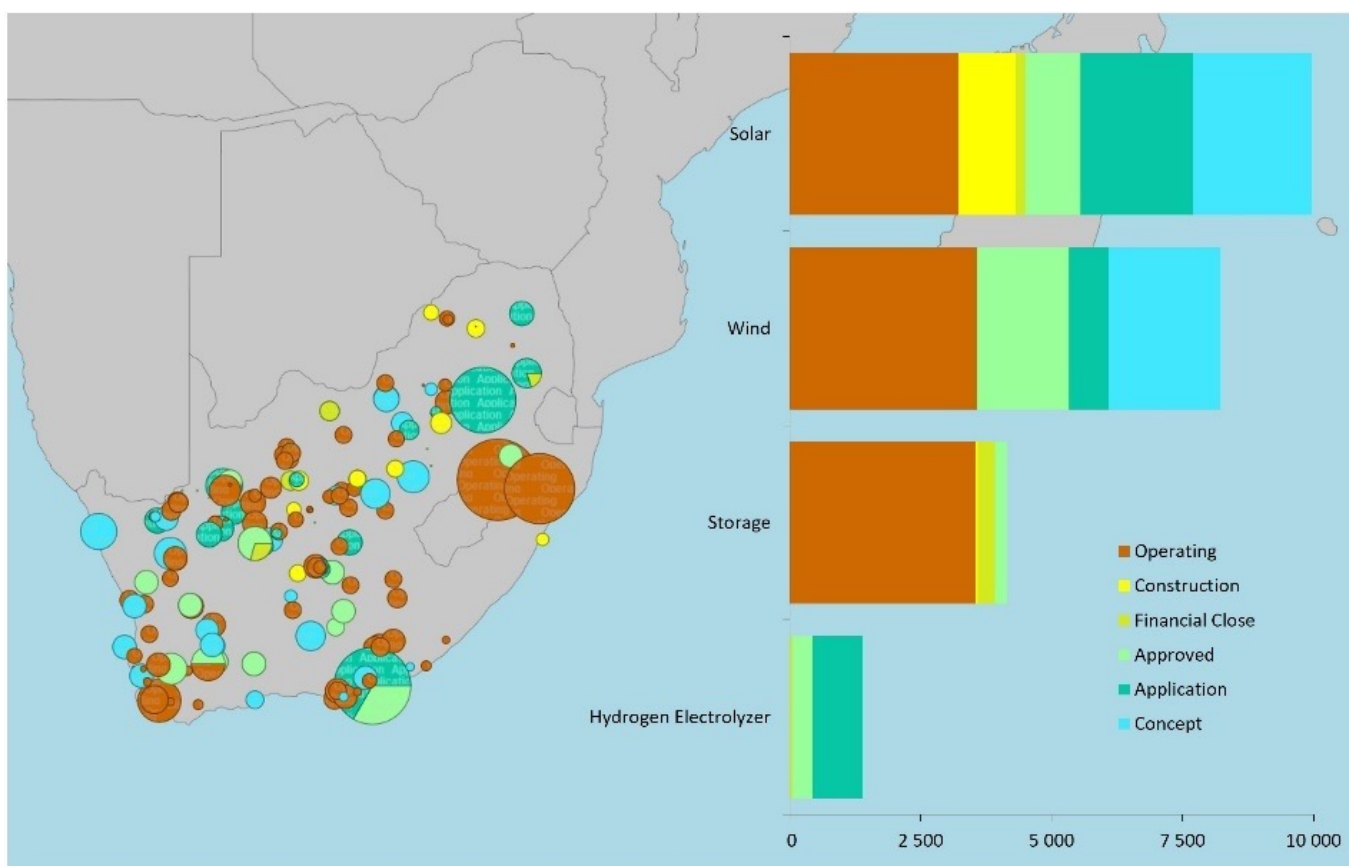
of electricity for solar PV dropped 55% to \$0.091 per kWh between 2013 and 2020, while the LCOE for onshore wind fell 64% to \$0.047 per kWh in the same period. As such, renewables capacity in South Africa is also driven majorly by solar PV and onshore wind in line with the immense potential. 65% of the overall renewable energy capacity in the long-term is expected to be driven by solar PV and onshore wind. The overall capacity is expected to see growth from an estimated 10.6 GW in 2023 to about 15.75 GW by 2025 and further to 18 GW by end of the decade. This growth too is largely driven by the growth in solar PV and onshore wind capacity.



## 4.2 Large chunk of capacity in pre-FID stage leaving room for growth

### South Africa renewables capacity overview

About 45% of the installed capacity currently operating



The capacity forecast has the opportunity to see larger accelerated growth as close to 45% of the overall capacity is currently operating, about 20% is in post-Final Investment Decision (FID) stage with the project either approved or finance secured or under construction with over a third of the overall capacity in either application submitted or concept stage. Individually, 32% and 43% of the overall solar PV and onshore wind capacity respectively is in operating stage. A quarter

of solar PV capacity and a fifth of the wind capacity have already been approved while a large chunk – 45% of the solar PV and 35% on onshore wind capacity are in application or concept stage. Similar to upstream project pipeline, if these pre-FID and/or concept stage projects are approved and executed at a faster pace with the grid integration also done, they not only improve the renewables capacity forecast but also bring more non-conventional source capacity into the power

mix enabling lesser requirement of load shedding. However, like any project, a lot of bureaucracy, paperwork, securing of finance, planning and execution is required for this. This will need a coordination between the contractors and the administration which will enable smoother and quicker execution of these projects. The operating projects will continue to add to the energy capacity, faster executed post and pre-FID projects will contribute to faster and larger growth in capacity.



