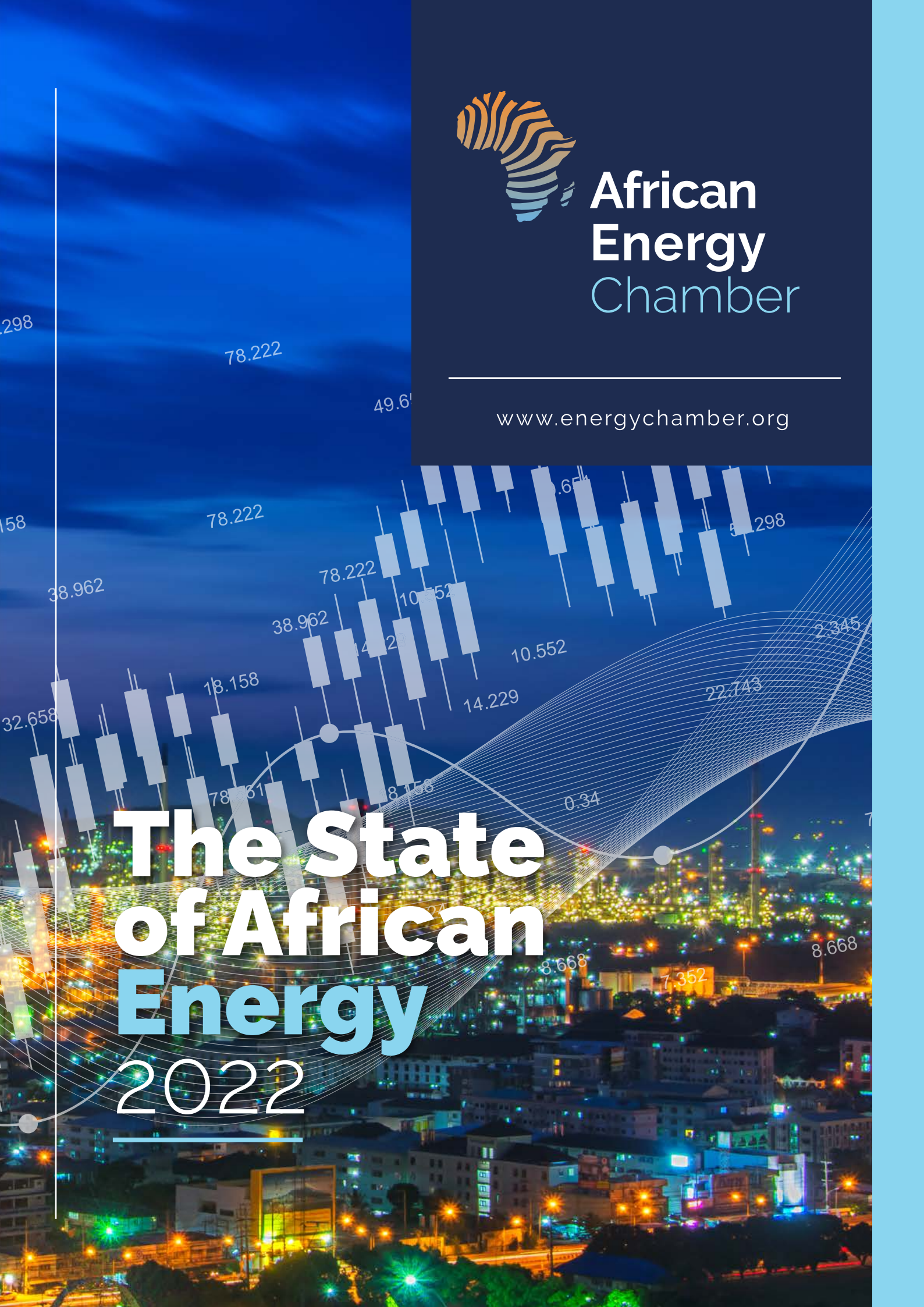




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The State of African Energy 2022





The State of African Energy 2022

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The State of African Energy 2022

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Foreword

Dear Reader,

This year's report on The State of African Energy 2022 is unlike any of the ones we produced previously. Last year was an extraordinary year for the oil and gas industry as the COVID-19 pandemic hit the global demand, leading to a fall in oil prices. Companies responded swiftly by slashing their budgets and delaying upcoming project sanctioning decisions. The pandemic has also been particularly challenging for many countries worldwide, more so in Africa. The continent entered its first recession in decades, with several African economies seeing a sharp slowdown in economic activity since early 2020 with the outbreak of the Coronavirus (COVID-19) pandemic. Although we have seen a rebound in economic activity, this renewed growth momentum on the continent still lags behind other regions such as emerging and developing Asia.

Reasons for the modest growth projections on the continent include continued lack of access to all important vaccines (vaccine inequity) and the weaker fiscal position of most governments. As of the end of mid-October 2021, less than 5% of the continent's adult population had been fully vaccinated. While the African continent has recorded relatively lower cases of the virus and deaths, there are several unintended socio-economic consequences of the pandemic, including for the continent's energy sector. The pandemic-induced economic decline has negatively affected the progress made on electrification in Africa. Oil and gas companies and utilities, for example, faced severe financial difficulties due to a freeze in investments.

Within the same period, there have been increasing calls by international governments, investors and governments to do more to tackle the existential threat of climate change – a key event this year will be the UN COP26 Climate Summit in Glasgow, Scotland.



These changing priorities have reflected increased attention to environmental, social and governance issues (ESG) by stakeholders and investors, manifested in various net-zero commitments. Going forward, energy projects, particularly upstream oil and gas, will be under more pressure to showcase their 'green street credibility' to attract funding.

Against this backdrop, the State of African Energy 2022 report assesses the energy value chain encompassing upstream, midstream and downstream investment needs, especially in light of the pandemic-related market shocks and the opportunities therein.

The 2022 Outlook demonstrates is that all is not

lost, especially for the African continent. There are at least three reasons why some of the adverse predictions about Africa's oil and gas and broader energy industry need putting in perspective. Firstly, exploration activity in the region is expected to increase gradually to 2019 levels, albeit well below pre-2015 levels. Greenfield activity is expected to keep increasing for the remainder of this decade as many of the LNG projects in East Africa start attracting investments. Greenfield investments offshore in Sub-Saharan Africa are also expected to increase with the recovery in sanctioning activity. Six licensing rounds are expected to conclude before the end of 2021, with about 92 blocks on offer, while another fourteen are expected to close in 2022.

Secondly, a key change visible in Africa is that the continent is expected to sanction more gas resources than the last decade, which focused mainly on crude oil projects. Due to energy poverty in Africa, net-zero targets are not at the forefront of most countries' minds. Instead, providing sufficient energy to fulfil the basic requirements of the population is foremost. Africa's abundant 600 trillion cubic feet (Tcf) of natural gas reserves can help meet the continent's future energy demand and play a key part in electrification in various countries due to its accessibility. Gas-to-power generation can help move away from other more polluting conventional fuels and assist in the energy transition.

Thirdly, rapid moves to attain net-zero at all costs will severely negatively impact Africa's energy sectors, which are a critical source of employment and foreign exchange earnings. Africa remains among the least CO₂ — and other greenhouse gases — emitters globally. The transition is less about technological and fuel choices than sustainable livelihoods for the

millions of people who live on the African continent. The increase in demand for battery metals will disrupt global supply chains and open new market opportunities for countries worldwide, particularly in Africa

Finally, in terms of doing business on the continent, we have to cut red tape to make life easier for hard-working Africans, businesses and investors to work and grow the energy sector. We know from experience that this will reduce the cost of doing business, speed up approvals and make life better for Africans. We must never be ashamed of supporting an industry that has brought so much to Africa and will continue to bring people out of poverty and reduce reliance on foreign aid.

This year's report's core message is that Africa has a fine opportunity to leverage all the energy resources at its disposal to support its post-COVID economic recovery agenda, bridge the access gap, and fight poverty. This imperative must not be lost on us.

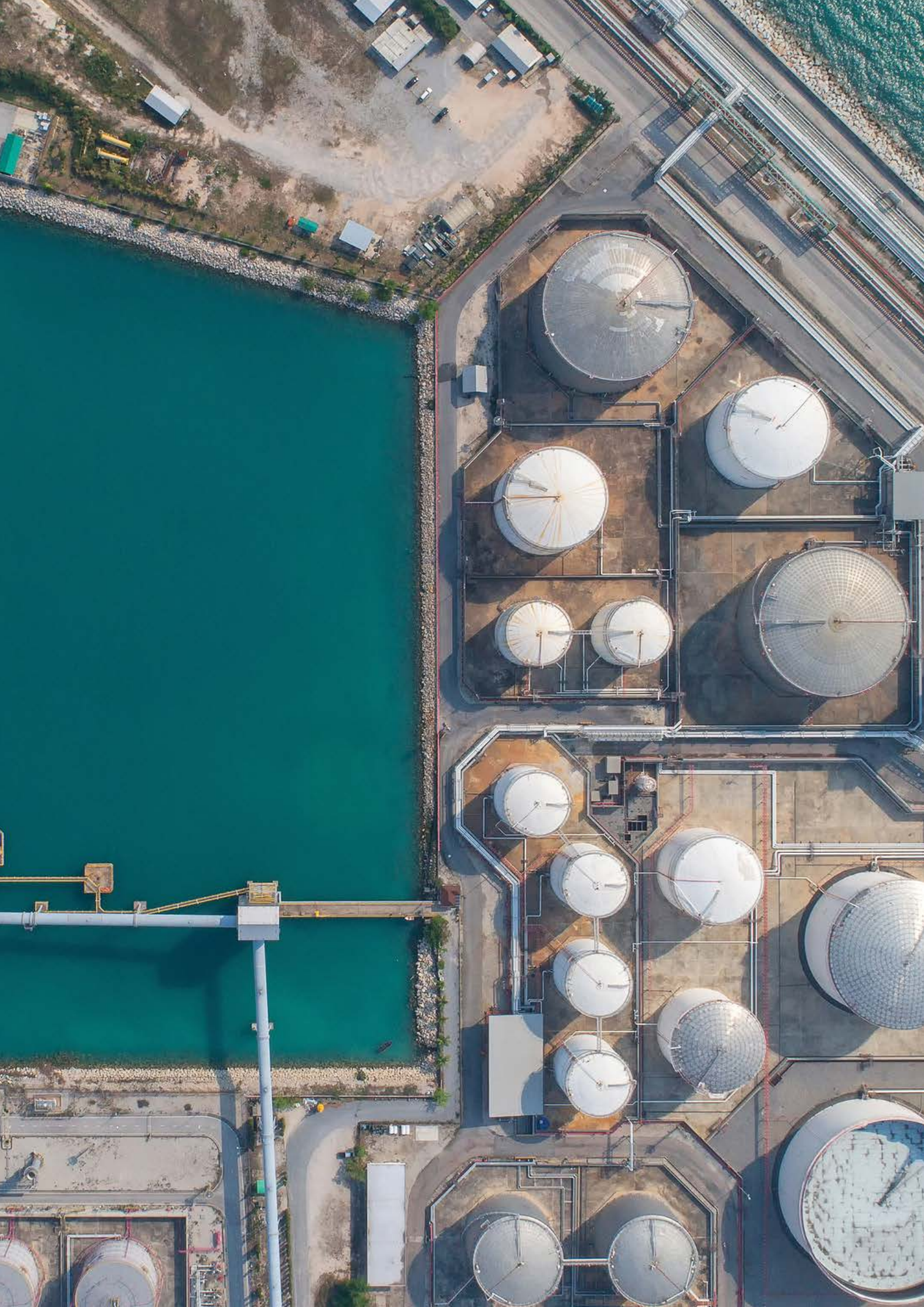
I hope you do enjoy reading the report.



Thank you,

NJ Ayuk
Chairperson

African Energy Chamber



Key Highlights

- Free cash flow (FCF) generation and government take declined by slightly less than 50% in 2020
- Highest free cash flow generation expected in 2021 supported by improving commodity prices and curbed capital investments
- Higher sanctioning and investment activities in 2022, decreasing free cash flow by 15%
- Short term outlook suggests a good supply demand balance for the rest of 2021 but an oversupply if OPEC+ delivers on its new supply targets
- There could be a correction in reference prices from 2022+ if additional volumes from OPEC+ result in supply outrunning the demand
- Demand and supply to recover after taking a hit in 2020 due to COVID-19 and a supply shortfall in 2021
- Major reference prices to remain on the higher side due to new LNG supply delays, exemplified in the recent escalation in gas prices during 2021, also impacted by pipeline flows
- COVID-19 and the subsequent disruption to global markets is estimated to have wiped out close to US\$150 billion of exploration and development expenditure from Africa between 2020 to 2025
- Over the last 12 – 15 months, more companies and especially majors have announced strategic revisions with increased focus on the energy transition, cutting down their carbon emissions and in doing so, reduce respective upstream expenditure going forward
- While 2021 is expected to see marginally higher upstream investment totaling just over US\$33 billion in Africa, the estimated drop in African upstream expenditure over the years 2022 – 2025 is close to US\$34 billion when compared to the estimates from year-end 2020
- Upstream capital expenditure halved from US\$60 billion+ levels in 2014 to an estimated US\$33 billion in 2022
- Drilling activity is expected to fall to about 950 wells per year in 2022 versus the 1475 wells drilled in 2012
- 2021 offshore rig demand cut by 22% versus 2020, but 2022 demand estimated to double from 2021 levels, spelling out a busy market for drilling service providers
- While 2020 witnessed the second lowest discovered volumes in the past decade, so far in 2021 much lower volumes have been discovered
- Only 1 high impact well has been drilled in 2021 which resulted in non-commercial oil flows; 3 more are expected to be drilled before the end of the year
- A much more encouraging year is anticipated in 2022 with 13 high impact wells expected to be drilled
- 6 licensing rounds are expected to conclude before the end of 2021, with about 92 blocks on offer. During 2022 14 rounds are expected to close, although 7 of these rounds remain uncertain
- Majors are divesting carbon intensive crude oil assets to meet carbon neutral goals through selling to NOCs and INOCs, amid a changing player landscape
- NOCs are acquiring majors crude oil assets
- European majors are expected to boost on gas output with the intention of tapping into global markets through the production of LNG
- G20 governments allocates US\$ 123 billion in public sector financing to Africa and Middle East from 2013-2019
- European finance institutions demonstrate strongest reluctance to invest in fossil fuel related projects
- Asian financing institutions likely to remain as key sources of financing for fossil fuel projects in Africa

1.1. Market Overview. FCF generation expected to decline into 2022 as **investment upcycle** emerges

Free cash flow (FCF) generation and government take declined by slightly less than 50% in 2020

Highest free cash flow generation expected in 2021 supported by improving commodity prices and curbed capital investments

Higher sanctioning and investment activities in 2022, decreasing free cash flow by 15%

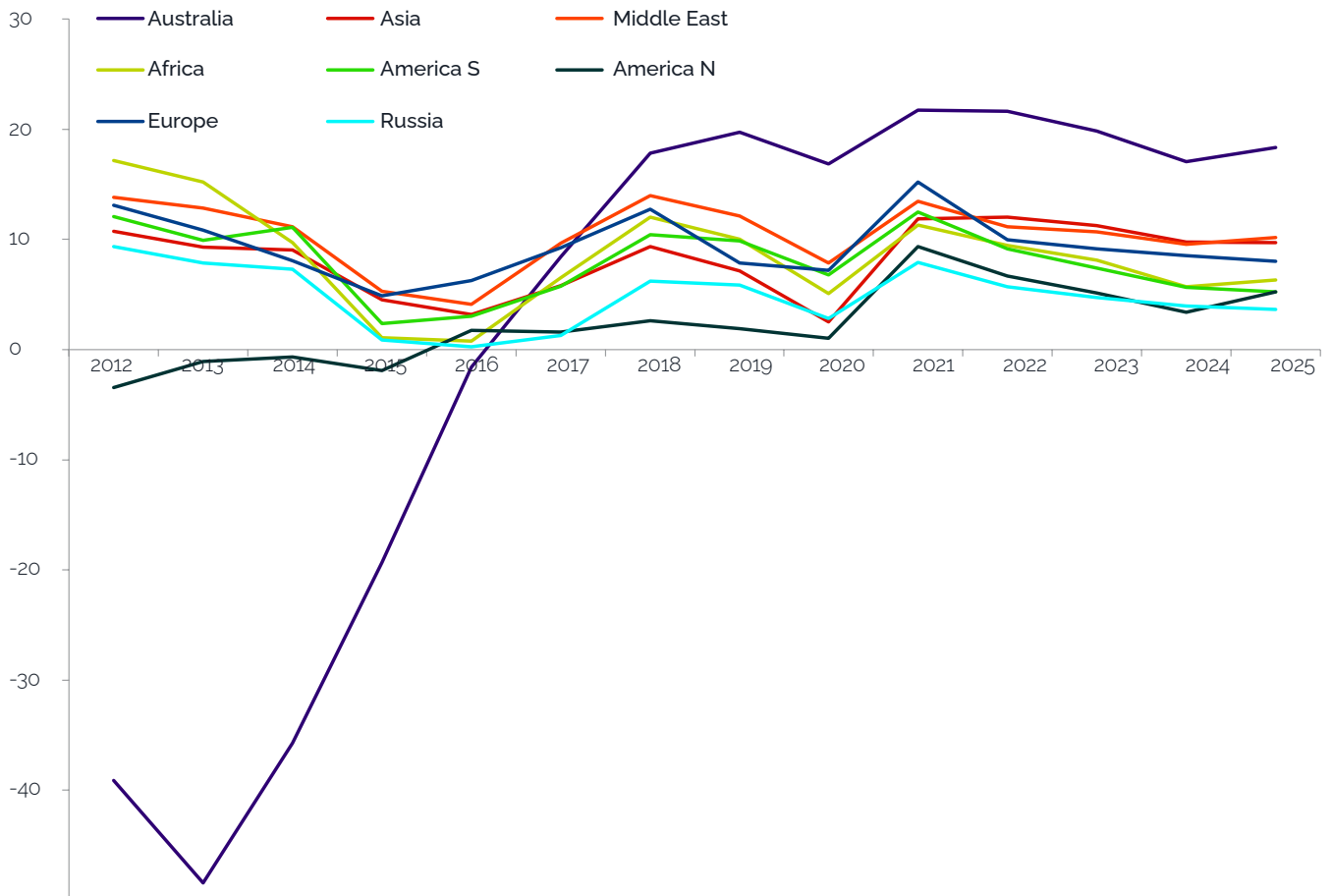
Last year was an extraordinary year for the oil and gas industry as COVID-19 hit the global demand, consequently leading to a fall in oil prices. Companies responded swiftly by slashing their budgets and delaying upcoming project sanctioning decisions. Such steps helped operators to withstand the storm and positioned the companies to reap the benefits in the coming years. This year is expected to be a record year in terms of free cash flow generation. Global free cash flow generation for all the publicly listed companies is estimated to exceed USD 350 billion supported by the increase in oil prices. Most of the increase is expected to come from North America while Africa is expected to contribute around USD 24 billion of the total. There remains a downward risk on oil prices in 2022 and hence we estimate the free cash flows to decrease to around USD 300 billion in 2022 of which USD 17 billion will come from Africa, which still remains above the 2019 level of USD 220 billion.

When observing the trends in Figure 1.1.1 where the free cash flow generated per barrel of oil equivalent

is illustrated per continent, all continents are expected to generate positive free cash flows going forward. The higher investment activities in Australia and United States were responsible for the negative cash flows in the period from 2012 to 2015, however major investments in the past and delayed sanctioning activity have returned the continents to a positive free cash flow position. Australia is expected to generate the highest free cash flows of more than USD 20/boe followed by Europe generating USD 15/boe in 2021. While Australia is expected to generate above USD 18/boe in the short term, Africa's free cash flow per barrel is expected to decline gradually from USD 11/boe in 2021 to USD 6.5/boe in 2025. Overall, the key contributor to making 2021 a record year is the United States, generating around USD 10/boe in 2021 compared to USD 1/boe in 2020. North America's cash flow per barrel is estimated to drop to around USD 5/boe in 2025 from the current levels of USD 9.5/boe. As the next investment cycle starts, free cash flow generation is expected to decline gradually in the short term.

Figure 1.1.1: Industry in review – Market overview
Upstream free cash flow evolution per continent – USD/boe nominal

Source: Rystad Energy UCube August 2021



Africa is more in line with other continents and the cumulative free cash flow from all African projects is illustrated on Figure 1.1.2. In 2021, the continent is expected to generate free cash flows of around USD 50 billion, slightly below the 2018 levels of USD 55 billion. With quick response by the companies, the shock wave in 2020 was less severe than that of 2015 crash. However, the bounce back is expected to be limited

to 2021 as free cash flow generation starts to decline as more resources are sanctioned and investment levels increase. This leads to an expected decline of 15% in free cash flow generation in 2022. In the first half of this decade, we estimate the largest volume of resources to be sanctioned in 2024, with more than half comprising offshore deep-water and ultra-deep-water projects.

The exploration activity in the region is expected to increase gradually to 2019 levels but well below pre-2015 levels. The recovery is predominantly driven by exploration in Ghana and Angola. However, greenfield activity is expected to keep increasing for the remainder of the decade as many of the LNG projects in East Africa start attracting investments. Greenfield investments offshore in Sub-Saharan Africa are also expected to increase with the recovery in sanctioning activity. A key change in trend that is clearly visible in Africa is that the continent is expected to sanction more gas resources compared to the last decade, which focused mainly on crude oil projects.

Figure 1.1.2: Industry in review – Market overview
Upstream FCF evolution and forecast to 2025, Africa – USD billion nominal

Source: Rystad Energy UCube August 2021



Figure 1.1.3: Industry in review – Market overview
Top 10 companies by 2021 free cash flow in Africa – USD billion nominal

Source: UCube August 2021

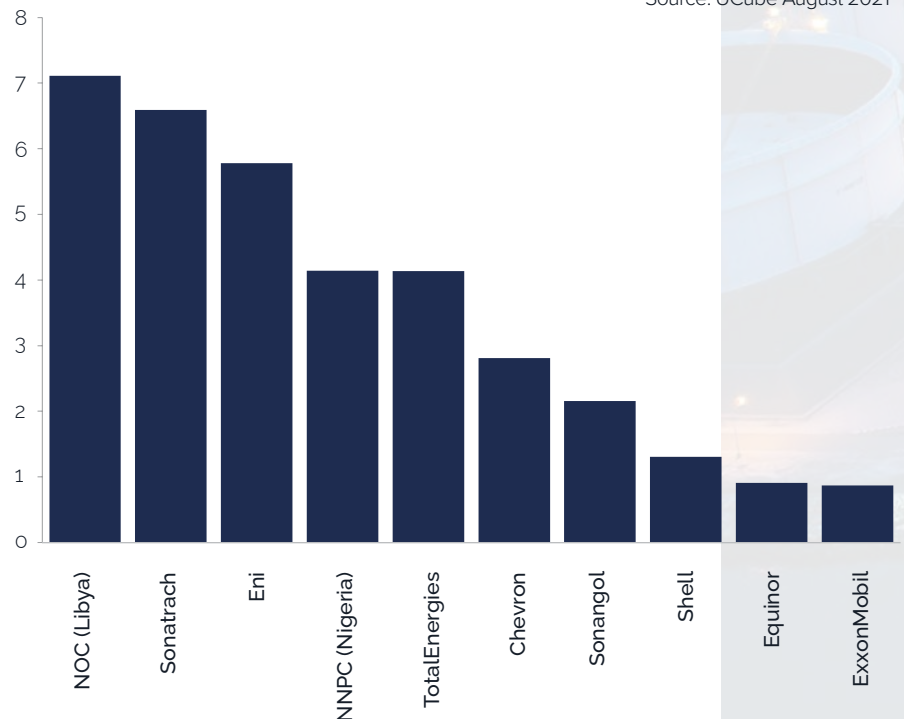


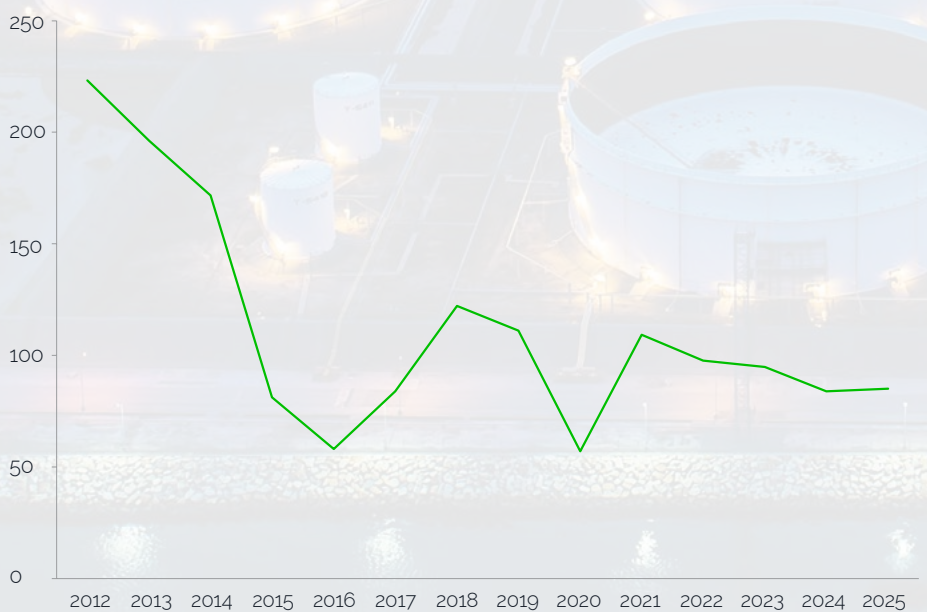
Figure 1.1.3 breaks down the expected 2021 and 2022 respectively free cash flow per top 10 companies that are active in Africa. With improved commodity prices and recovery in production in countries such as Libya, the list is dominated by national oil companies and Majors. The national oil companies of Libya (NOC Libya) and Algeria (Sonatrach) are the top contributors for both the years and Eni being the biggest contributor among the Majors. BP's cashflows improve significantly driven by increasing production from its asset-base in Egypt and Rosneft also makes it to the list in 2022..



Figure 1.1.4 illustrates the evolution of free cash flow earned by governments in Africa. Various tax parameters such as royalties, profit oil and other taxes contribute to these cash flows. These vary on different parameters such as production, profitability and commodity prices, dependent upon the fiscal regimes of the respective countries. While such cash flows remain well below the 2012 levels, they are expected to bounce back to 2019 levels of around USD 100 billion this year from lows of USD 55 billion in 2020. Thereafter, a gradual decline is expected. While gas is going to play an important role going forward, the government take is not expected to change much and will remain around 75% on average for Africa

Figure 1.1.4: Industry in review – Market overview
Government take evolution for Africa – USD billion nominal

Source: Rystad Energy UCube August 2021

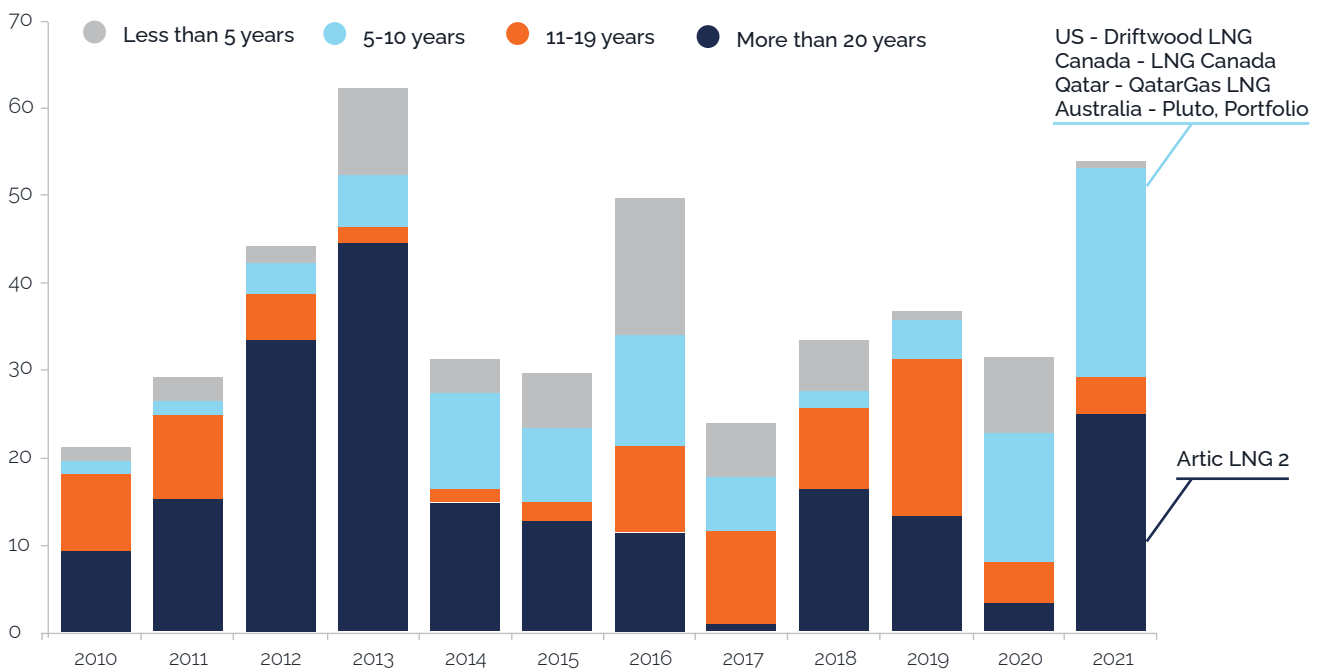


Recently the spot market within the gas market has become quite active due to the ongoing market conditions such as high gas prices in Asia and Europe. We have indeed observed more activity on the spot market however, when it comes to LNG project sanctioning, operators are still signing long term agreements to avoid for uncertainties. Previously, it has been noticed LNG projects being sanctioned after booking at-least 85% of the project's capacity under long term contracts, but this has gone down recently. Another interesting trend is the shift

from signing 20 year-contracts to signing more 5 to 10-year contracts. However, even in these times of high activity in the spot gas market, long term contracts continue to hold significant value as can be seen from in Figure 1.1.5. In 2021, there have been more than 50 million tonnes of long-term LNG contracts signed, which is comparable to 2016 levels. Driftwood LNG in United States, LNG Canada in Canada, Qatar LNG in Qatar, Arctic LNG 2 in Russia and Pluto LNG in Australia are some examples of projects that signed such long-term agreements.

Figure 1.1.5: Industry in review – Market overview
Government take evolution for Africa – USD billion nominal

Source: UCube August 2021



Many of the nations in Africa still rely on hydrocarbons for export revenues and domestic consumption. In North Africa, Algeria is one such country that is a major gas exporter to Europe and produces significant crude volumes. In the Sub-Saharan Africa, Nigeria and Angola both produce more than 1 million barrels per day of crude oil annually, while

countries such as Mauritania and Senegal hold vast discovered gas resources. In East Africa, countries such as Uganda and Kenya are expected to begin their first crude oil developments in the latter half of the decade and Mozambique and Tanzania are making efforts to commercialize gas resources.

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1.2. Oil Market. Covid causes unprecedented oil market turmoil **covid lockdowns** easing out globally and **OPEC+ agreements** resulted in crude price recovery

Short term outlook suggests a good supply demand balance for the rest of 2021 but an oversupply if OPEC+ delivers on its new supply targets

There could be a correction in reference prices from 2022+ if additional volumes from OPEC+ result in supply outrunning the demand

2021 has so far been the year of recovery for crude oil prices after COVID-19 brought the lows of 2020. The lockdowns eased out gradually throughout the world and resulted in the lifting of transport restrictions. Between 2019 to 2020 global liquids demand saw an annual average contraction of about 9 million barrels per day, which is expected to recover by about 5.15 million barrels per day in 2021. Figure 1.2.1 illustrates the impact on average Brent oil price per year, along with best estimate projection towards 2025.

Figure 1.2.1: Oil price outlook (Brent USD/bbl nominal)

Source: Rystad Energy Ucube August 2021

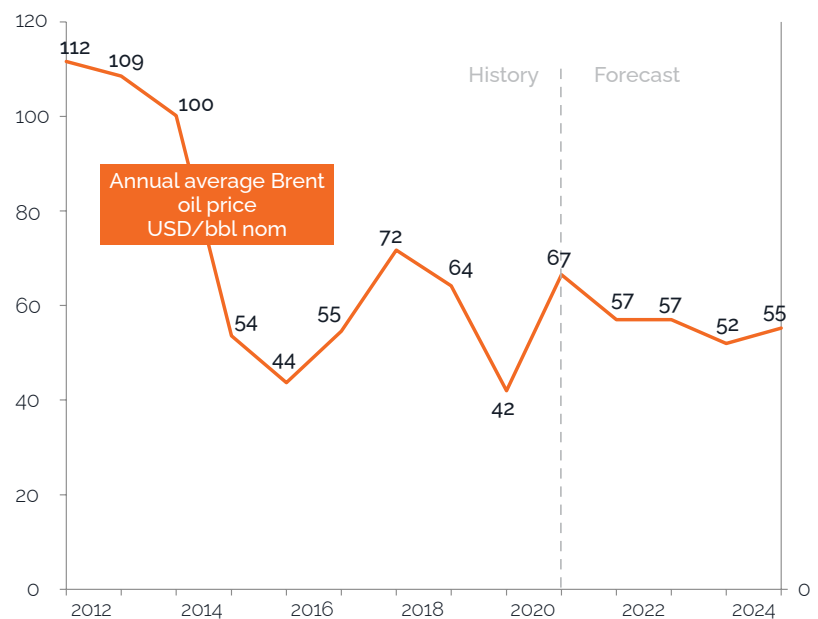
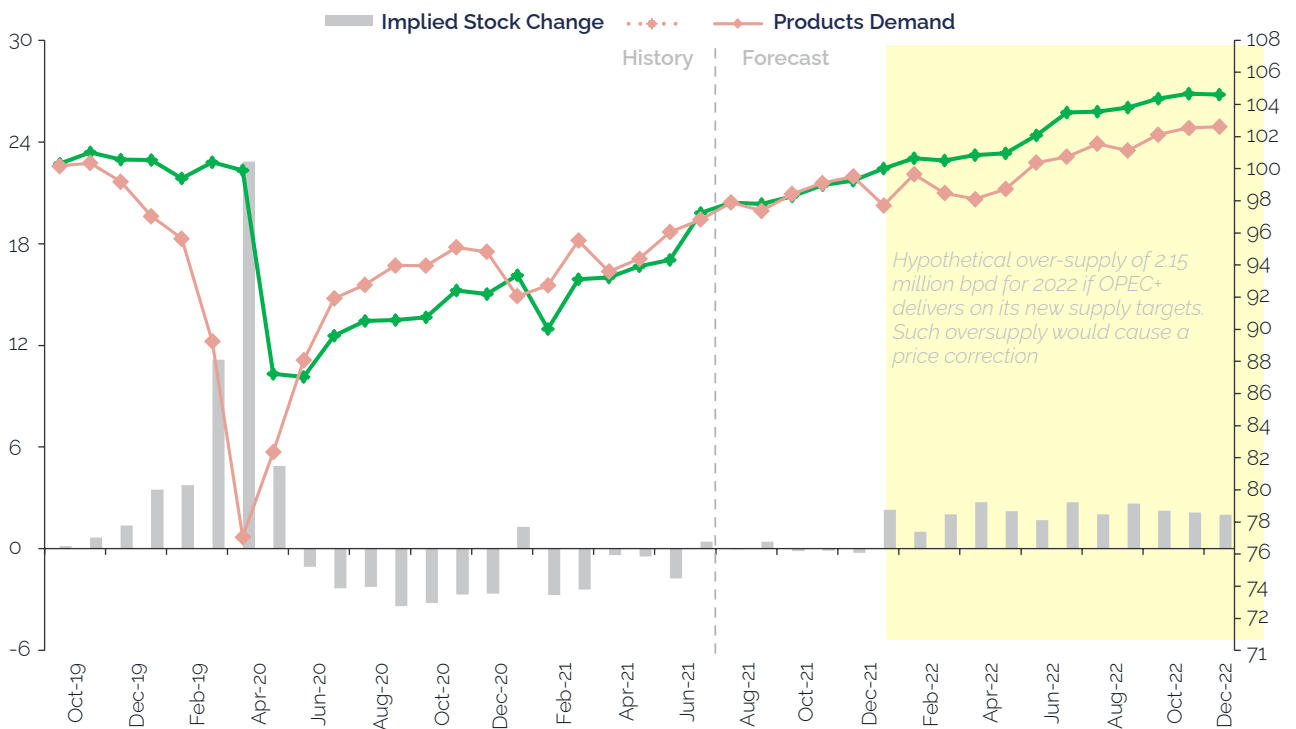