## 5 NATURAL GAS – IMPORTS, AVAILABILITY AND CHALLENGES

South Africa domestic natural gas production is diminishing and is expected to follow the trend till the big gas discoveries come online

Mozambique is the sole exporter of gas to South Africa via the ROMPCO pipeline

The African Renaissance Pipeline (ARP) Project and any gas finds in the recently successful Orange Basin present further natural gas import opportunities from Mozambique and Namibia respectively

Up until the success of Brulpadda and Luiperd, South Africa has seen scattered exploration activity and success, especially in the deep waters

Brulpadda opened up the Paddavissie Fairway and Luiperd further proved the hydrocarbon presence

Block 11B/12B, where both the discoveries were made, is home to three other prospects in the same Paddavissie play and has unexplored Kloofpadda play further northeast in the block

South Africa offers competitive tax terms for upstream development

NERSA approvals mandatory for construction, ownership and operating oil and gas pipelines

The 2nd Amendment Bill (the Amendment Bill) of the Electricity Regulation Act, 2006 aims at establishing an open market for competitive electricity trading with NERSA holding the authority

The large gas – condensate finds have the capacity to produce 120,000 barrels of oil equivalent per day (boepd) of gas and 55,000 barrels per day (bpd) of liquids at peak levels

If integrated into domestic markets, Brulpadda and Luiperd can support energy needs of the country by feeding the power plants and maintaining Mossel Bay GTL plant at capacity

Climate activists and green groups have often showed strong resistance and ran campaigns against oil and gas activities in the country, making their case for the environment

While climate advocates are putting their efforts to stop fossil fuel exploration and/or development in the country, oil major TotalEnergies, the operator of Block 11B/12B, has assured that environmental impact assessment and mapping of marine life will be done, and all regulations will be followed

TotalEnergies also noted transitioning from coal to gas will have a major impact of the emissions

However, climate activists have raised strong objections to the project and have warned that citizen resistance will be organized against the development

Another obstacle to South Africa's plans of diverting Brulpadda and Luiperd gas to domestic markets are the gas export aspirations of TotalEnergies as discussions towards signing domestic gas sales agreements with state-owned entities take the best part of a year without any progress.

## 5.1 South Africa natural gas demand vs supply vs imports

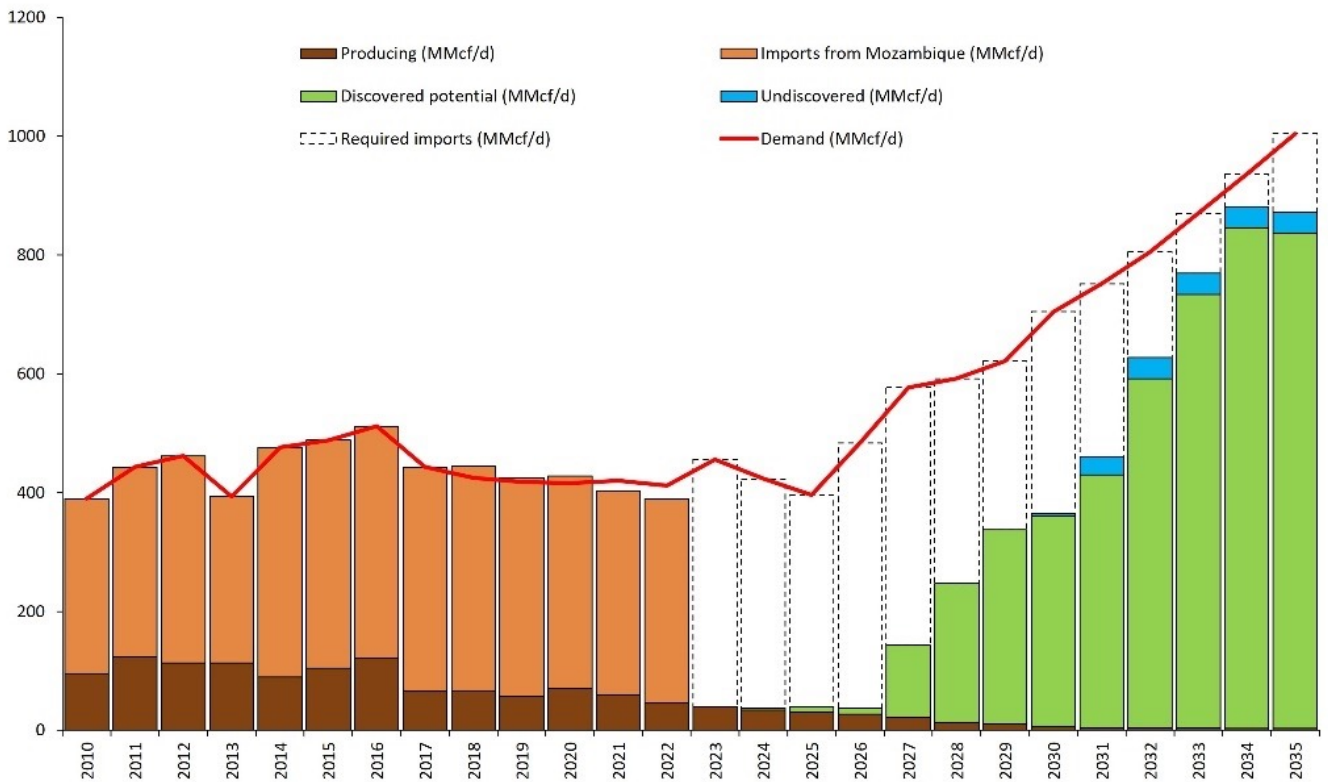
South Africa's existing natural gas production from the country comes from the state-owned company Petroleum Oil and Gas Corporation of South Africa (PetroSA) operated shelf water depth projects like F-A, E-M, F-AD and F-O. These projects are all declining and have been producing little volumes compared to the overall domestic requirements of the country. As such, the country has been historically dependant on natural gas imports. This gas comes from Mozambique's Pande