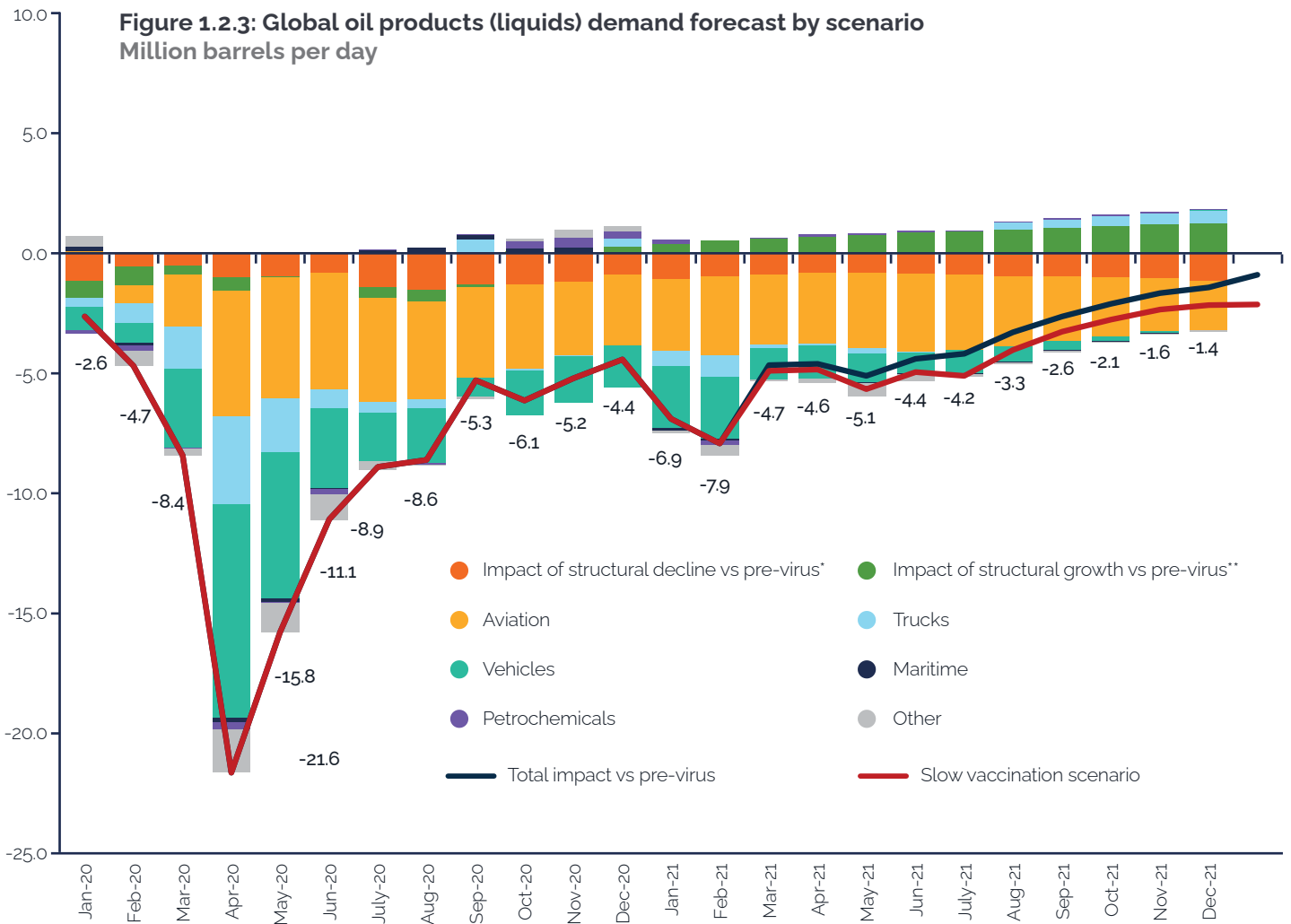
Figure 1.2.2 illustrates the month over month market imbalances with corresponding stock builds or stock draws. The disastrous month of April 2020 saw unprecedented market turmoil resulting from various economies entering lockdown, the effect of which was compounded as OPEC and Russia increased production resulting in an oversupply situation of about 23 million barrels per day. Suppliers globally responded to the oversupply situation and negative prices by curtailing production. OPEC+ and government mandated production cuts saw some

balance restored to the oversupply situation of 2020. Following this, the supply – demand balance was restored or rather moved towards an under-supplied market as restrictions came into force. The remainder of 2020 saw the liquids supply drop down to an average of 90 million barrels per day with demand gradually recovering to an average 91.6 million barrels per day. OPEC+ production quotas remained in place and lockdown restrictions eased out during early 2021, resulting in liquids supply dropping marginally below demand.

Figure 1.2.2: Global liquids supply and demand balances: current base case
 Million barrels per day

Source: Rystad research and analysis; OilMarketCube





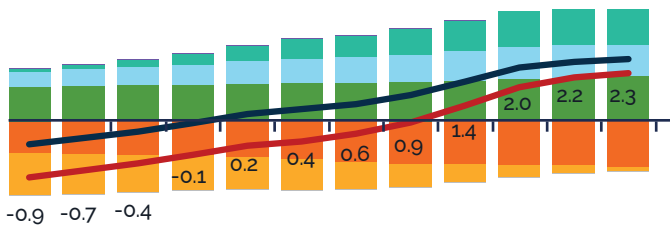
Early 2021 regained further balance but the COVID-19 second wave across Europe and Asia created further turmoil. The long-lasting effects of this second wave in Europe and the new outbreaks in Asian countries slowed down oil demand recovery in 1H21. However, the demand recovery can be expected to speed up in the second half of the year, prompted by increased internal mobility as the rates of vaccinated people increase globally. Although a seasonal increase of flight activity is currently observed, global jet fuel demand levels re-

main substantially low, and international aviation restrictions undermine a prompt recovery of jet fuel demand. Overall, 2021 is estimated to see a balanced situation where supply meets demand.

So far in the second half of 2021 China has witnessed a surge in COVID-19 cases and certain regions in India are showing a worrying trend of COVID-19 cases, with risks of further restrictions ever present. As such, going forward towards 2022 there remains some uncertainty around how the virus outbreak will

unfold, how economies will react and ultimately what the impact will be on oil markets. As health experts around the world suggest vaccination to be one of the strongest barriers against the spread of the virus, a slow vaccination trend can be dangerous. Figure 1.2.3 illustrates a potential view of what can happen should the global vaccination process see a slow progress resulting in further spread of the virus. The base view is a gradual increase in demand throughout 2021 to reach the pre-COVID demand levels by late 2021.

Source: Rystad research and analysis



*Structural declines represent legacy declines regardless of Covid in the following sectors: agriculture, industry, energy own use, buildings, non-energy use and power
 Structural growth represents growth regardless of Covid in the following sectors: buses, maritime and petrochemicals. * Pre-virus levels are 2019 demand for the corresponding month of the year. Other sectors include: agriculture, buildings, energy own use, industry, non-energy use and power.

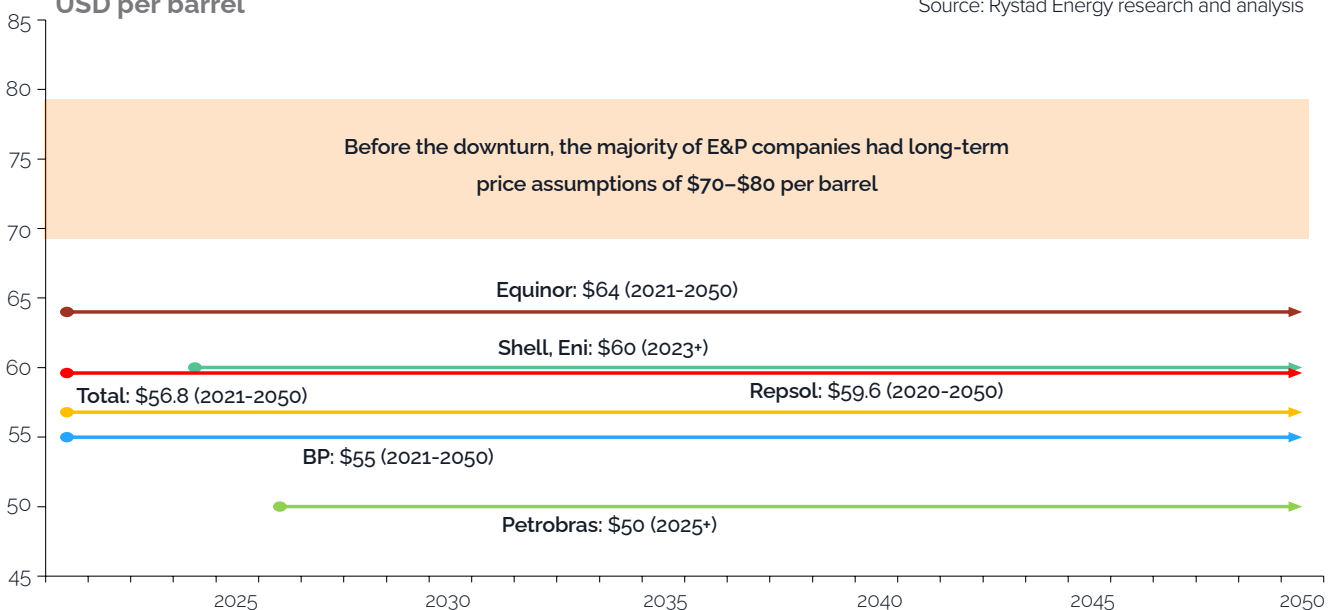
Provided that the demand outlook is in line with the base view, the lag can be expected to become very apparent in 2022 if OPEC+ sticks to its current plan to increase production by 400,000 bpd per month and then introduce higher quotas for the “Chosen 5” – Saudi Arabia, Russia, Iraq, Kuwait, and the UAE – in May-22.

Overall, across the oil price expectations of leading E&Ps the general consensus appears to be a downwards revision in oil price outlook, yet the overarching view is that the price will remain north of 50 USD/bbl. Such a price level is supported by the cost of bringing new volumes to the market. Figure 1.2.4 compares the communicated oil price outlooks from the latest updates.

Jan-22 Feb-22 Mar-22 Apr-22 May-22 Jun-22 Aug-22 July-22 Sep-22 Oct-22 Nov-22 Dec-22

Figure 1.2.4: Long-term oil price assumptions very similar across majors
 USD per barrel

Source: Rystad Energy research and analysis



1.3. Gas Market: **Gas prices set to increase** on the back of strong global demand.

Demand and supply to recover after taking a hit in 2020 due to COVID-19 and a supply shortfall in 2021

Major reference prices to remain on the higher side due to new LNG supply delays, exemplified in the recent escalation in gas prices during 2021, also impacted by pipeline flows

Both gas demand and gas production have consistently grown over the last decade, representing a trend that is expected to continue going forward as global decarbonisation efforts intensify. However, last year witnessed a drop due to COVID-19 restrictions impacting gas demand and supply, which fell by 3% and 4% respectively. As illustrated in figure 1.3.1 the majority of the reduction in gas production came from Russia, followed by North America. Demand from Asia remained resilient while dropping slightly for most of the other continents including North America, Russia, and the Middle East.

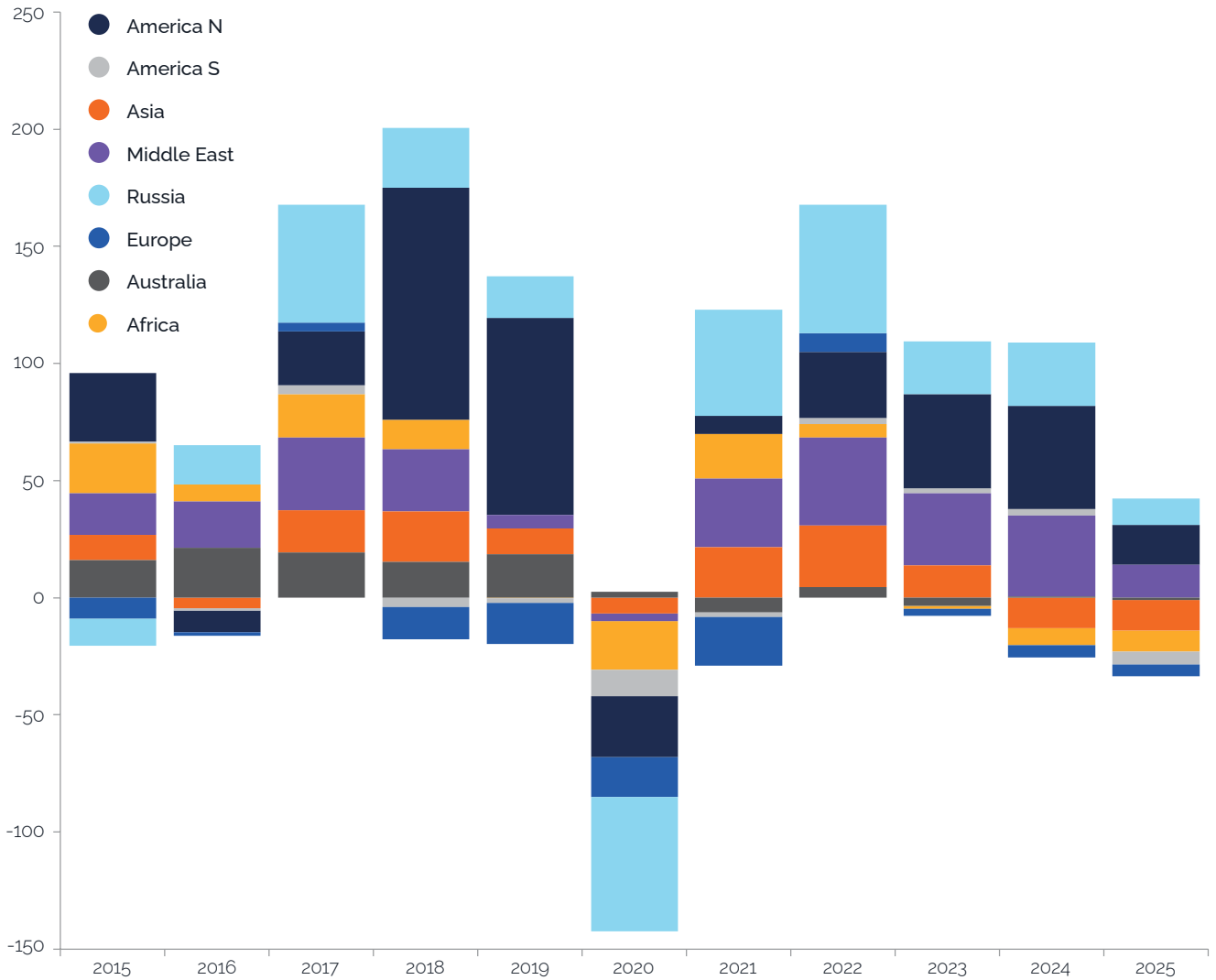
Apart from the immediate gas produc-

tion curtailments, several LNG projects also faced sanctioning delays and expected first gas. One such case is the 13 MMtpa Mozambique LNG project in Area 1, the start-up of which is likely to get delayed significantly as the country handles threats from insurgency. That said the project is still anticipated to go ahead and the status remains suspended. Sanctioning of the other Area 4 project, the 15 MMtpa Rovuma facility, has also been delayed. On the back of LNG supply delays, the long-term outlooks for TTF and Asia LNG prices have increased and a peak in gas price is expected in 2025. As new projects come online by 2027, the gas prices will see some downward pressure.



Figure 1.3.1: Gas Market
Gas supply growth by continent - Bcm

Source: Rystad Energy UCube August 2021

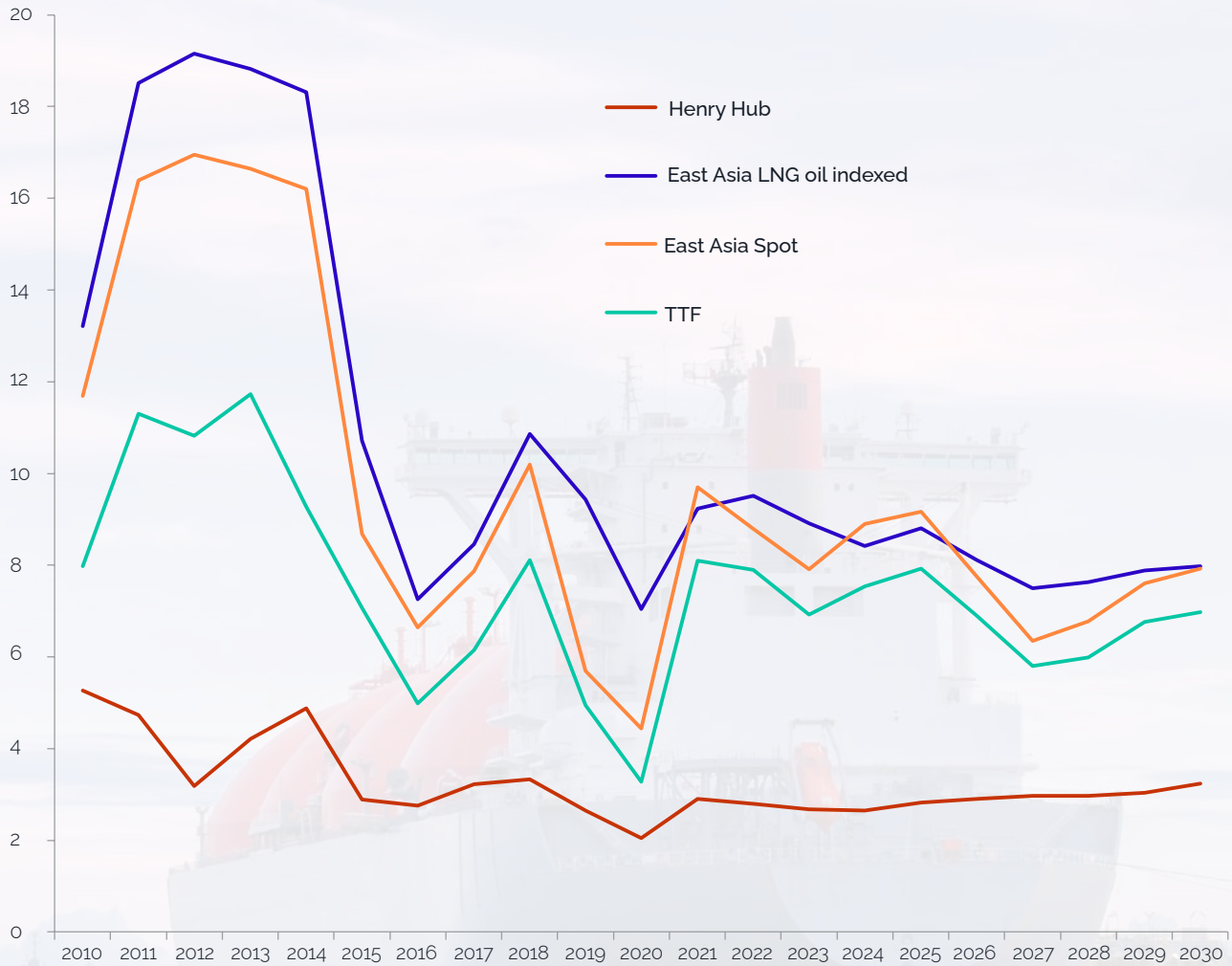


In addition to low European storage levels, Russian gas exports remain lower than expected and consequently the TTF gas prices are expected to be on the higher side. It is estimated that European prices will average \$8.1 per MMBtu in 2021 while Asian LNG prices are expected to average \$9.7 per MMBtu on the back of strong demand.

Figure 1.3.2: Gas Market

Historical gas reference price and outlook to 2030 – USD/MMbtu

Source: Rystad Energy UCube August 2021

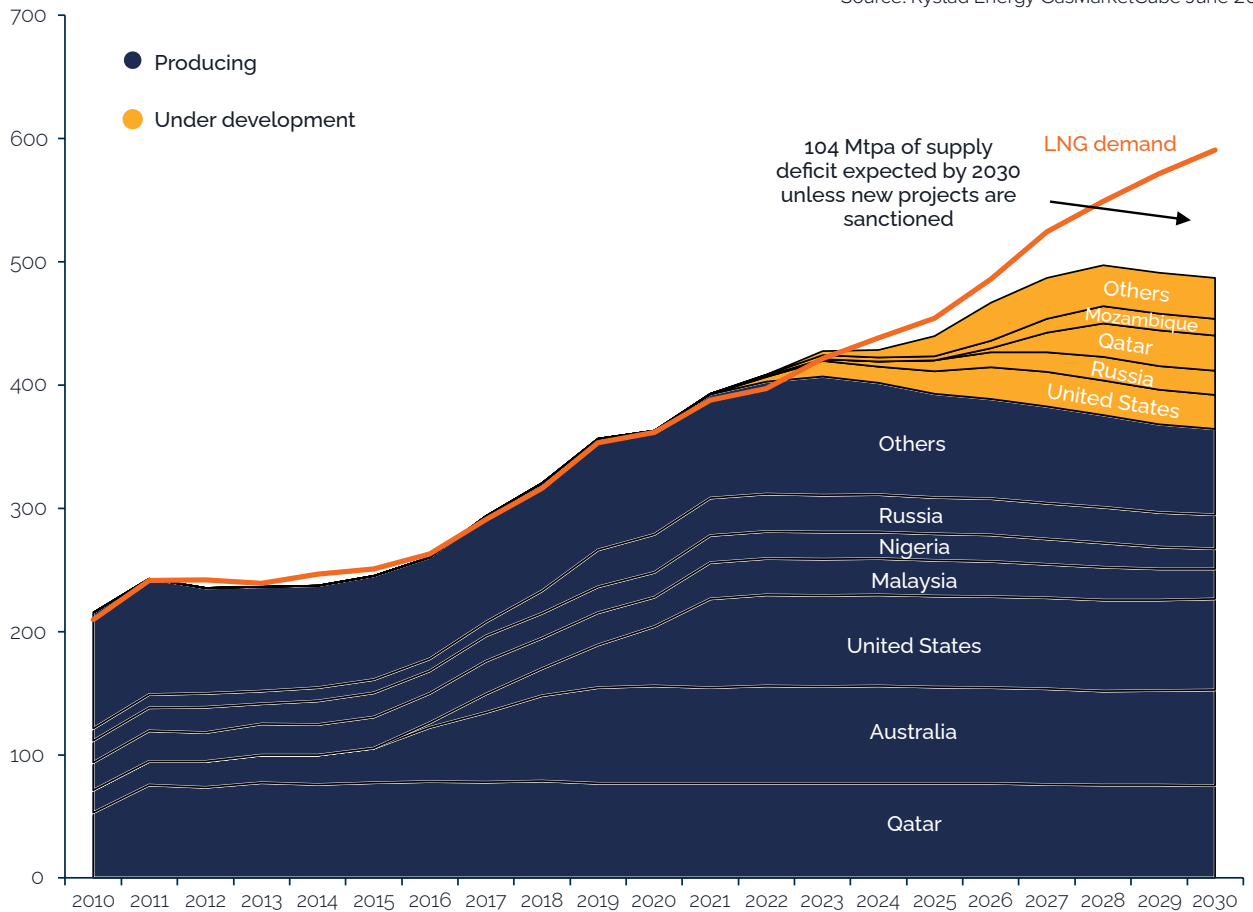


For the next two years, there is sufficient LNG supply to satisfy the demand, as new projects come online in 2022 such as Coral FLNG in Mozambique, Tangguh Train 3 in Indonesia, and Calcasieu Pass in the US. During this time, LNG demand is expected to grow at a healthy CAGR of 5%. Despite the start-up of key LNG projects

including Arctic LNG 2, Golden Pass, Nigeria LNG Train 7 and Qatar's North field expansion project, a supply deficit is expected from 2024 onwards, displayed in Figure 1.3.3. This is driven mainly by strong demand resulting from gas-fired power generation as increased environmental pressure stymies coal-fired generation.

Figure 1.3.3: Gas Market
Global LNG supply by lifecycle and LNG demand balance- MMtpa

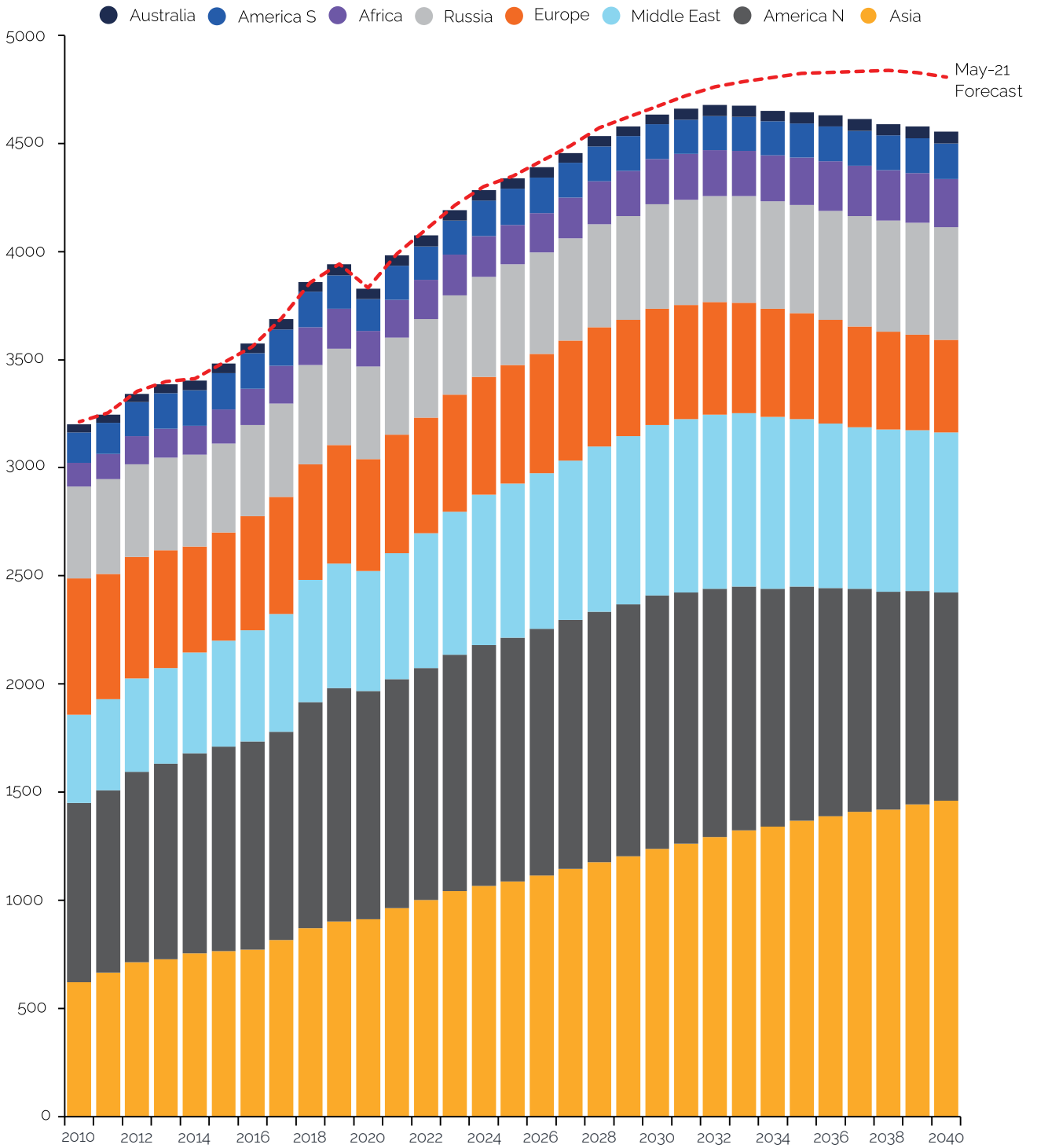
Source: Rystad Energy GasMarketCube June 2021



As greener energy sources attract more attention and mature markets focus on emissions, it is expected that total natural gas demand will be lower than previously estimated. Gas demand is forecast to reach about 4.5 Tcm in 2040, down by roughly 250 Bcm or 5.5% from previous estimates. Peak demand is estimated to have shifted from 2037 at 4.9 Tcm to 2032 at 4.7 Tcm. North America and Europe are estimated to contribute to the majority of the reduction in demand.

Figure 1.3.4: Gas Market
Global natural gas demand by continent- Bcm

Source: Rystad Energy GasMarketCube June 2021



1.4. Impact of COVID-19 on O&G industry

COVID-19 and the subsequent disruption to global markets is estimated to have wiped out close to US\$150 billion of exploration and development expenditure from Africa between 2020 to 2025

Over the last 12 – 15 months, more companies and especially majors have announced strategic revisions with increased focus on the energy transition, cutting down their carbon emissions and in doing so, reduce respective upstream expenditure going forward

While 2021 is expected to see marginally higher upstream investment totaling just over US\$33 billion in Africa, the estimated drop in African upstream expenditure over the years 2022 – 2025 is close to US\$34 billion when compared to the estimates from year-end 2020

The African oil and gas industry has so far been one of the hardest hit in the aftermath spurred by the COVID-19 outbreak. The initial aftereffects of the demand vacuum and price crash caused by the pandemic led to production sanctions imposed by the African OPEC member nations. The initial reaction from the operators included delays to projects with high breakeven prices, reduction of broader capital and operating expenditure, and cashflow neutral forecasts at lower oil price curves. Eni and ExxonMobil have both stated that they were going to focus on developing projects with a breakeven crude price of less than \$35 per barrel. Shell announced that it was going to distance itself from deep water mega-projects off the coast of Nigeria. Many of the projects in Africa that were up for sanctioning were planned assuming an oil price of between \$55 and \$60 per barrel. The oil price crash to below \$35 per barrel revised project economics expectations, especially as some of the top upcoming final investment decisions (FIDs) in Africa have a breakeven crude price of over \$45 per barrel, with some even close to \$60 per barrel. Focusing on reducing project breakevens remains a crucial challenge for the African continent as a whole and should

form a key focus area for governments to center strategies upon.

2021 saw the crude price stabilize well above the lows of 2020. The Chevron operated Sanha lean gas development, the Eni operated Cuica field in Angola, CNOOC operated Kingfisher South project and Total Energies operated Tilenga project onshore Uganda are key projects that have been sanctioned. As a result, capital expenditure in Africa is estimated at approximately US\$33 billion, slightly above the year end 2020 estimates. However, as the Major's long-term strategies regarding the energy transition and carbon emission cuts are announced, upstream investments in Africa over the years 2022 – 2025 are expected to be cut down by about US\$34 billion compared to the year-end 2020 estimates.

The level of post-FID greenfield investments has not changed by much compared to the estimates post the most recent pandemic related restrictions, as illustrated in Figure 1.4.2. However, lower sanctioning activity and reduced brownfield investments during the years 2022 – 2025 are expected to drive down overall capital expenditure in Africa during the period

Figure 1.4.1: Contraction in African investment outlook
 African upstream capex (including exploration), October 2020 estimates vs. current estimates (2021 Report) Billion USD, nominal

Source: Rystad Energy UCube August 2021

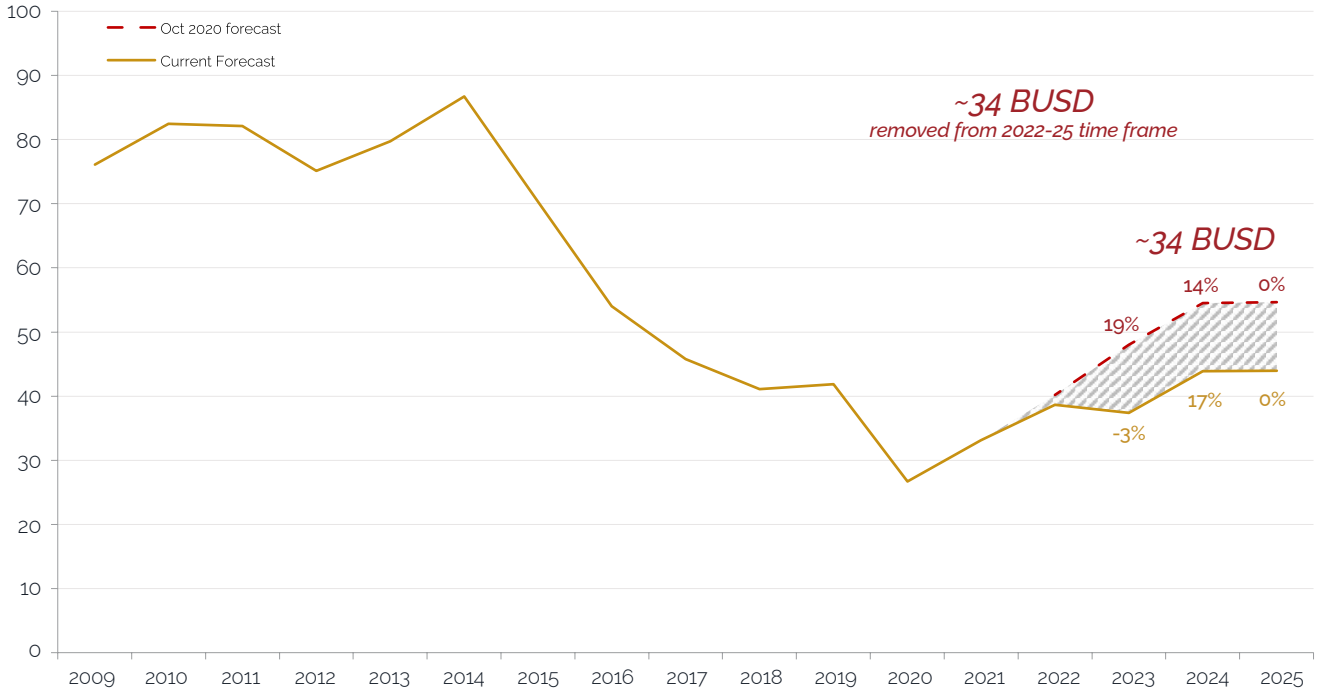


Figure 1.4.2: Impact of COVID-19 on expenditure in Africa, before v after COVID-19, split by lifecycle
 Billion USD