and Temane fields and is transported to Sasol's Secunda GTL plant via an 865km pipeline owned by the Republic of Mozambique Pipeline Investments Company (ROMPCO) – a joint venture (JV) between the South African Gas Development Company Limited (iGas), Companhia Limitada de Gasuduto (CMG) and Sasol. The diminishing production the domestic fields versus a currently sustaining gas demand and future gas-to-power aspirations are expected to result in a large and increas-

ing gap between the within-the-country supply and demand. So, the country is expected to continue to rely on natural gas imports in the future as well. Brulpadda and Luiperd, if catering to the domestic markets cover this gap substantially and have the capacity to completely bridge the gap. But it remains to be seen what the capacity level of these gas finds would be when they come online and if they would cater to the domestic markets or to international markets.

### South Africa natural gas imports vs demand vs supply

Until the big discoveries fill the gap, South Africa expected to rely heavily on imports



Source: Rystad Energy GasMarketCube

## 5.2 Intra-African natural gas import opportunities and plans

### Mozambique – African Renaissance Pipeline (ARP) Project

Mozambique, which has been the sole exporter of natural gas to South Africa, kicked off its LNG exports from the 3.4 million tonnes per annum (MMtpa) Coral South project late last year in November. The first cargo was shipped off to Europe and CEO Claudio Descalzi said that this was “a new and significant step forward in Eni’s strategy to leverage gas as a source that can contribute in a significant way to Europe’s energy security, also through the increasing diversification of supplies, while also supporting a just and sustainable transition”. Mozambique also has the capacity to pump more gas into regional and international markets considering the giant offshore gas finds being looked at as future liquefied natural gas (LNG) projects. Conservative estimates suggest that the Golfinho, Atum, Mamba South, Barquentine, Camarao, Mamba Northeast and Agulha gas deposits hold a cumulative recoverable gas volume of close to 55 trillion cubic feet (Tcf).

Apart from the LNG export solution, the proposed African Renaissance Pipeline (ARP) Project is aimed at linking Mozambique’s vast gas reserves with increasing demand in the intra-African markets through the establishment of a cross-border onshore gas pipeline from Rovuma Basin in Mozambique to Houten Springs, South Africa. The ARP was established by a JV agreement between a private consortium of – Profin Consulting Sociedade Anónima, South Africa’s Sako Petroleum Holding, China International Pipeline Construction Corporation, China Petroleum Pipeline Bureau, and the Mozambique National Oil and Gas Company. The 2,600km long,

42” diameter onshore pipeline, with a total estimated greenfield spending requirement of US\$7.98 billion, will run through eight provinces in Mozambique covering a length of 2,175km and a further 425 km via two provinces in South Africa. The total project cost of US\$7.98 billion, of which a debt/equity ratio of 70:30 will promote the development of the project. This pipeline also enables gas monetization of any new discoveries made in any blocks being explored in the Mozambique Basin. The annual transport capacity is 18 billion cubic metres (Bcm) of natural gas, equivalent to 13.2 MMtpa of LNG. The construction, which has already been postponed a few times and is currently scheduled to start in 2024, is proposed to be completed in three phases –

- **Phase 1-1** – from the Mozambique Basin to Maputo Province
- **Phase 1-2** – from the Mozambique Basin to Rovuma
- **Phase 2** – From Maputo Province to Houten Springs

Such projects ensure the much-required Africa’s natural resources for Africa first sentiment and can help energy poor or energy insecure African markets generate energy from Africa’s resources. This is also in line with Africa’s Conference of the Parties of the UNFCCC – 2022 (COP27) resolution of using natural gas as a transition fuel. However, in April 2022, one of the investors in the ARP project – Sasol dropped its plans to invest in the project, opting instead to import LNG by tankers from Mozambique. The project that has multiple delays so far due to the high greenfield spending requirement and has been having difficulties in finding financing partners gets another blow with this decision from Sasol. However, African Renaissance

Pipeline Limitada, the Mozambican company planning the project said it was not concerned about Sasol’s departure from the pool of potential investors as there is sufficient interest at this point from other buyers. Reportedly, there is expressions of interest from potential domestic users for almost 60% of the pipeline capacity. Moreover, the shareholders of the project have received formal expressions of interest to finance the project from three major banks – Industrial and Commercial Bank of China, the China Development Bank, and the China Construction Bank.

### Namibia – Orange Basin

Namibia’s Orange Basin has become one of the global exploration hotspots with back-to-back successes from supermajors Shell Plc and TotalEnergies. Shell Plc opened up the play with its Graff discovery. Graff-1 wildcat in Block 2913A was initially reported to hit 300 million barrels (MMbbls) of recoverable oil in about 2400 metres of water. However, post further evaluation and results from the appraisal-cum exploration probe, La Rona-1, in the vicinity of the Graff-1 well, the find is estimated to hold close to 1 billion barrels (Bbbls) of oil and 5 – 6 Tcf of gas. Graff-1 success was soon followed by TotalEnergies’ “world beater” Venus-1 wildcat that initially encountered approximately 84 meters of net oil pay in an excellent quality Lower Cretaceous reservoir in Block 2913B. But further analysis of data from the Venus-1 wildcat suggested the huge structure which is thought to straddle blocks 2913B and 2912 could hold upwards of 10 Bbbls of oil and 10 – 20 Tcf of natural gas. And more recently, Shell Plc’s Jonker-1x probe in Block 2913A hit light oil and is said to be larger than previously successful Graff and La Rona. Further



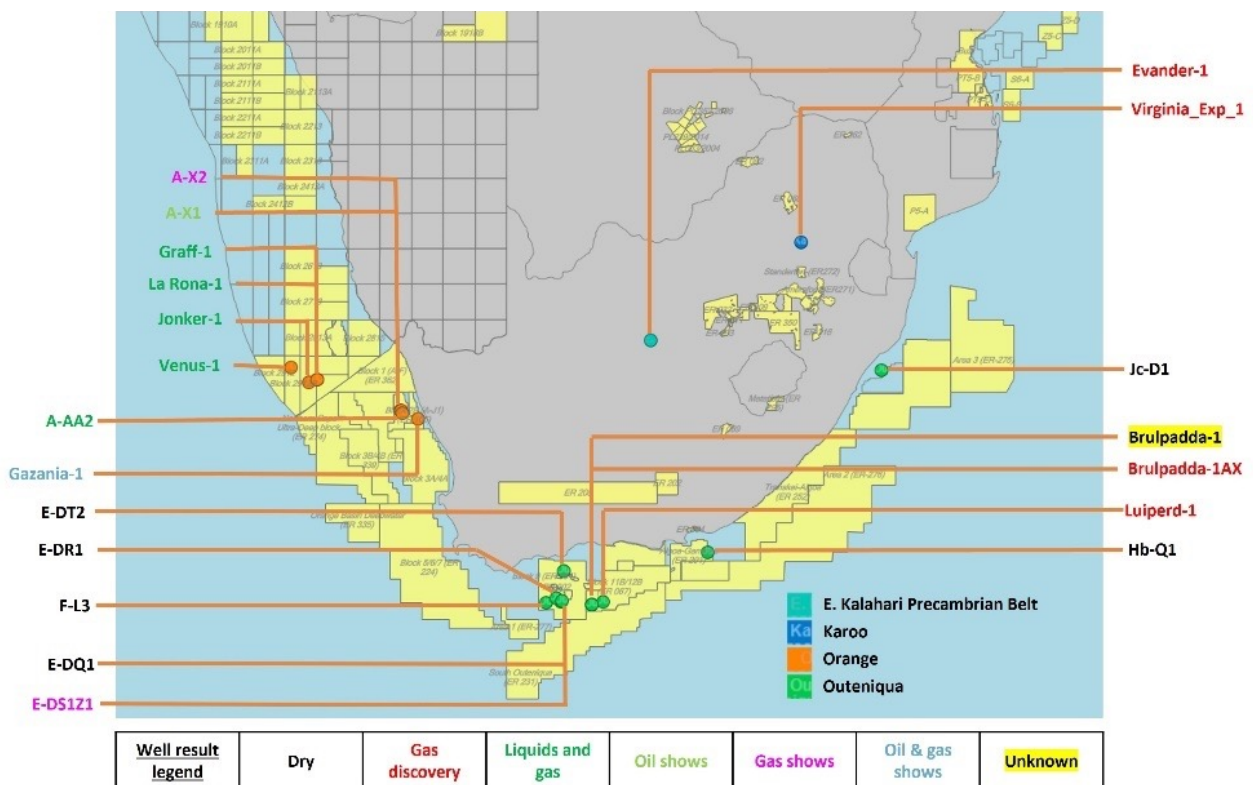
appraisal and exploration drilling is on the cards in the Orange Basin as well as elsewhere offshore Namibia. Although these mega finds are reported to hold large volumes of gas, this is yet to be proved and these finds so far have been

primarily called “oil finds”. Any confirmation of presence of gas will further solidify Namibia’s status as a regional energy hub which is already confirmed due to the large oil finds. However, obstacles to overcome include the development

timeline of these discoveries, infrastructure to export any gas to South Africa and the required large scale greenfield investments. But Namibia’s role as a natural gas exporter to South Africa cannot be ruled out yet.

### 5.3 Exploration in South Africa – scattered and sporadic success

Exploration drilling in South Africa and Orange Basin  
Scattered in well count and well success



Source: Rystad Energy LCube

Oil and gas exploration in South Africa has been scattered and success minimal. Over the past decade, up until the recently drilled Gazania-1 probe, 16 wildcats have been drilled both onshore and offshore. Of these, only four have been successful with Evander-1 (onshore), Virginia\_Exp\_1 (onshore), Brulpadda-1AX (offshore) re-entry well and Luiperd-1 (offshore) coming up with natural gas. Six of the 16 wells were dry and six other wells resulted in uneconomical volumes of hydrocarbons. In an otherwise dormant scene, the Brulpadda-1AX re-entry well was the one to shake up exploration in South Africa.