Source: Rystad Energy UCube August 2021

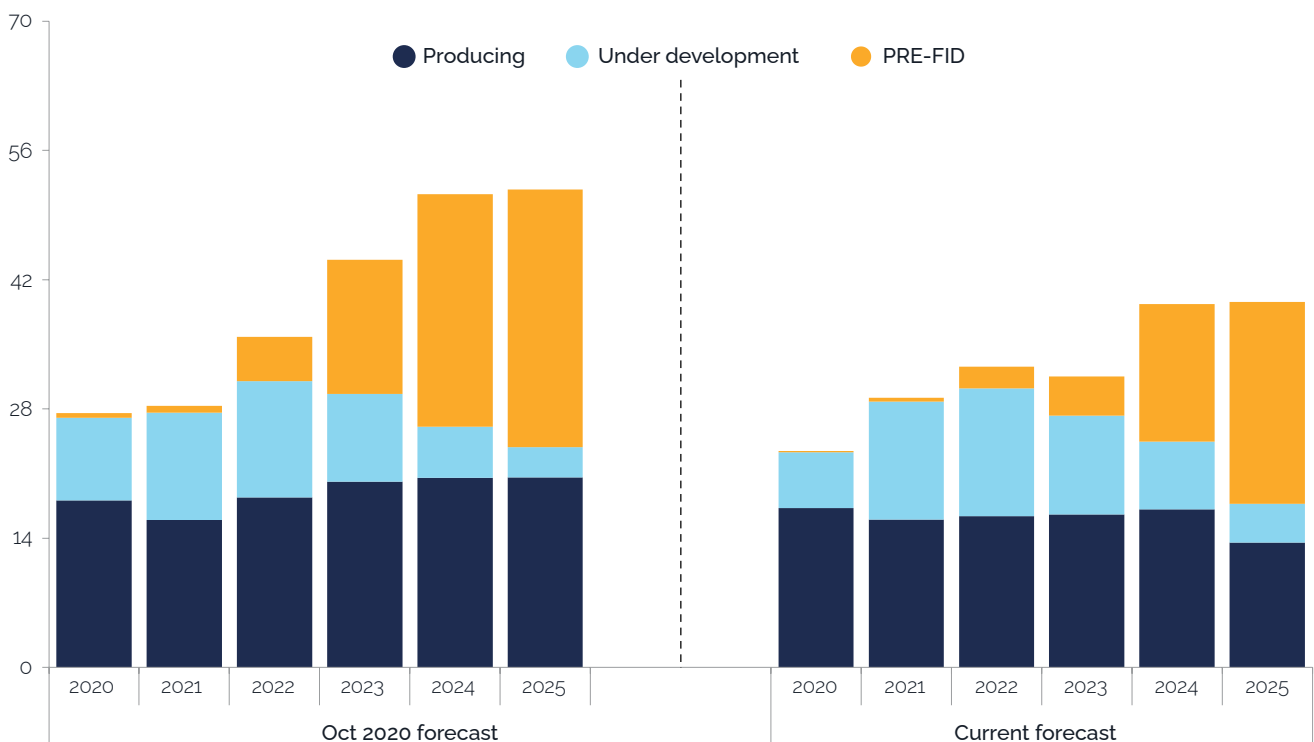


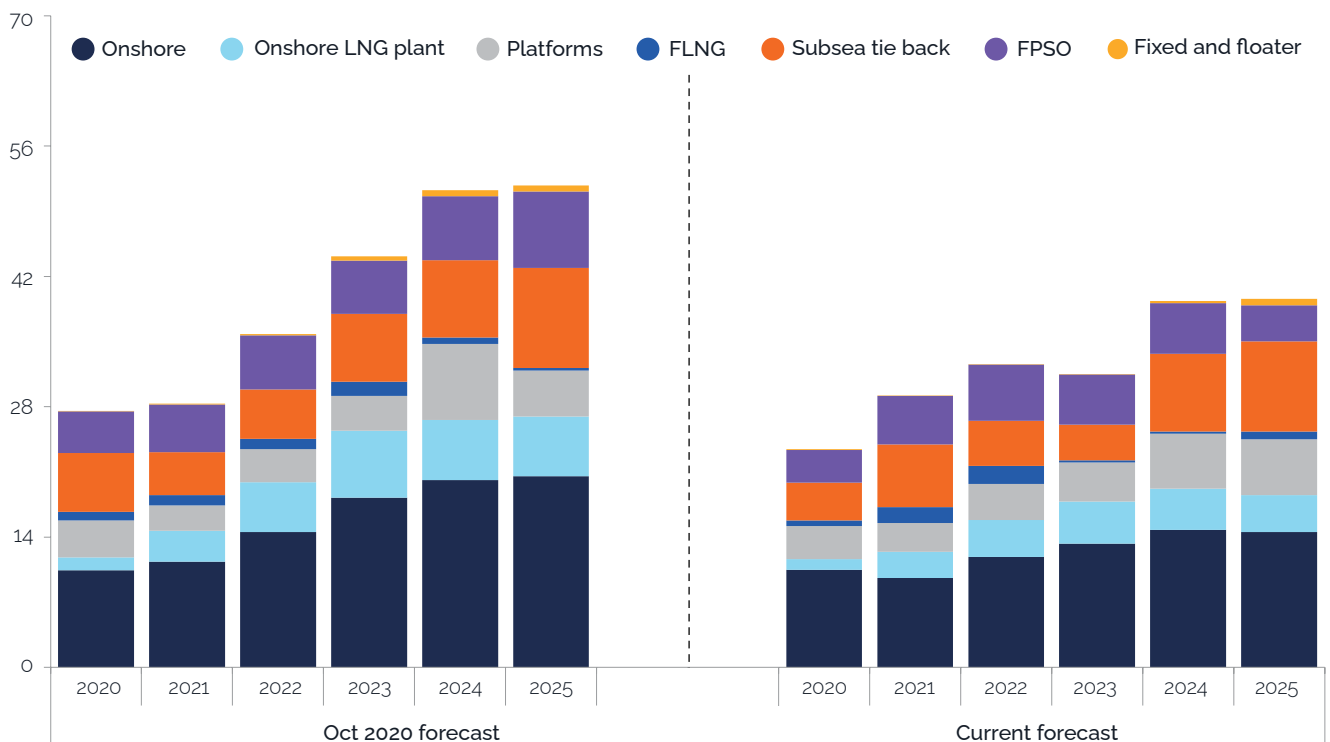
Figure 1.4.3 below further breaks down the changes in upstream expenditure expectation comparison between the October-2020 forecast and the latest forecast. Lower onshore brownfield spending and down-sized LNG spending in Mauritania are the drivers behind the reduced onshore capital expenditure. Cost intensive deep-water spending was on the chopping block as well, resulting in reduced investments on FPSO – subsea tieback projects. Marginal changes are expected in spending

on projects developed using various kinds of platforms and FLNG vessels, with the overall impact represented through lower spending in the latest forecast compared to the year end – 2020 forecast.

Lower oil price expectations may shave off growth potential as projects are deemed commercially unviable and/or deferred further out in time. At the current expected crude price forecast, investments are expected to rebound to 2019 levels by 2024.

Figure 1.4.3: Impact of COVID-19 on expenditure in Africa, before v after COVID-19, split by facility type
 Million USD

Source: Rystad Energy UCube August 2021





Source: : Rystad Energy UCube August 2021

However, the pandemic has spurred governments like Nigeria to accelerate the long delayed administrative and fiscal reforms in the country, namely the long awaited and hugely significant Petroleum Industry Bill which has been signed into law in July 2021. Nigeria also concluded its marginal field bid round during the pandemic which resulted in the award of 57 marginal fields and the agreements are expected to be completed soon. Many other African nations can also be expected to float exploration blocks. The economies of the hydrocarbon-producing African nations are heavily reliant on their respective output to meet both domestic energy needs and exports. As the possibility of additional market pressures from the pandemic looms closer, an extended period of low crude prices could prove detrimental to the health of these economies. Swift action to improve the outlook for investments in a lower oil price environment could serve to benefit the African continent, yet this is contingent upon rapidly implementing further incentives for development.

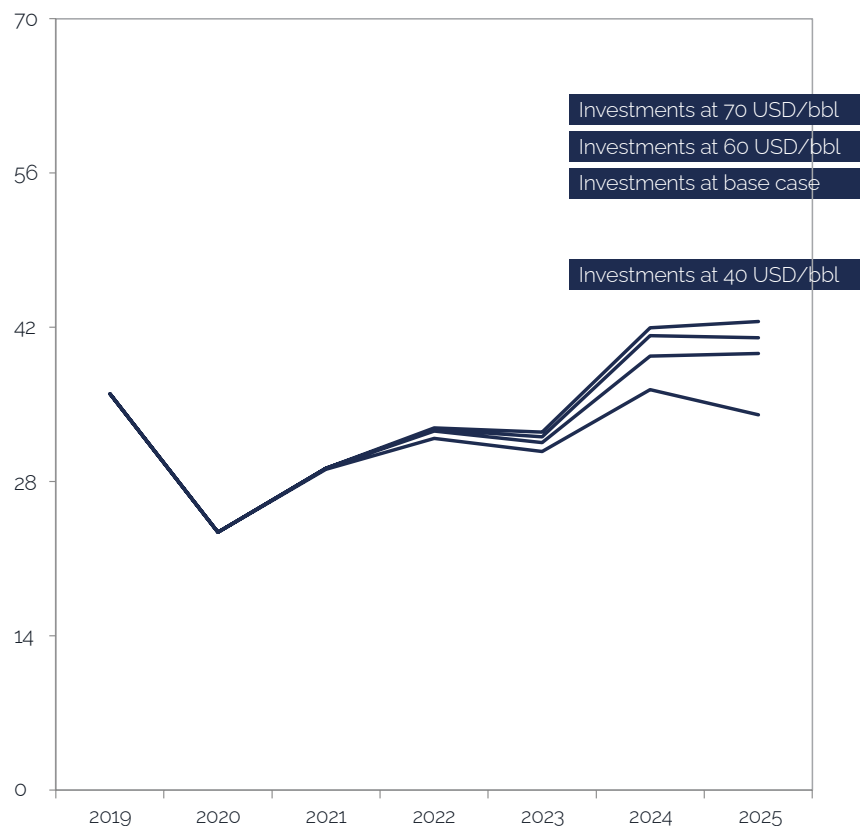


Figure 1.4.4: Investment outlook sensitivity to oil price scenario
Billion USD

Chapter Two

2.1. State of African energy industry in 2022

Upstream capital expenditure halved from US\$60 billion+ levels in 2014 to an estimated US\$33 billion in 2022

Drilling activity is expected to fall to about 950 wells per year in 2022 versus the 1475 wells drilled in 2012

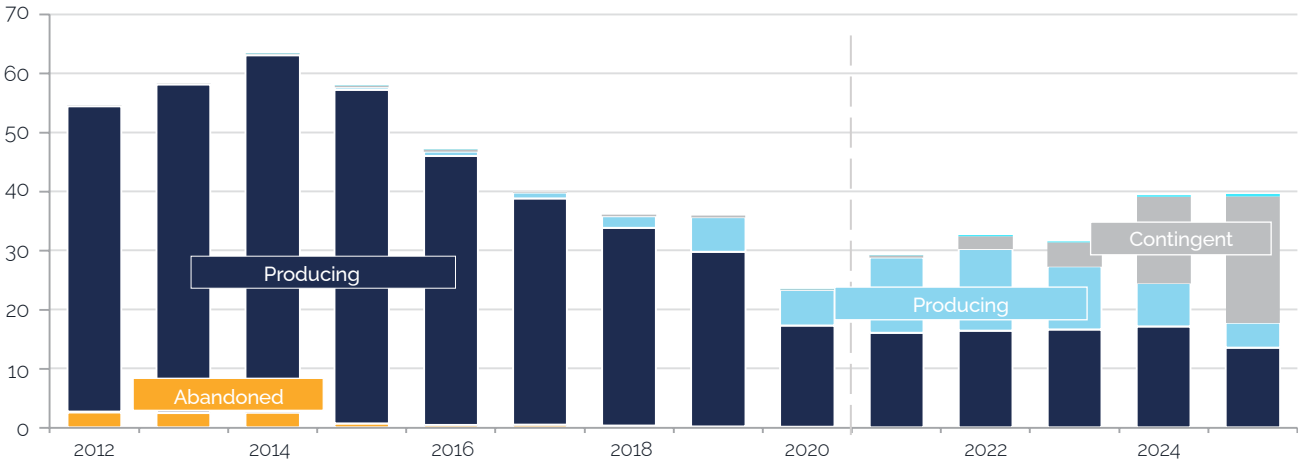
2021 offshore rig demand cut by 22% versus 2020, but 2022 demand estimated to double from 2021 levels, spelling out a busy market for drilling service providers

From the peak in 2014 at about US\$63 billion, capital expenditure in Africa steadily declined to about US\$35 billion by 2019. This decline is a result of lower activity from new projects, general cost compression in the industry and friction in getting new projects sanctioned due to external influences such as export route disagreements and fiscal parameters. Going into 2020, expenditure dropped further to below US\$24 billion, representing an almost 35% drop versus 2019. The impact of COVID-19 is the main culprit as the pandemic deferred investment decision on many projects. As some greenfield investments return, 2021 is expected to be better than 2020 but still under

2019, with overall capital expenditure estimated to be US\$30 billion. It is expected that currently under development projects will lift capex in 2022 to US\$33 billion. The spending level is expected to stay relatively flat for the years 2022 – 2023 and any growth in 2024 – 2025 is expected to come from contingent expenditure. Ensuring such contingent investment takes place is in the hands of the decision makers capable of incentivizing projects through innovative deal structuring and collaboration efforts. The fruits of such labor could reward the continent with an additional US\$40 billion of investment, critical for sustaining the longevity of the oil and gas industry.

Figure 2.1.1: African upstream capex, 2012-2025, split by life cycle Billion USD

Source: Rystad Energy UCube August 2021

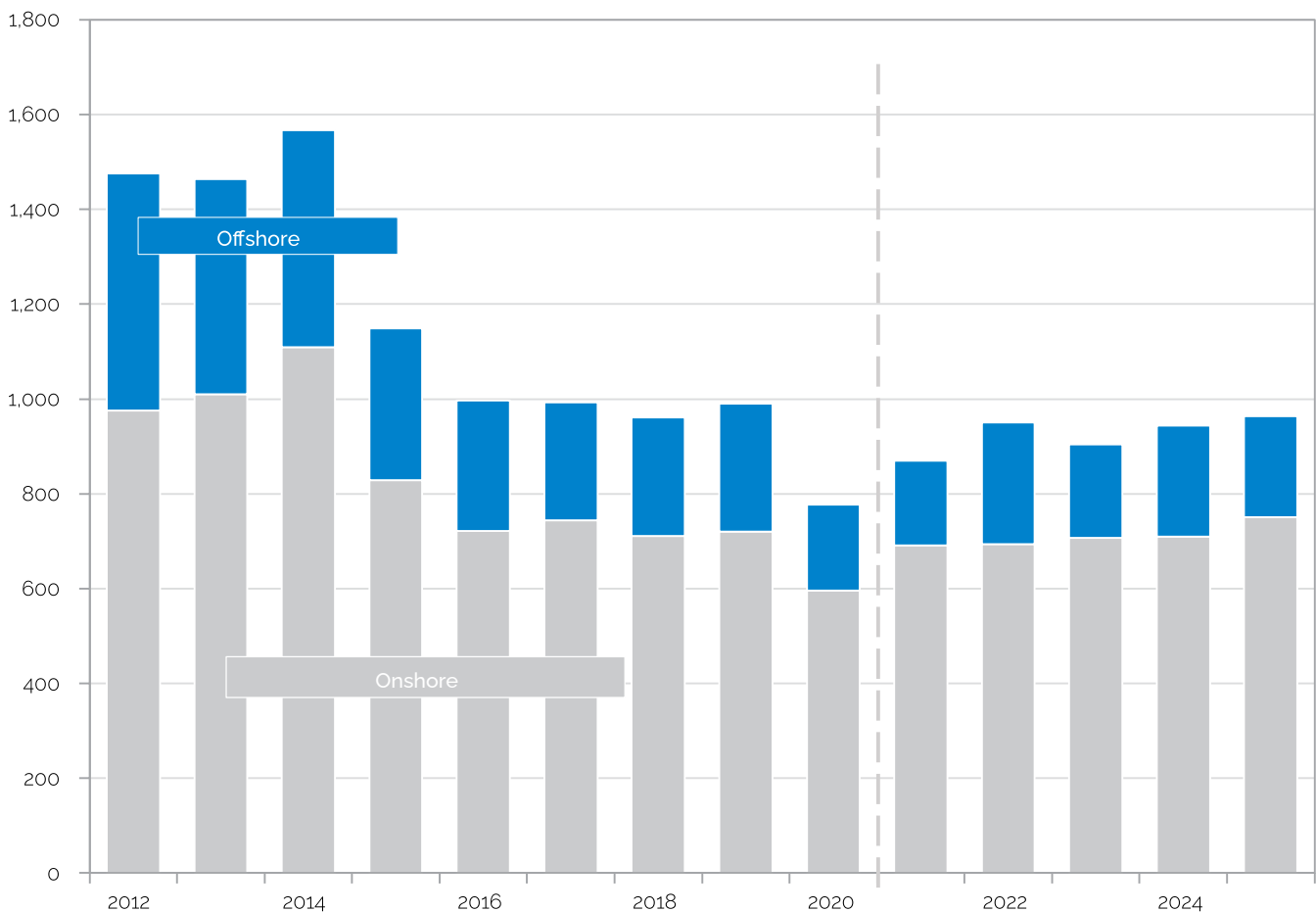


Wells drilled in Africa and associated continental shelves ultimately represent the activity that ensures hydrocarbon recovery from its underground deposits. Figure 2.1.2 below illustrates how an estimated 1475 wells were drilled during 2012 with 66% drilled onshore and the remaining 34% drilled offshore. From 2012 – 2014 there was a slight increase in the overall number of wells drilled, but the oil price drop in 2014 led to a sharp decline in drilling activity, falling from approximately 1570 wells in 2014 to close to 1150 in

2015. In 2016, further declines ensued with around 1000 wells drilled and the trend remained flat till 2019, overall representing a 45% drop-in activity versus 2012. Reduced drilling activity onshore Libya and Egypt are the main drivers behind this decline. COVID-19 then did what years of civil war could not – it brought a complete halt to offshore drilling in Angola and the overall wells drilled in 2020 fell further down to an estimated 780 wells, a mere 53% of 2012 levels and just under 50% of 2014 activity levels.

Figure 2.1.2: Wells drilled in Africa, split by on/offshore Count

Source: Rystad Energy WellCube August 2021



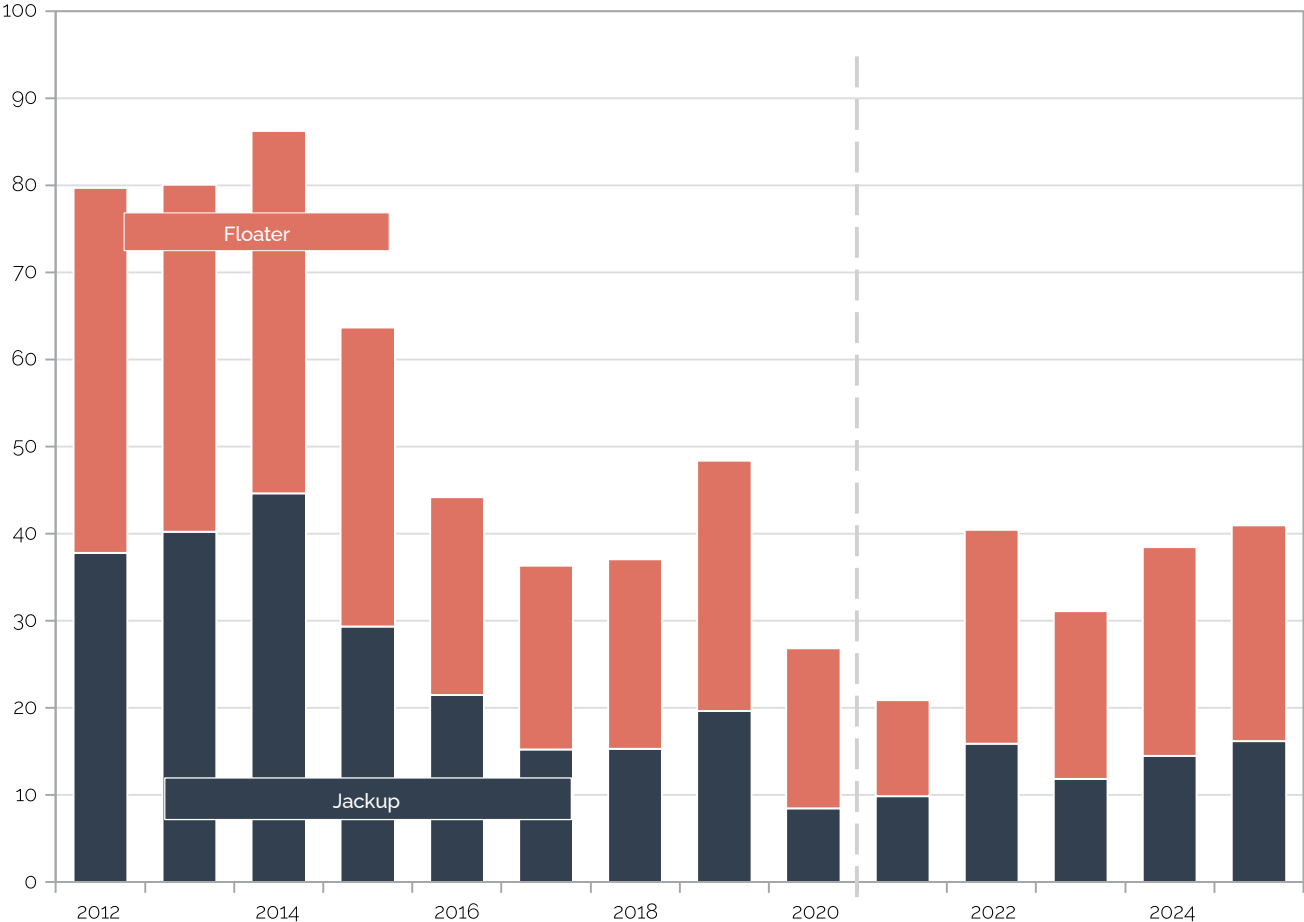
Going into 2021, activity is expected to slightly improve from 2020 levels as onshore drilling picks up. The current estimate indicates about 950 wells are to be drilled, representing a year-on-year increase of about 9%. Beyond 2021 there is limited respite expected until 2025 with the number of wells hovering around 900 – 950 per year.

The number and type of wells can be

translated into rig demand expectations. In other words, how many drilling rigs have to be operational for a year in order to drill the wells. Figure 2.1.3 below illustrates offshore rig demand split by jackups and floaters. Jackups are typically used in shallow water with water depth up to 125 meters while floaters serve drilling demand in deeper waters.

Figure 2.1.3: African offshore rig demand evolution, 2012-2025, split by floater / jackup
Rig years

Source: Rystad Energy RigCube August 2021



The rig demand pattern is similar to what was observed in the estimated number of wells drilled per year. From a high level of demand in 2012 to 2014 of about 80 – 85 rig years, the late 2014 oil price collapse reduced drilling demand significantly. By 2018 demand was down to 37 rig years implying a reduction of 53% from 2012 and 57% from the highs of 2014. In that respect, 2019 was a more promising year as demand increased towards 50 rig years representing an increase of almost 30%.

At the start of 2020, demand was not expected to decline towards and below

2018 levels again, however the unprecedented impact of COVID-19 meant that 2020 levels fell as low as 27 rig years, a year-on-year decline of about 45% and 2021 is pointing to record low rig demand of about 21 rig years.

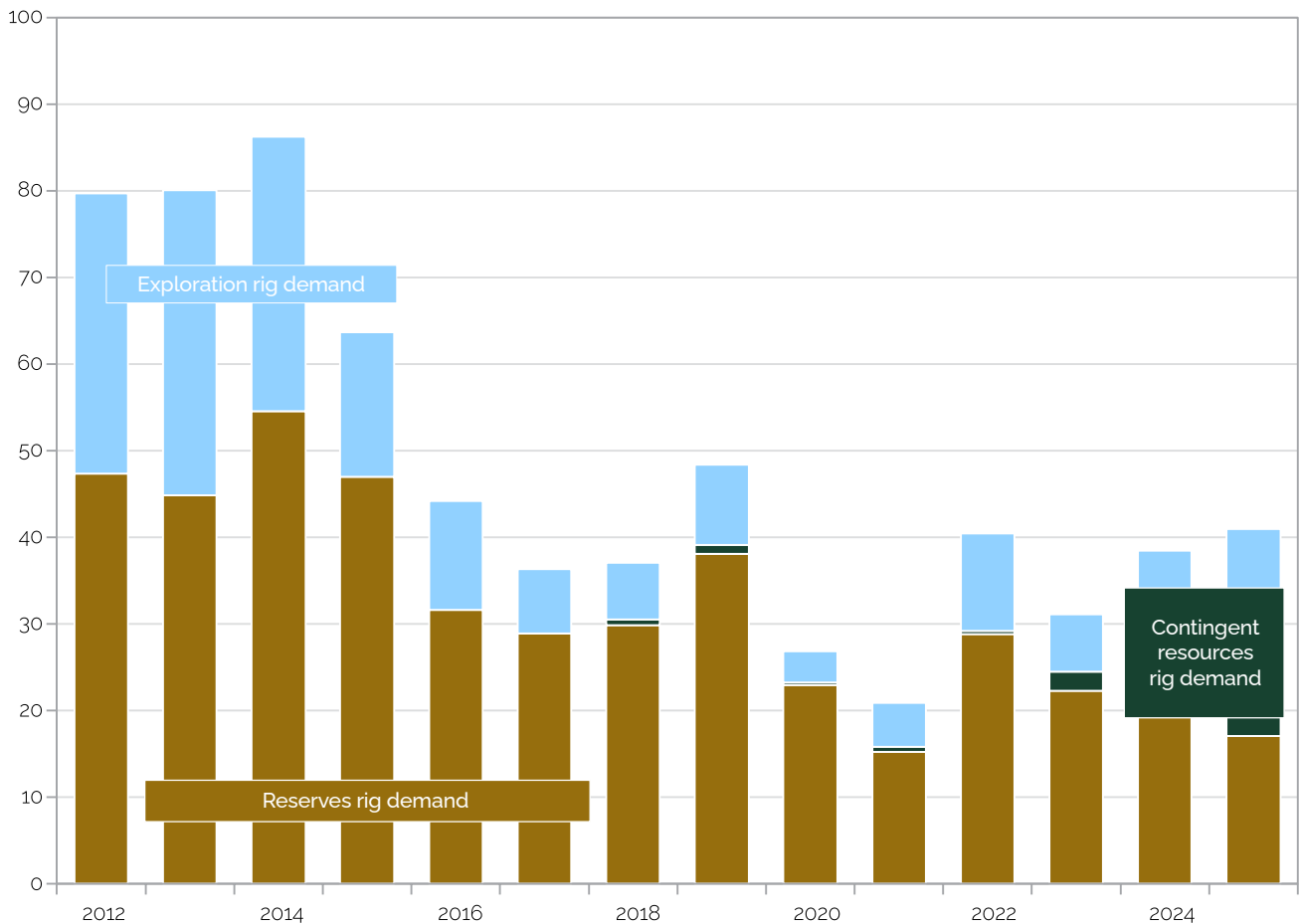
However, from 2022 onwards it is expected that rig demand is to rebound significantly as drilling programs associated with projects currently under development are initiated and a higher oil price expectation helps to revive exploration activity.

Rig demand is expected to decline

slightly from 2022 to 2023 but picks back up to 2022 levels by 2025. Figure 2.1.4 below demonstrates further how the expected growth towards 40 rig years in 2025 is contingent on new projects being sanctioned. Based on the oil price outlook presented in the oil market outlook, the combined potential of these new projects and further exploration activity will be able to propel demand towards pre COVID-19 levels. However, should the oil price not recover it could jeopardize about 60% of the expected 2025 rig demand, representing a devastating blow for future production levels.

Figure 2.1.4: African offshore rig demand evolution, 2012-2025, split by life cycle illustrating contingent resources
Rig years

Source: Rystad Energy RigCube August 2021



Breaking down cumulative offshore rig demand from 2020 to 2025 per country reveals Egypt as the most active country with about 55 rig years followed by Angola and Nigeria. Figure 2.1.5 below provides the breakdown of the top 10 countries by rig demand with associated split on what resource class is supporting the rig demand. For Angola about 45% of the demand is related to contingent resources implying

that rig demand in this particular area is sensitive to investment decisions expected over the next years. Nigeria and Gabon show relatively robust rig demand with only about 20% related to contingent resources. Therefore, the Angolan regulatory authorities should ensure that projects are expedited to provide longer term visibility on future production volumes and the associated government take.

Figure 2.1.5: African cumulative offshore rig demand 2020-25, split by country, clustered columns representing life cycle illustrating contingent resources

Source: Rystad Energy RigCube August 2021

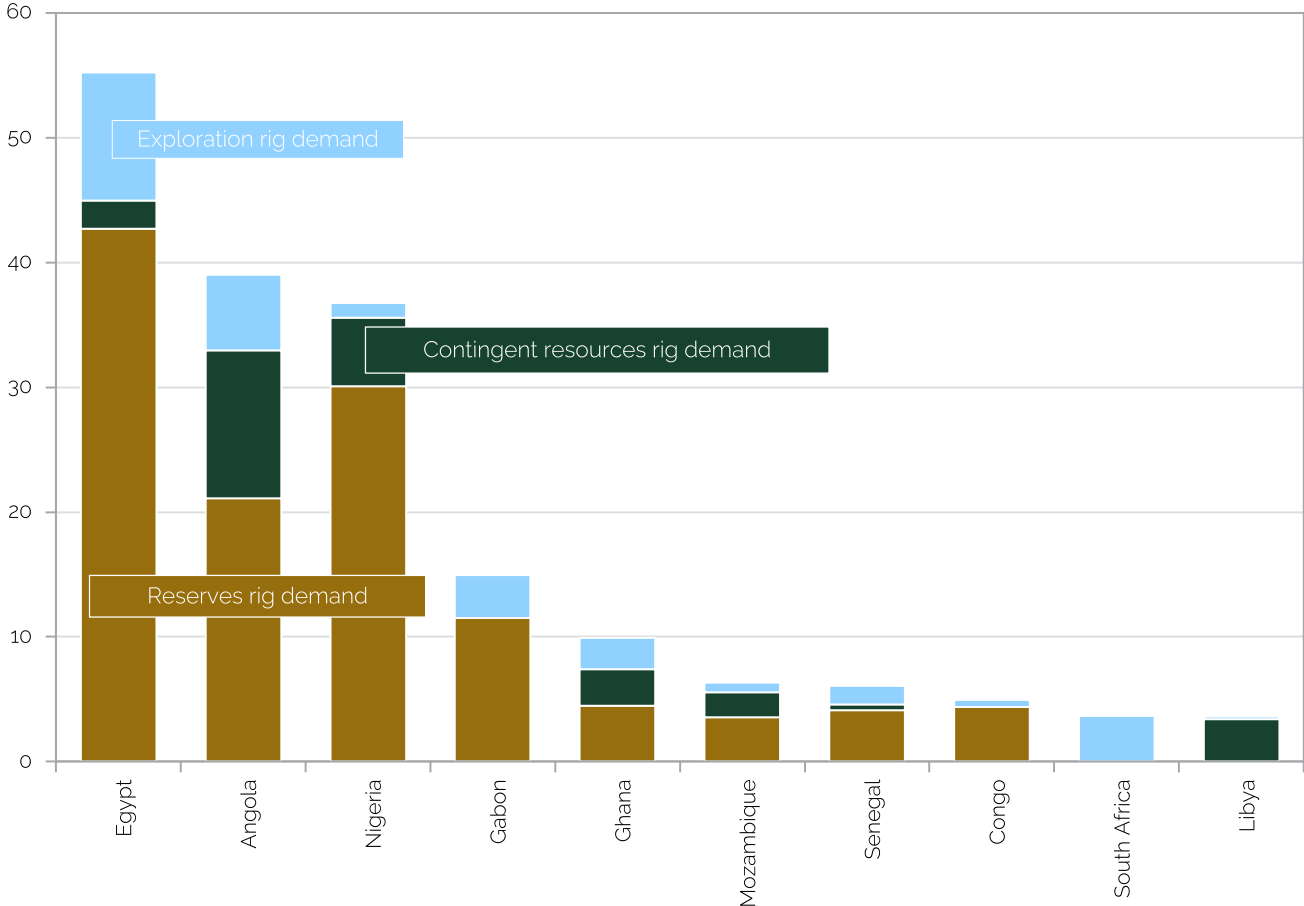
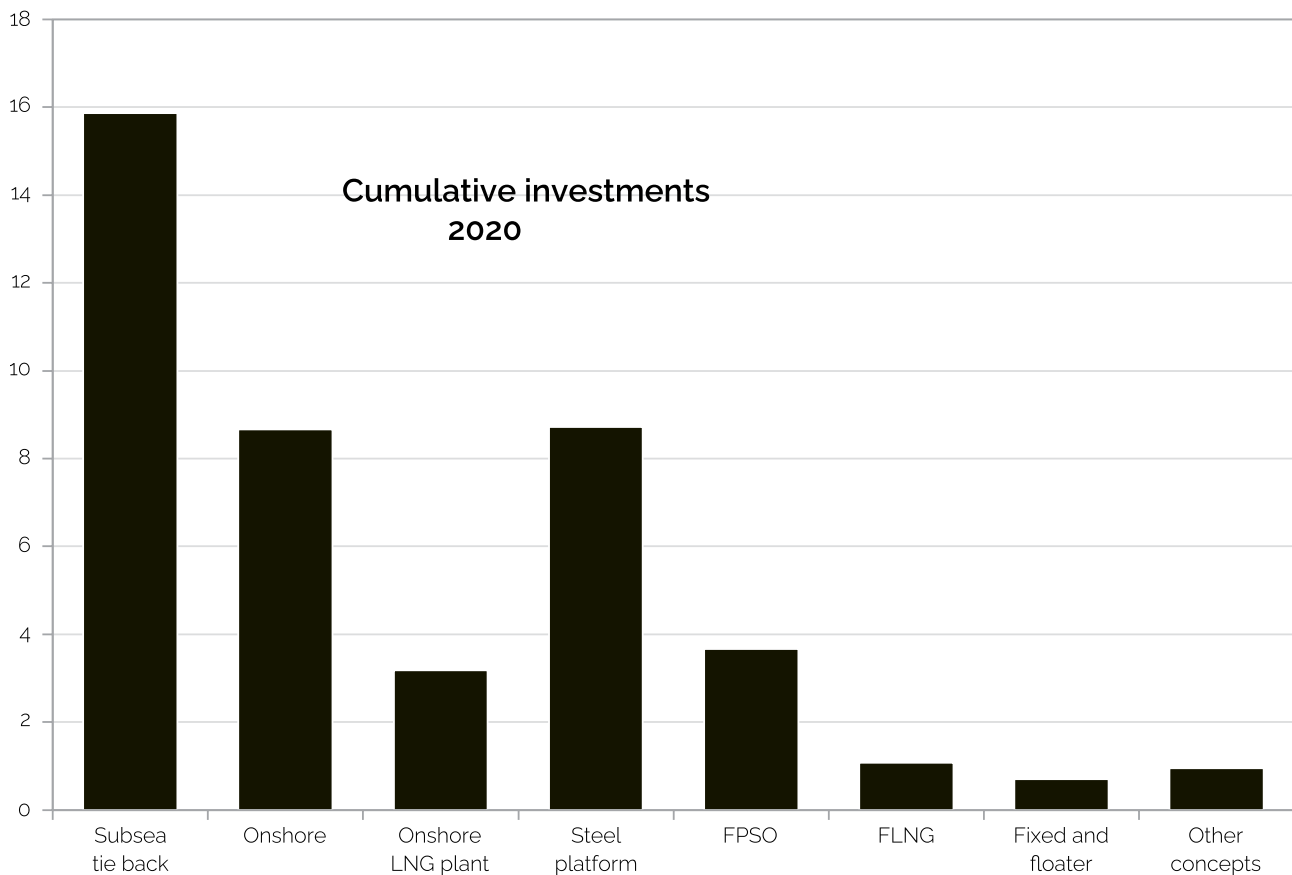


Figure 2.1.6: African contingent expenditure per project type
Billion USD

Source: Rystad Energy UCube August 2021



Investments related to subsea tiebacks is the single greatest category with investments reaching almost US\$16 billion across the period. Subsea tiebacks are likely to be much more common as it makes commercial sense to piggy-back smaller hydrocarbon accumulations on existing infrastructure. This is due to the very competitive breakeven typically achieved from such a development solution. The category also includes the offshore related part of LNG developments which further boosts this category, considering the mega-projects expected in Mozambique.

Investments related to onshore production and offshore platforms both take the second biggest category spot

as the investments in these categories are expected to be about US\$8.7 billion each. Continued drilling of new wells and other improvements are needed to arrest production decline in the mature areas of African onshore production. Contingent investments in many sub-Saharan African countries and Algeria, Libya and Egypt are the main drivers behind this spending.

The third biggest category at US\$3.7 billion relates to investments in FPSOs. It is the Ghanaian and Angolan deep-water projects that are driving these investments.

Africa holds more gas potential in the medium term than oil, with vast gas

discoveries planned to be developed as LNG projects, as can be seen in the list of major projects (Figures 2.1.7 and 2.1.8). From Mozambique and Tanzania in the East to Mauritania and Senegal in the West, the emphasis remains on LNG. Out to 2025, Nigeria is expected to incur the highest expenditure levels followed by Mozambique, as can be seen in figure 2.1.9. Just a year ago, Mozambique would have taken the first spot, but investments have been delayed as the country is impacted by the growing insurgency. TotalEnergies declared a force majeure on its Mozambique LNG project during 2021 as attacks around the facilities increased.