## 5.4 Brulpadda and Luiperd – play opening finds on a block with ample upside

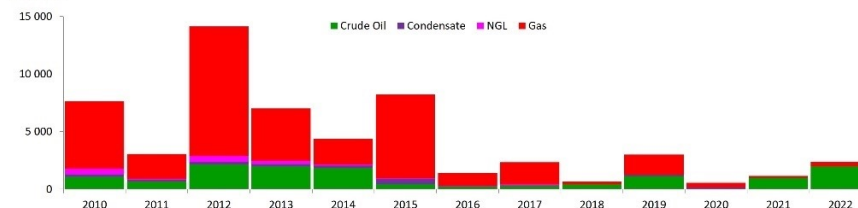
Total revealed in early February 2019 that the deep water Brulpadda-1AX re-entry well, which was drilled on Block 11B/12B in the Outeniqua Basin, 175 kilometres off South Africa’s southern coast, detected 57 meters of net gas-condensate pay in Lower Cretaceous reservoirs. This well was spud in late December 2018 in 1432 meters of water, and ambitiously targeted gross prospective resources of more than 500 million barrels. It was drilled to a final total depth of 3633 meters. Brulpadda-1AX was only the second well drilled in South Africa’s deep-water sector and opened up the new Paddavissie Fairway. The Brulpadda prospect was identified and was de-risked with 2D seismic and electromagnetic surveys. Four additional prospects – Platanna, Woudboom, Luiperd and Blaasop – were also defined within the fairway. The Paddavissie turbidite play covers an area of more than 2,000 square kilometres, with geological similarities to the smaller Oryx and Sable oil fields to the northwest in the adjacent Bredasdorp Basin. These complexes contain stratigraphically and structurally trapped oil and gas within channel sandstones that form feeders to the outboard Paddavissie fan systems. The Brulpadda prospect was actually expected to be oil-bearing, with any discovered gas to be directed to the Mossel Bay gas-to-liquids plant, which is running out of feedstock as the nearby offshore gas fields are declining. Total’s chief executive, Patrick Pouyanne, commented that while the Brulpadda wildcat revealed gas condensate and light oil, the find is “mainly gas”. Brulpadda-1AX was a re-entry of an earlier probe drilled in 2014, which had to be abandoned due to challenging marine conditions.

Another significant gas-condensate discovery was made with the Luiperd

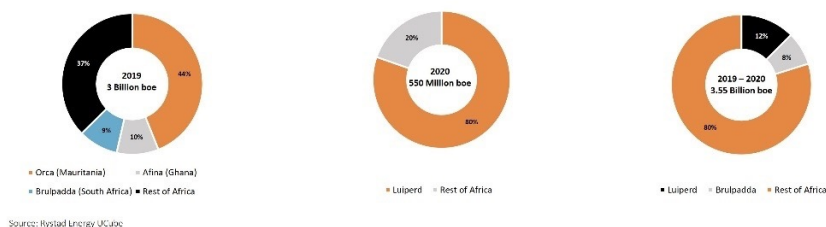
### Brulpadda and Luiperd discoveries

Accounted for 20% of the total African discovered volumes in 2019 – 2020

Annual discovered resources across Africa  
Million boe



2019 – 2020 Africa discovered volumes split  
Million boe



wildcat well in October 2020, confirming the deepwater play that opened up the Paddavissie Fairway in 2019 with the Brulpadda find. The Luiperd-1X well was drilled in approximately 1,800 meters of water to a total depth of about 3,400 meters by Odfjell Drilling’s semi-submersible rig Deepsea Stavanger, targeting a deep marine sequence of mid-Cretaceous age where fan sandstone systems are developed within a combined stratigraphic/structural closure. The pay zone is located in a mid-Cretaceous high-quality reservoir interval, and the well did not encounter the water contact. The partners are now testing the well to assess dynamic reservoir characteristics and deliverability. The well encountered 73 meters of net gas-condensate pay, 16 meters more than the Brulpadda well. Conservative preliminary estimates put Luiperd’s recoverable reserves at close to 500 million barrels of oil equivalent, with potential upside for Luiperd and the remaining prospects in the license. The exploration success prompted Total and its partners to proceed with

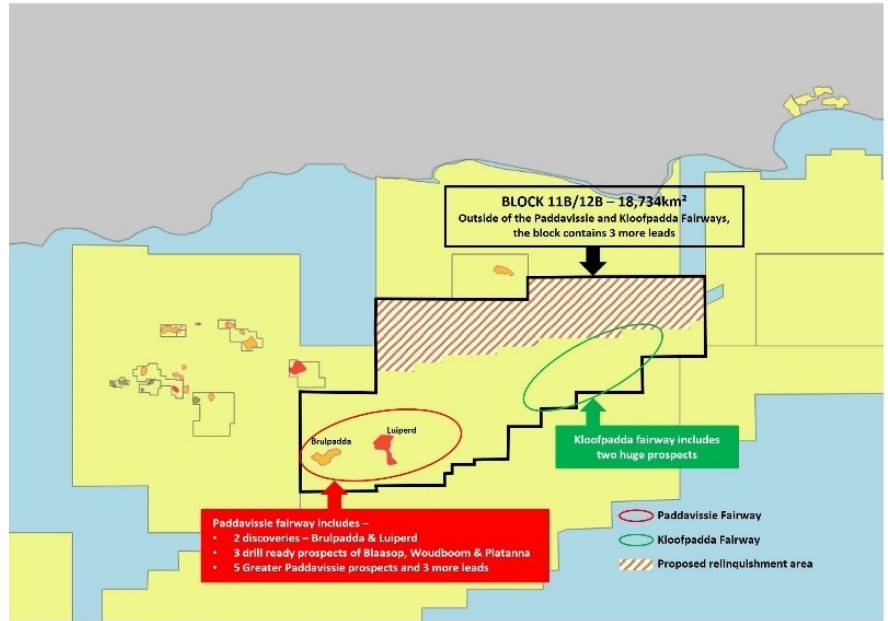
development studies and engage with South African authorities to commercialize the gas rather than drill another exploration well in this program. The partners on the block earlier lined up the Blaasop and Kloofpadda prospects to be drilled after Luiperd, but post Luiperd discovery, shifted focus to development of Brulpadda and Luiperd instead of further exploration drilling. Both Brulpadda and Luiperd rank high on the list of Africa’s largest discoveries in the past five years – at current volume estimates both the South African discoveries are in the top five, only beaten by discoveries in the prolific Senegal–Mauritania region. Both Brulpadda and Luiperd rank high on the list of Africa’s largest discoveries in their respective year of discovery – at current volume estimates both the South African discoveries are in the top five, only beaten by discoveries in the prolific Senegal–Mauritania region. Brulpadda accounted for 10% of the overall discovered volumes in Africa in 2019 and Luiperd accounted for a whopping 80% of the overall volumes

discovered in 2020. Cumulatively, these two discoveries added up to 20% of the overall discovered resources in 2019 – 2020. Estimates put Brulpadda at 275 million barrels of oil equivalent (MMboe) and Luiperd at 340 MMboe, with 70% gas each in both discoveries.