Figure 2.1.7: Upcoming Liquids projects in Africa and their timeline and recoverable reserves estimates

Project	Country	Operator	FID*	Start-up*	Resources (MMboe)
Tilenga	Uganda	TotalEnergies	2021	2025	960
Bonga SouthwestAparo	Nigeria	Shell	2023	2027	632
OwowoWest	Nigeria	ExxonMobil	2024	2027	550
Cameia-Golfinho	Angola	TotalEnergies	2024	2028	286
Afina	Ghana	Springfield E&P	2024	2027	283
Kingfisher South	Uganda	CNOOC	2021	2025	239
Agogo FFD	Angola	Eni	2023	2026	210
Eban (Cape three Points)	Ghana	Eni	2022	2023	180
Egina	Nigeria	TotalEnergies	2022	2025	141
AgademPhase 2	Niger	PetroChina	2021	2024	119
PAJ	Angola	BP	2023	2026	114
RhourdeEl Krouf	Algeria	Cepsa	2022	2025	83
Pecan FPSO	Ghana	AkerEnergy	2023	2026	75
South Lokichar Phase 1	Kenya	Tullow Oil	2023	2026	70
Eastern Hub	Angola	Eni	2021	2021	56

*Rystad Energy estimated timeline

Source: Rystad Energy UCube August 2021

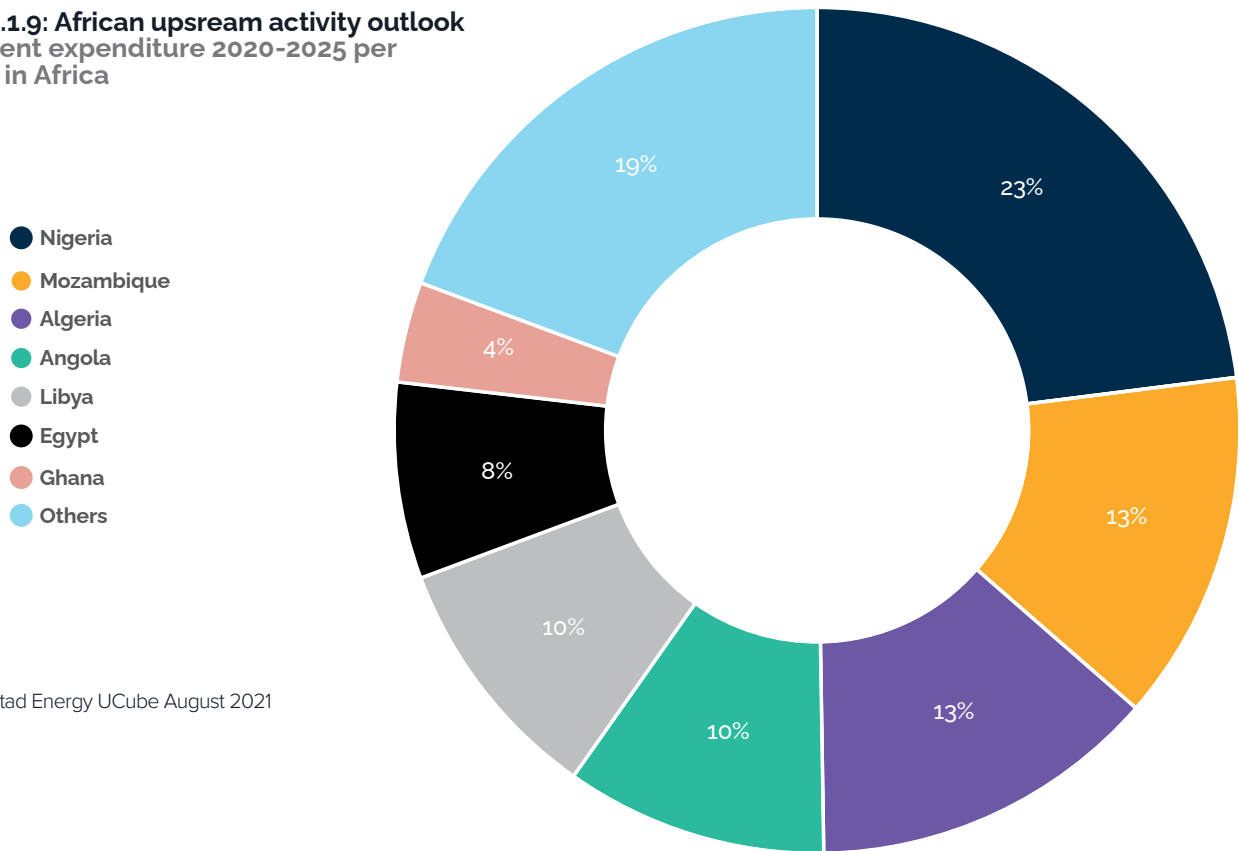
Figure 2.1.8: Upcoming Natural gas projects in Africa and their timeline and recoverable reserves estimates

Project	Country	Operator	FID*	Start-up*	Resources (MMboe)	Liquids	Gas
MZLNG Joint Development(T1 - T2)	Mozambique	ExxonMobil	2028	2033	4625		
Area 1 LNG (T1 - T2)	Mozambique	TotalEnergies	2019	2026	3590		
Area 4 LNG (T1 - T2)	Mozambique	ExxonMobil	2024	2028	2330		
Yakaar - TerangaLNG Hub	Senegal	BP	2028	2033	2145		
NLNG Seven Plus	Nigeria	Shell	2019	2024	1450		
Greater TortueAhmeyimLNG Hub	Mauritania	BP	2023	2027	1480		
Djibouti FLNG T1	Ethiopia	Poly GCL	2025	2029	520		
Assa North	Nigeria	Shell	2025	2028	415		
Tinrhert Gas Project	Algeria	Sonatrach	2022	2024	385		
Fortuna FLNG	Equatorial Guinea	Lukoil	2025	2029	250		
Quiluma/ Maboqueiro (Northern Gas Complex)	Angola	Eni	2023	2025	250		
Yakaar (domestic)	Senegal	BP	2025	2028	215		
HA	Nigeria	Shell	2024	2027	210		
Ima gas	Nigeria	AMNI	2025	2028	185		
Sanha Lean Gas	Angola	Chevron	2021	2023	115		

*Rystad Energy estimated timeline

Source: Rystad Energy UCube

Figure 2.1.9: African upstream activity outlook
Contingent expenditure 2020-2025 per country in Africa

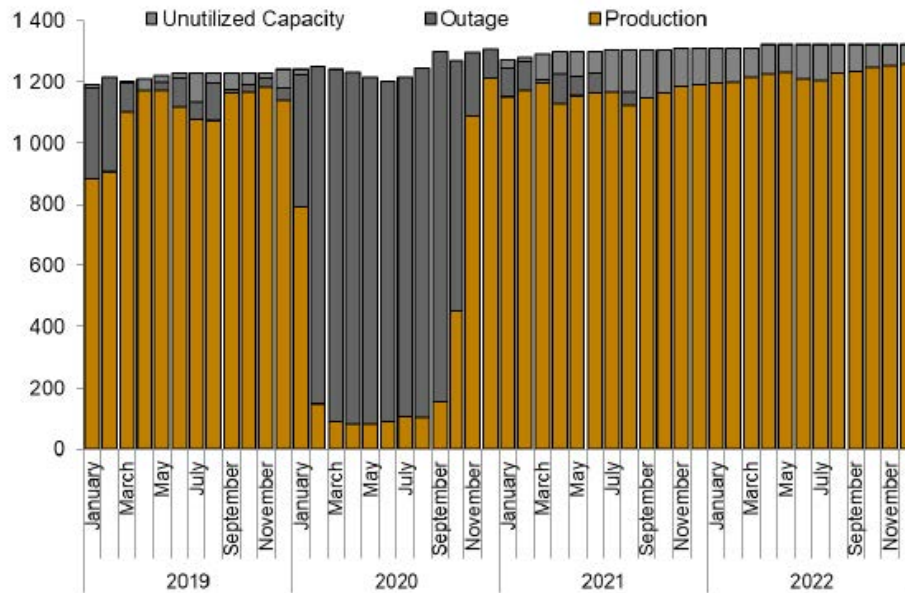


Source: Rystad Energy UCube August 2021

Offshore Sub-Saharan African projects constitute the majority of the upcoming major oil projects in the continent. Such cost-intensive developments have either picked up steam in recent months, like the Bonga SW - Aparo FPSO development offshore Nigeria and Pecan FPSO offshore Ghana or have been granted tax cuts as in the case of Palas - Astraea - Juno (PAJ) and Agogo offshore Angola. Operators in the region have also focused on fast tracking recent discoveries like Cuica and Eban in the deep waters of Angola and Ghana respectively, because of their proximity to existing infrastruc-

ture. In terms of a roundup of the key projects, the TotalEnergies operated Cameia - Golfinho offshore Angola, is currently undergoing pre-FEED work. Preowei will be tied back to Egina FPSO and Springfield operated Afina, which is in the middle of a unitization dispute with Eni's Sankofa round off the major upcoming offshore oil projects in Africa. Tilenga and Kingfisher South operated by TotalEnergies and CNOOC respectively, both located in the landlocked country of Uganda are now approved and will bring online close to 1.2 billion barrels of oil within the next five years.

Figure 2.1.10: Libya's short term production capacity outlook
Kbbl/d



Source: Rystad Energy UCube August 2021

Post break-out of civil war in 2011, Libya's oil and gas industry suffered to a great extent. Country's crude oil production fell from the highs of 1.6 million bpd in 2010 to as low as 70,000 bpd in 2020, as illustrated in Figure 2.1.10. Although Libya was looking stable towards the end of 2019 with crude oil production reaching about 1.2 million bpd but a fresh counterattack staged by General Khalifa Haftar led LNA forces in Jan-20 led to complete chocking of the oil and gas industry in the country. Crude oil production from all the major IOCs and NOC operated assets were shut for almost 10 months. After multiple rounds of negotiations between the warring sides, a peace treaty was signed and country's crude oil production slowly started to ramp-up towards 1.2 million bpd.

But this prolonged 10-months forced shutdown in 2020 had deeper effects

on the Libyan oil and gas industry than just loss of revenue for a year. Mature oil and gas facilities are taking too long to get back to pre-shut-in levels, at the same time mature fields are facing technical difficulties due to the prolonged shutdown. Libya's NOC has been trying hard to bring new investments in the Libyan oil and gas industry but the volatile political scenario in the country isn't helping NOC's campaign. Exploration has also been muted due to this instability as the IOCs shy away from risk. Post restart of oil fields in Oct-20, Libya's crude oil production has been able to cross 1.2 million bpd, however these higher production levels don't look sustainable as every time the production crosses 1.2 million bpd mark there is resurgence of technical issues with oil transportation pipelines or there is strike by the Petroleum Facility Guards.

With Presidential election due in Dec-21 and ongoing tussles between the oil minister and the NOC chief the oil production outlook for Q421 also looks very volatile. Although it is currently estimated that crude oil production will average around 1.18 million bpd in 4Q21, any resurgence of violence in the nation could bring back the NOC to its knees like 2020 and we could see severe production impacts of 700,000 to 800,000 bpd. Slower but continued crude oil production growth through 2022 is expected on the back of formation of a new stable government and allocation of funds to the NOC for maintenance and refurbishment works. Libya's crude oil production is estimated to average around 1.22 million bpd in 2022, which could go to as high 1.3 million bpd if sufficient funds are allocated to major NOC controlled operators like AGOCO and Sirte Oil Company.

2.2 Exploration poised for resurgence in 2022

While 2020 witnessed the second lowest discovered volumes in the past decade, so far in 2021 much lower volumes have been discovered

Only 1 high impact well has been drilled in 2021 which resulted in non-commercial oil flows; 3 more are expected to be drilled before the end of the year

A much more encouraging year is anticipated in 2022 with 13 high impact wells expected to be drilled

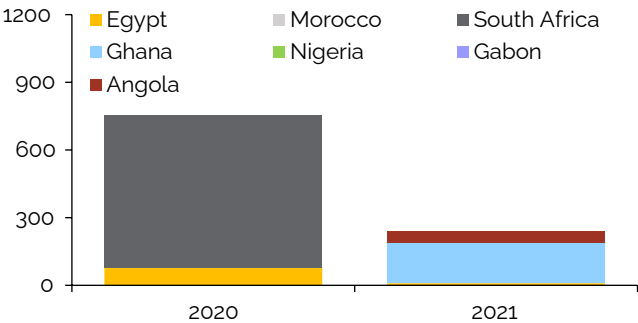
6 licensing rounds are expected to conclude before the end of 2021, with about 92 blocks on offer. During 2022 14 rounds are expected to close, although 7 of these rounds remain uncertain

Similar to project approvals and greenfield investments, Africa upstream exploration also took a major hit due to COVID-19. The devastation was to such extent that it led to offshore rigs left idle in Angola – something that even years of civil war did not do. In 2020, the second lowest volumes of resources were discovered in the last decade. While 2019 saw discoveries in Angola, South Africa, Ghana, Gabon, Egypt and so on, 2020 discovered volumes have been largely supported by the Luiperd gas-condensate discovery offshore South Africa. Despite the 75% decrease in 2020 in overall discovered volumes year-on-year, 2021 so far has been even worse with only a third of the volumes discovered compared to 2020. Figure 2.2.1 shows the overall discovered volumes in 2020 and 2021 (as of September) in different regions and supply segments within Africa, along with the hydrocarbon split.

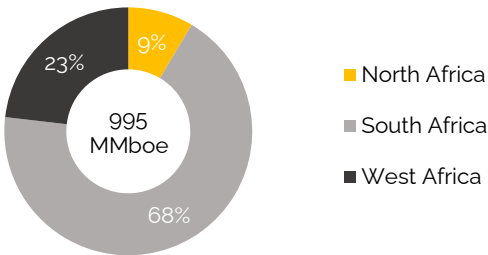
Figure 2.2.1: Discovered volumes in Africa in 2020 – 2021
 Million boe

Source: Rystad Energy UCube September 2021

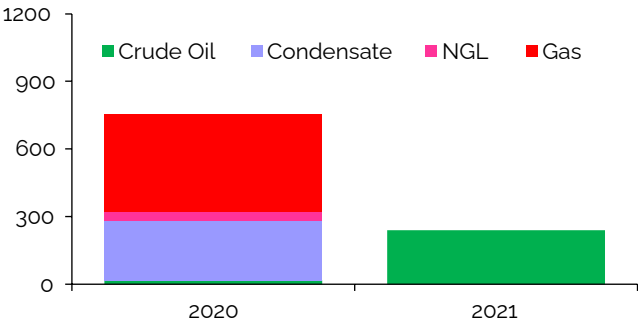
Discovered resources by country



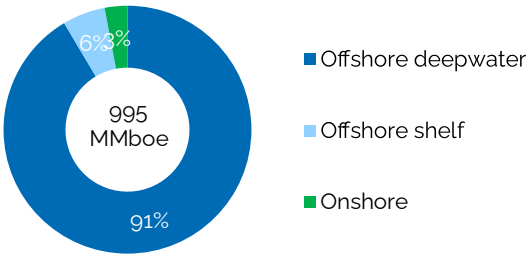
Discovered resources by region



Discovered resources by hydrocarbon



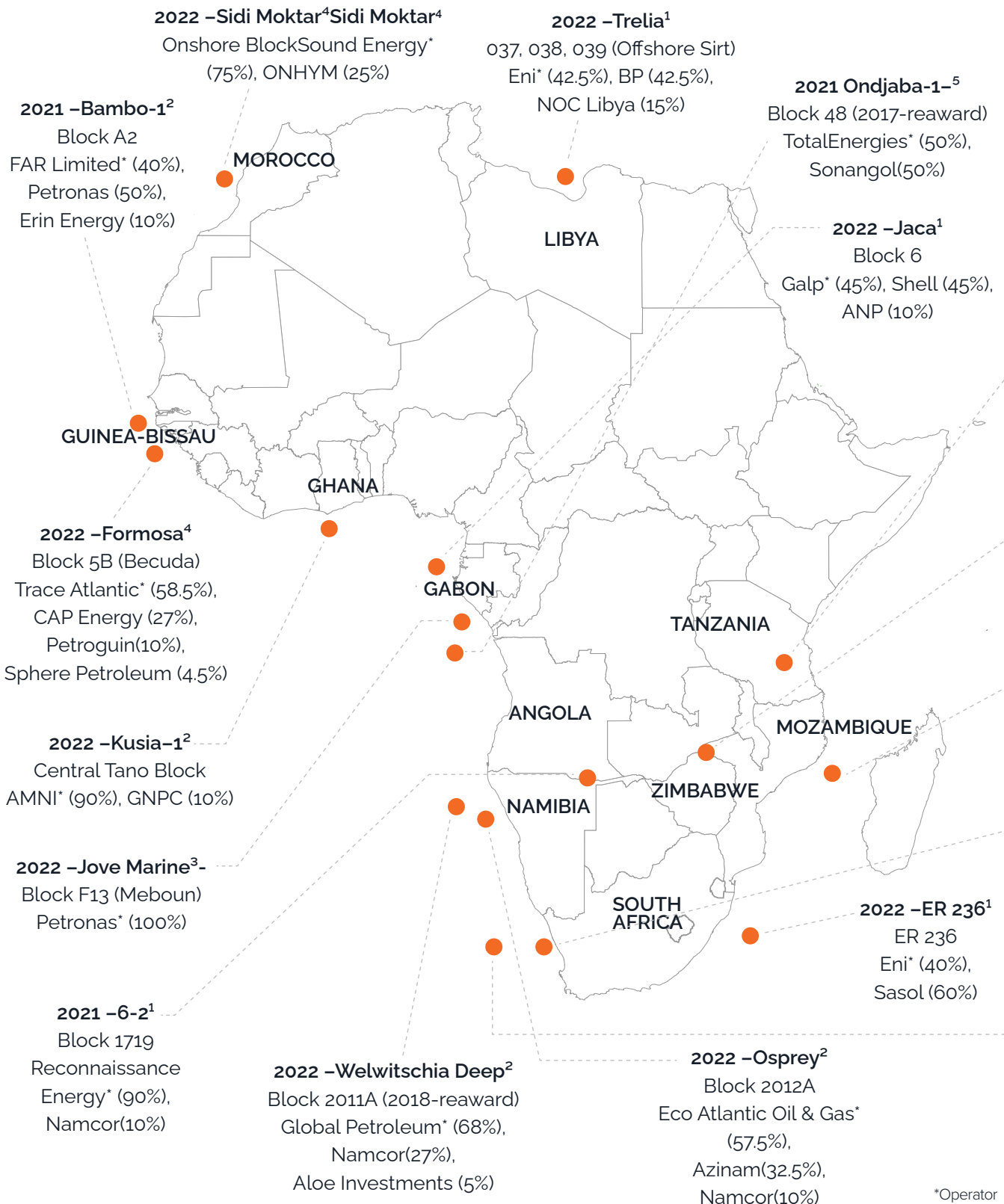
Discovered resources by water depth



As exploration deteriorated further, the drilling of high impact wells was also affected. Only one high impact well has been drilled so far in 2021 and three more such wells are expected to be drilled by the end of the year in Angola (offshore), Guinea-Bissau (offshore) and Namibia (onshore). High impact well drilling is expected to pick up with drilling in all regions of the continent, both onshore and offshore. Figure 2.2.2 shows the location and estimated timeline of drilling for the 2021 – 2022 high impact wells across the continent.

Figure 2.2.2: High impact wells in Africa

Source: Rystad Energy ECube September 2021



2022 Kito-³

Kilosa-Kilombero Block-
Swala Energy* (75%),
Invenire Energy (25%)

2022 –Mzarabani¹

SG 4571
Invictus Energy* (80%),
One Gas Resources (20%)

2022 –A5-B

A5-B (Angoche Basin)
ExxonMobil* (40%),
Rosneft (20%), ENH (20%),
Eni (10%),
Qatar Petroleum (10%)

2021 –Gazania-1³

Block 2B (A-J1)
Azinam* (50%),
Africa Energy (27.5%),
Panoro (12.5%),
Crown Energy (10%)

2022 –Venus –1²

Block 2913B
Total Energies* (40%),
Qatar Petroleum (30%),
Impact Oil & Gas (20%),
Namcor (10%)

An uptick in licensing activity was observed in 2019 and the same or higher level of license awards was estimated in 2020. Licensing rounds were opened in the countries – Angola, Egypt, Equatorial Guinea, Ghana, Gabon, and Congo, in 2019. But many such rounds were either delayed or cancelled eventually due to the industry downturn. Some licensing rounds which opened before 2020 and were expected to close in 2020, also spilled into 2021. Overall, 6 rounds are expected to close before the end of this year including rounds that actually opened in 2018 and 2019, two rounds that opened last year and two more which were announced this year. The Cuvette licensing round in Congo, which opened in 2019, is expected to close in 2022 now along with 6 more rounds that were opened in 2021 so far. South Sudan also launched its first ever licensing round for 5 blocks. Seven more licensing rounds across the continent are expected to be opened next year, but this would be highly dependent on the direction the pandemic takes and its subsequent impact on the oil and gas industry. Highly structured, well organized licensing rounds utilizing digital solutions could be a breakthrough for increasing exploration on the continent. However, this requires the release of as much data as possible and therefore relies upon the integration of digital solutions into processes traditionally weighed down by paperwork and bureaucracy. Whilst requiring an upfront investment, the potential rewards could far outweigh the costs and represent the catalyst required to ignite exploration activity on the continent.