Block 11B/12B which houses the Brulpadda and Luiperd finds, is a 12000 km<sup>2</sup> block post relinquishment of partial acreage, is expected to hold a large upside. The previously identified prospects in the Paddavissie Fairway – Platanna, Woudboom and Blaasop are yet to be drilled and then there is the Kloofpadda Fairway further northeast in the block, which is estimated to hold two more large prospects yet to be drilled. As such, the block has already proven potential but still holds multiple prospects and large unexplored acreage, and thus presents ample exploration opportunity.

**Block 11B/12B potential**

Ample exploration opportunity as majority of the block is yet-to-be-explored



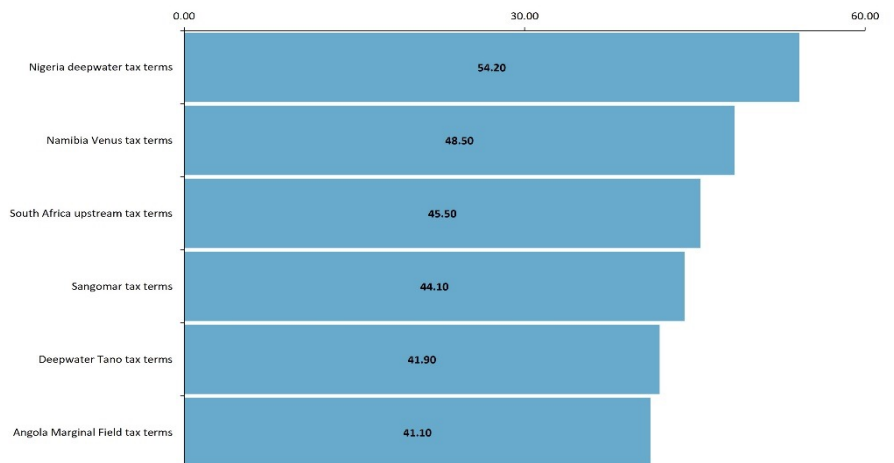
## 5.5 Upstream, pipeline and energy regulatory set-up in South Africa

### Upstream Regulations

As stated earlier, both Brulpadda and Luiperd are large finds and the block partners have shifted their focus from further exploration to developing these large finds. Considering the size and the deepwater location of both gas discoveries the greenfield spending also is expected to be on the higher end. As such, competitive fiscal terms or fiscal incentives can encourage the partners on the field to put in the investments and bring the field online. South Africa’s oil and gas fiscal terms’ key provisions include –

**Luiperd sensitivity analysis**

South Africa upstream fiscal terms very competitive in Sub Saharan Africa



Source: Hystad Energy VCube



- **Annual exploration fees**
- **Relinquishment of a portion of the exploration area on renewal**
- **Royalty** – Based on profitability with a minimum rate of 0.5% and a maximum of 5% per annum
- **Income tax** – Maximum of 28%

(All expenditure and losses incurred to be allowed as deductions. A further 100% of EXPEX and 50% of post exploration spending to be deducted to calculate the base for income tax calculation. All CAPEX and OPEX to be immediately expensed for income tax purposes)

- **State and Black Economic Empowerment (BEE) companies' participation** – State participation of 10% at the production stage, carried through exploration, through PetroSA. A further 10% participation by BEE companies to be taken up by PetroSA in the absence of any BEE participants

Compared to some of the prominent and/or contractor friendly fiscal regimes across sub-Saharan Africa, South Africa's upstream fiscal regime currently being enacted on the Brulpadda and Luiperd finds fares quite well. A sensitivity analysis on the bigger Luiperd discovery using different fiscal regimes suggests that the breakeven oil price in South Africa regime is 16% lesser than

the notorious Nigeria deepwater fiscal regime and 10% higher compared to the very contractor friendly deepwater terms of Ghana and Angola's marginal field terms. It is also to be noted that the South Africa's terms result in 6% lesser breakeven oil price compared to neighbour Namibia's Venus fiscal regime.

### Pipeline Regulations

The regulations around transportation of oil and gas by pipelines include necessary approvals to be granted by the National Energy Regulator of South Africa (NERSA). Construction of a petroleum pipeline, loading facility or storage facility without a licence issued by NERSA is not allowed. Whereas, gas transmission, storage, distribution, liquefaction and re-gasification facilities, or conversion of infrastructure into such facilities, or trade in gas requires a mandatory licence issued by NERSA. There are no formal restrictions on foreign ownership of oil and gas pipelines. However, foreign companies operating in South Africa will have to comply with Broad-Based Black Economic Empowerment Legislation.

### Electricity Regulations

The 2nd Amendment Bill (the Amendment Bill) of the Electricity Regulation Act, 2006 was published for public comment in February 2022 and closed

in March 2022. The Amendment Bill primarily aims at diversifying the country's Eskom-dependent electricity market to a multilateral and competitive one, managed by a transmission system operator (TSO) established by NERSA. The Amendment Bill allows private power purchase agreements in terms of which licensed or registered generators enter into power purchase arrangements with direct customers and traders. The "construction" of generation facilities will be treated as licenced activity alongside operation and maintenance and will require NERSA approval. NERSA is now treated as the ultimate arbitrator in the determination of any modifications in the licence conditions. Independent Power Producers (IPPs) and funders should take into consideration all of the above objectives of the Amendment Bill, when entering this new electricity market situation, which have further implications primarily like the open market for competitive electricity trading. Post public gauge, the Bill was presented to the Economic Sectors, Investment, Employment and Infrastructure Development (ESIEID) cluster, and the cluster recommended the Bill to be presented in the Parliament. ESIEID cluster is one the groupings of government departments with cross-cutting programmes aimed at improving government planning, decision making and service delivery.

## 5.6 Brulpadda and Luiperd – production potential and support to energy needs

The large scale finds of Brulpadda and Luiperd, when developed, have an equally impressive natural gas and condensates production potential. Brulpadda alone has the potential to deliver a peak output of about 25,000 barrels per day (bpd) of condensates and 50,000 barrels of oil

equivalent per day (boepd) of natural gas. Luiperd phases 1 and 2 put together have an estimated peak production capacity of about 30,000 bpd of liquids and 80,000 boepd of natural gas. Cumulatively, Brulpadda – Luiperd project peak output is an estimated to be 50,000 bpd of liquids

and 125,000 boepd of natural gas. The individual fields are expected to come online through late 2020s or early 2030s. The average output from the project cumulatively is estimated to be around 35,000 bpd of liquids and about 100,000 boepd of natural gas. For a nation that is

currently dependant on ageing and emission intensive coal-fired power plants for electricity generation and a continent that has pledged to utilise natural gas as a transition fuel towards 100% utility generation from renewables, Brulpadda and Luiperd can help South Africa negotiate through the power crisis that the country is going through if the gas is directed towards domestic markets and gas-to-power plants.

Block 11B/12B is estimated to be able to supply 560 million cubic feet per day (MMcf/d) of natural gas for more than 15 years. The Mossel Bay GTL plant has a nameplate capacity of 45,000 barrels of oil equivalent per day (boepd) but has been operating at just 36,000 boepd for several years due to insufficient natural gas supplies. The plant's feedstock gas is currently supplied from PetroSA's FA and EM fields in Block 9, but due to lower production, operations at the plant have been halted since December 2020. Block 11B/12B has the potential to supply the GTL plant with 210 MMcf/d of gas and 18,000 bpd of condensates, preventing its permanent closure.

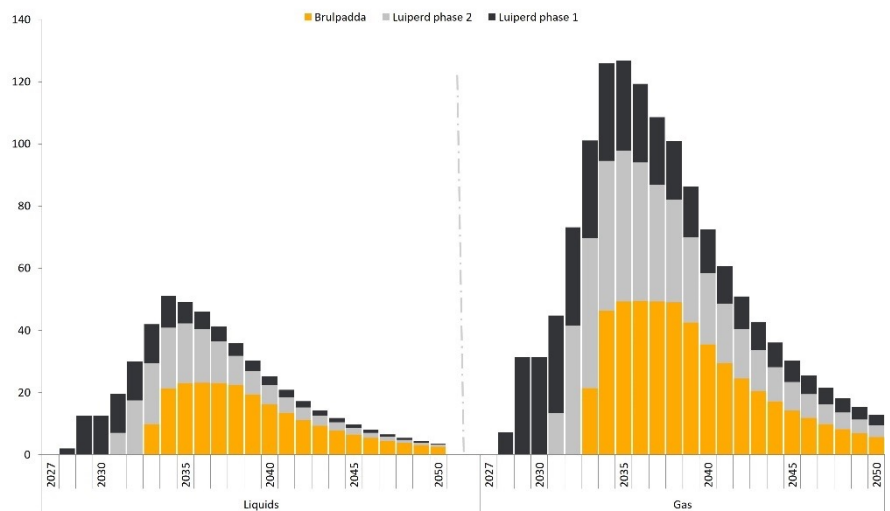
The gas from Brulpadda and Luiperd can also enable conversion of power plants like Gourikwa station with a capacity of 740 MW and Dedisa station with a capacity of 335 MW to run on baseload gas, and any further potential can cater to future gas-to-power requirements. The initial development plan for Luiperd is to drill two or three subsea wells and tie back via a 70-kilometre pipeline to the FA fixed steel platform, from where gas can be fed by an existing pipeline to the Mossel Bay GTL plant. According to Petroleum Agency of South Africa (PASA), the country's agency for promotion of petroleum exploration and exploitation, Block 11B/12B project has the potential to create 1500 direct jobs

and 5000 indirect jobs and boost the country's annual gross domestic production (GDP) by 22 billion rand. The agency estimates the block will also benefit South Africa's balance of payments by 26.5 billion rand each year by removing the necessity of importing oil and refined

products and an additional 25 billion rand to the government in the form of taxes and royalties. As such, catering Block 11B/12B potential to the domestic market can result in not only meeting the country's energy needs but will also a significant boost to the economy.

### Brulpadda and Luiperd production potential

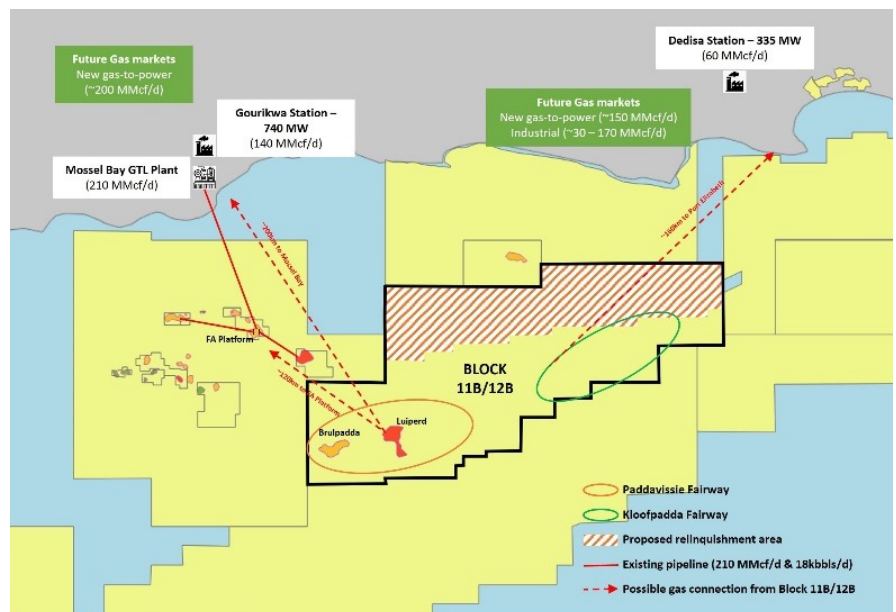
Peak production capacity of 125,000 boepd of gas and 50,000 bpd of liquids



Source: Hystad Energy UCapec

### Block 11B/12B gas to South African domestic markets

Potential to support current & future gas-to-power and GTL plant at capacity



## 5.7 Challenges in gas exploration and development, and domestic supply

One of the key challenges that upstream projects in South Africa are facing is the strong opposition from climate activists who are raising concerns of – disturbance to regional flora and fauna due to these upstream developments, doubts over usage of gas instead of coal as a step towards energy transition and a possible impact on the marine environment due to these offshore projects. The year 2022 saw anti-fossil fuel campaigners, including Greenpeace, bring a case against the government's approval granted to Shell Plc to shoot seismic off the country's Wild Coast in the south of South Africa. The High Court in Makhanda ruled this approval as illegal to conduct this seismic survey. Shell Plc later filed an appeal against this decision and is awaiting the outcome. If the supermajor fails to get the decision in its favor, it might sound alarm bells to the offshore oil and gas industry in the country which is just beginning to spring to life.

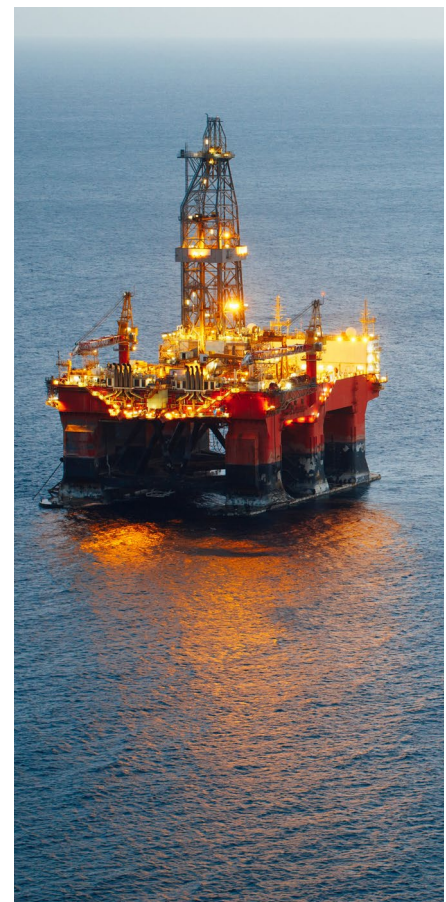
Two other climate activist bodies – South Africa based The Green Connection and France non-profit Bloom published an open letter questioning TotalEnergies' decision to exploit the Block 11B/12B offshore South Africa. They have raised objections against not only this particular project that TotalEnergies is pursuing, but also against the company's global portfolio. They want to take measures against the progress of the project and have expressed their intent to halt the project as a whole. While the CEO of TotalEnergies, Patrick Pouyanne, confirmed that they had applied for a production licence on the block and that an environmental and societal impact assessment process was initiated to satisfy South African regulations, the green groups have their

concerns. Pouyanne assured a detailed description of the project's economic, social and environmental impacts, the measures planned to preserve the environment, and the related social and economic benefits will be submitted. He also said a survey to map the marine life and the impact of this project on the same was launched and that measures would be taken to eliminate any disturbance to the marine environment. It is to be noted that the scope of its licence was reduced, excluding a protected marine area, in the submitted application.

South Africa's economy relies on coal for energy but wants to reduce the dependence on coal for power as it looks towards eliminating power outages and take steps towards energy transition at the same time. The use of gas in place of coal has the capacity to half the CO2 emissions and reduce air pollution, according to Pouyanne. TotalEnergies is developing a portfolio of solar and wind projects in South Africa, including a solar plant in the Northern Cape, and was successful in recent renewables supply tenders. The route that TotalEnergies is taking – looking to replace coal with gas and use gas as a transition fuel while developing renewable energy projects, seems to be the way to go for South Africa, but climate groups question the usage of fossil fuels at all and demand cease of any oil and gas activities, especially in the environmentally sensitive areas. This is a key challenge to overcome for any energy player in the country.

While the climate groups are posing a threat to the operators developing upstream projects, another challenge is directed at diverting Brulpadda and Lu-

iperd's gas to much-needed domestic markets to re-establish a baseload energy supply. As talks with state-owned entities who are the domestic buyers drag on for almost a year, TotalEnergies now seems to be considering a gas export scheme via a potential 3.4 million tonnes per annum (MMtpa) floating liquefied natural gas (FLNG) vessel to export the gas to European markets. Every bit of LNG from Africa can play a major role in Europe as the EU looks for alternate sources post the Russia – Ukraine conflict. If this is the scheme that the French major adopts eventually, it will be a major blow to South Africa's plans of ending load shedding in the country.







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