High impact well reason**1Frontier basin:**

The basin with little or no exploration

2Large prospective resources:

The pre-drill estimates by the company are quite significant.

3Focus for Company:

The wells which are highly talked and strategically important for companies.

4Emerging Basin:

The basins where some significant recent exploration has taken place.

5Play Opening:

The well targeting a new play or area within the province or basin.

Figure 2.2.3: 2021 – 2022 Lease Rounds in Africa

Source: Rystad Energy ECube September 2021



Algeria

Licensing Round Planned but uncertain

Tunisia –2021

Licensing Round Planned Assumed Award Year –2022

Senegal 2020

Licensing Round Bids under evaluation – Assumed Award Year 2021

Egypt –2021

International Bidding Round (EGPC & EGAS) Open for bidding Assumed Award Year –2021

Senegal

AGC Shallow Block Round- Planned – Assumed Award Year 2022

Sudan –2021

Bid Round Planned Assumed Award Year 2022 –

Liberia

Direct Negotiation Round Open for bidding – Assumed Award Year 2022

Sudan

1st Licensing Round Planned Assumed Award Year –2022

Cote d'Ivoire –2021

Offshore Round Planned but uncertain

Somalia –2020

Offshore Licensing Round Open for bidding Assumed Award Year –2021

Equatorial Guinea

EG Ronda 2022 Planned but uncertain

Uganda

Second Oil Licensing Round Bids under evaluation Assumed Award Year –2021

Gabon

12th Licensing Round Bids under evaluation – Assumed Award Year 2021

Kenya

Offshore Round Planned but uncertain

Congo

Cuvette Licence Round Open for bidding Assumed Award Year –2022

Tanzania –2022

Offshore Round (Zanzibar) Planned but uncertain

Democratic Republic of Congo

2021 International tender Planned Assumed Award Year –2022

Mozambique

6th Licensing Round Planned but uncertain

Angola 2020

Onshore Bid Round Bids under evaluation – Assumed Award Year 2021

Angola 2021

Limited Public Tender Planned but uncertain

2.3. LNG projects to boost **Africa's oilfield** services outlook

Figure 2.3.1: African OFS Outlook
African upstream capital expenditure per service segment- Billion USD Nominal

Source: Rystad Energy UCube August 2021

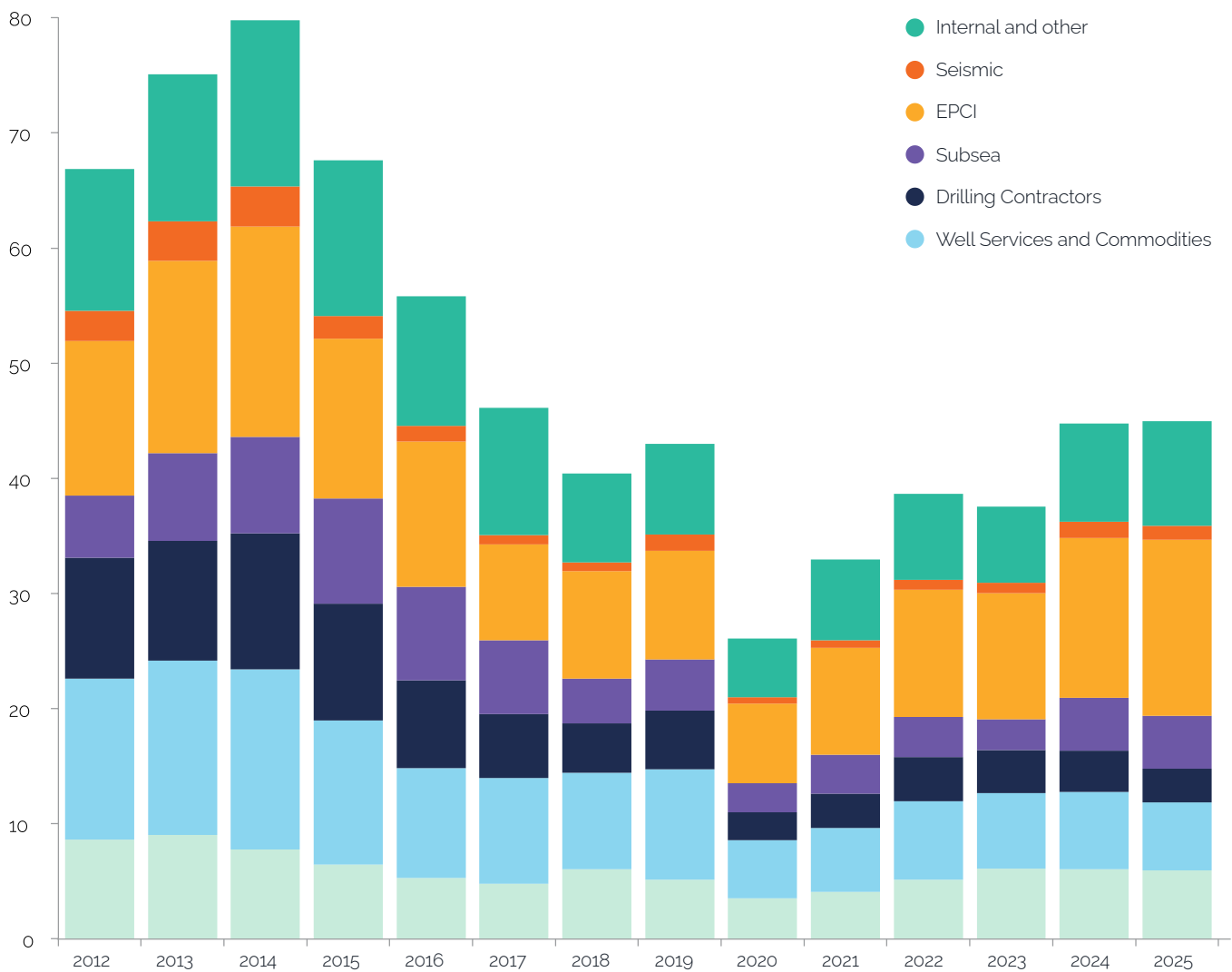


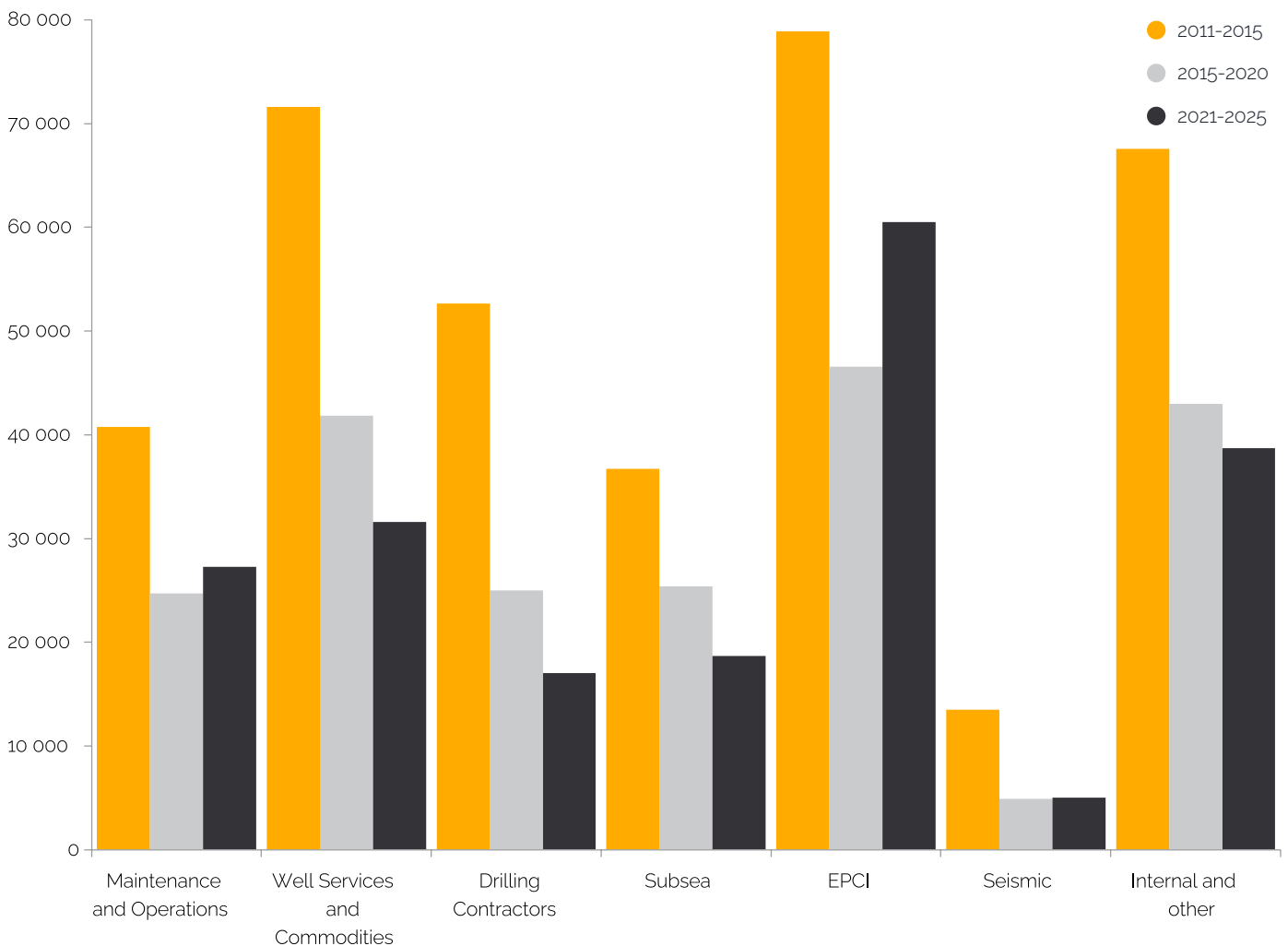
Figure 2.3.1 shows the breakdown of upstream expenditure by service segment, which includes internal upstream spend that primarily relates to salaries. Last year was a difficult one for the service industry which was once worth \$80 billion in 2014. It dropped to less than half the value in 2020, however a recovery is expected going forward as OPEC+ restrictions ease out and new projects are sanctioned. The recovery is also driven by LNG projects in East Africa that have been delayed to later years; as such, it is estimated that 2019 levels of \$43 billion will be surpassed by 2025.

Figure 2.3.2 compares the cumulative expenditure for three 5-year periods, 2011-2015, 2016-2020 and 2021-2025. Out of all the segments, the EPCI segment is expected to grow significantly on the back of LNG project construction awards while a marginal increase is expected from the maintenance segment as well. LNG projects including both Coral FLNG and Mozambique LNG in Mozambique, NLNG seven plus in Nigeria along with major onshore oil projects in Uganda are driving the increase in the EPCI segment. The increase in the maintenance segment is

driven primarily by the recovery in on-shore projects in Algeria and Libya as the easing of OPEC quotas lift Algeria’s output, and more production comes online in Libya. The remaining segments are expected to decline over the next 5 years. Historically, the worst hit segment is the drilling contractors and well services segment, mainly due to volatile oil prices which are now been well below 2014 levels. The outlook also remains poor for these segments as more gas projects are being targeted which are less drilling intensive.

Figure 2.3.2: African OFS Outlook
Cumulative capital expenditure per period- Billion USD Nominal

Source: Rystad Energy UCube August 2021



Chapter Three

As Majors Exit, Nocs Acquire

Majors are divesting carbon intensive crude oil assets to meet carbon neutral goals through selling to NOCs and INOCs, amid a changing player landscape

NOCs are acquiring majors crude oil assets

European majors are expected to boost on gas output with the intention of tapping into global markets through the production of LNG

Figures 3.1 and 3.2 illustrate that in 2021 Majors will account for 30% of total production in Africa. However, Majors operating on the African continent are at an inflection point as they aim to reduce their carbon footprints and diversify

portfolios to accommodate major gas producing fields. NOCs account for a larger proportion of total output at 42% with Sonatrach, NOC (Libya) and NNPC leading production of both crude oil and gas.

Figure 3.1: Total Production split by Company Segment in 2021
Total African production in 2020 - %

Source: Rystad Energy UCube August 2021

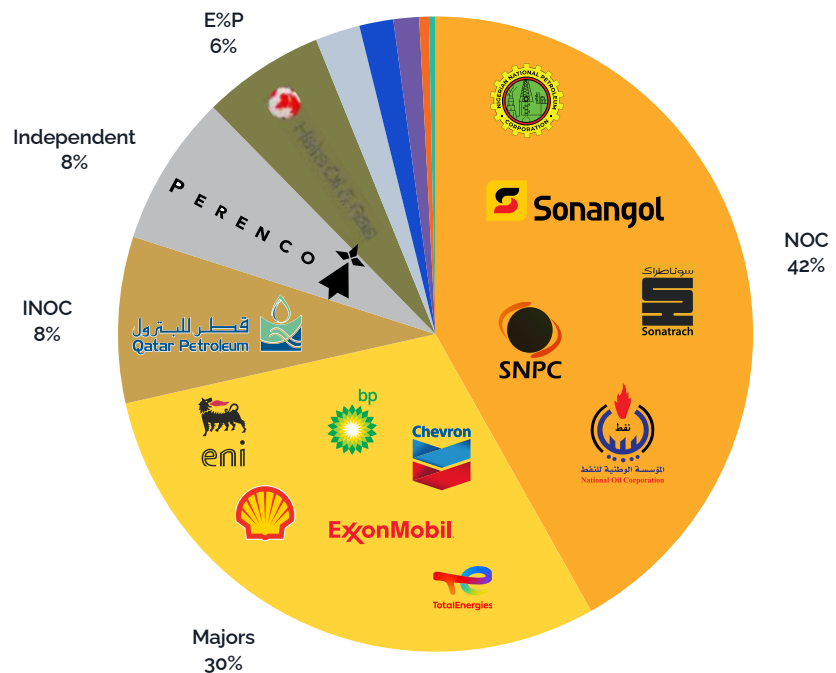
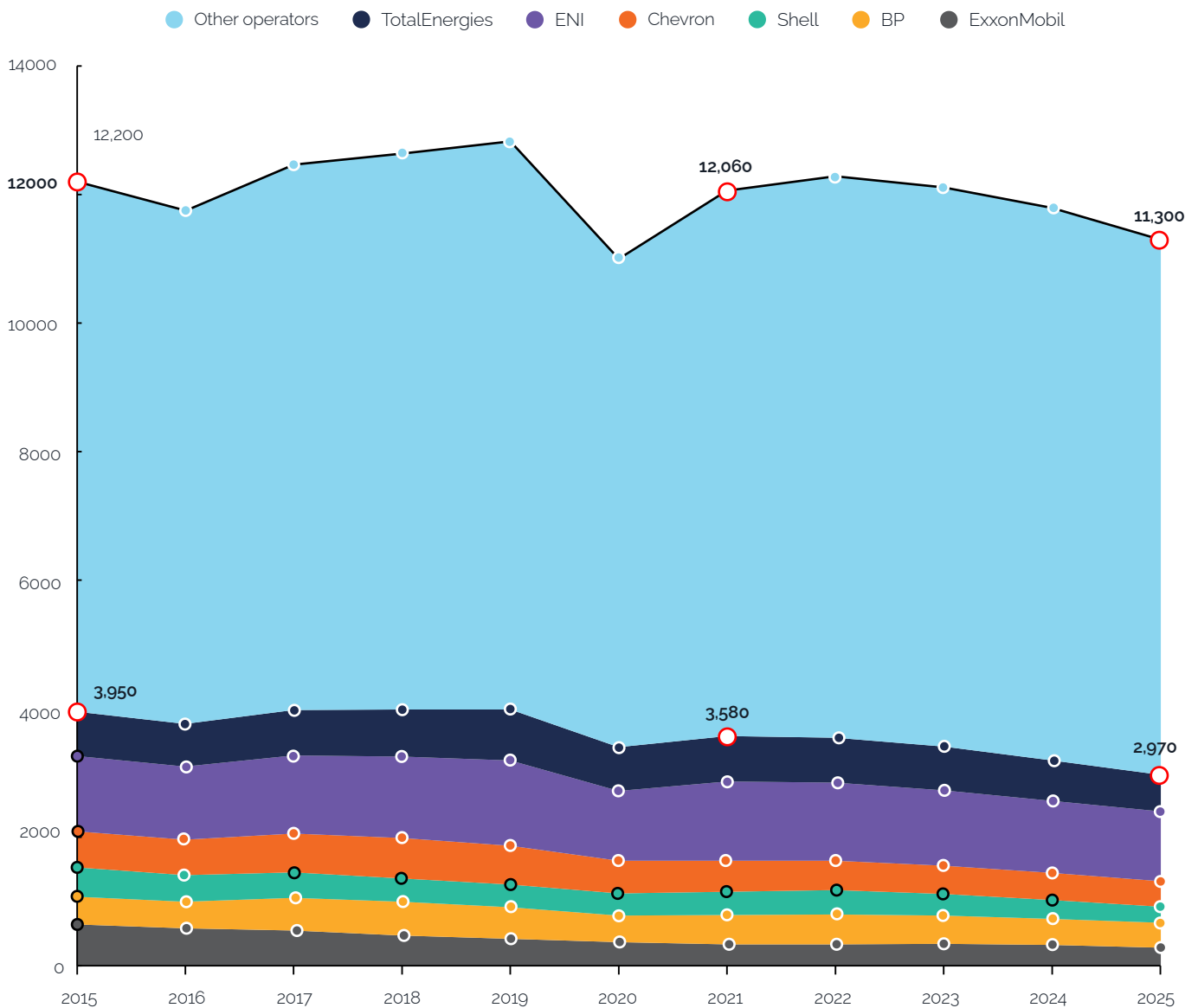


Figure 3.2: Majors are offloading oil assets in favour of gas
Total African production - Kbbld

Source: Rystad Energy UCube August 2021



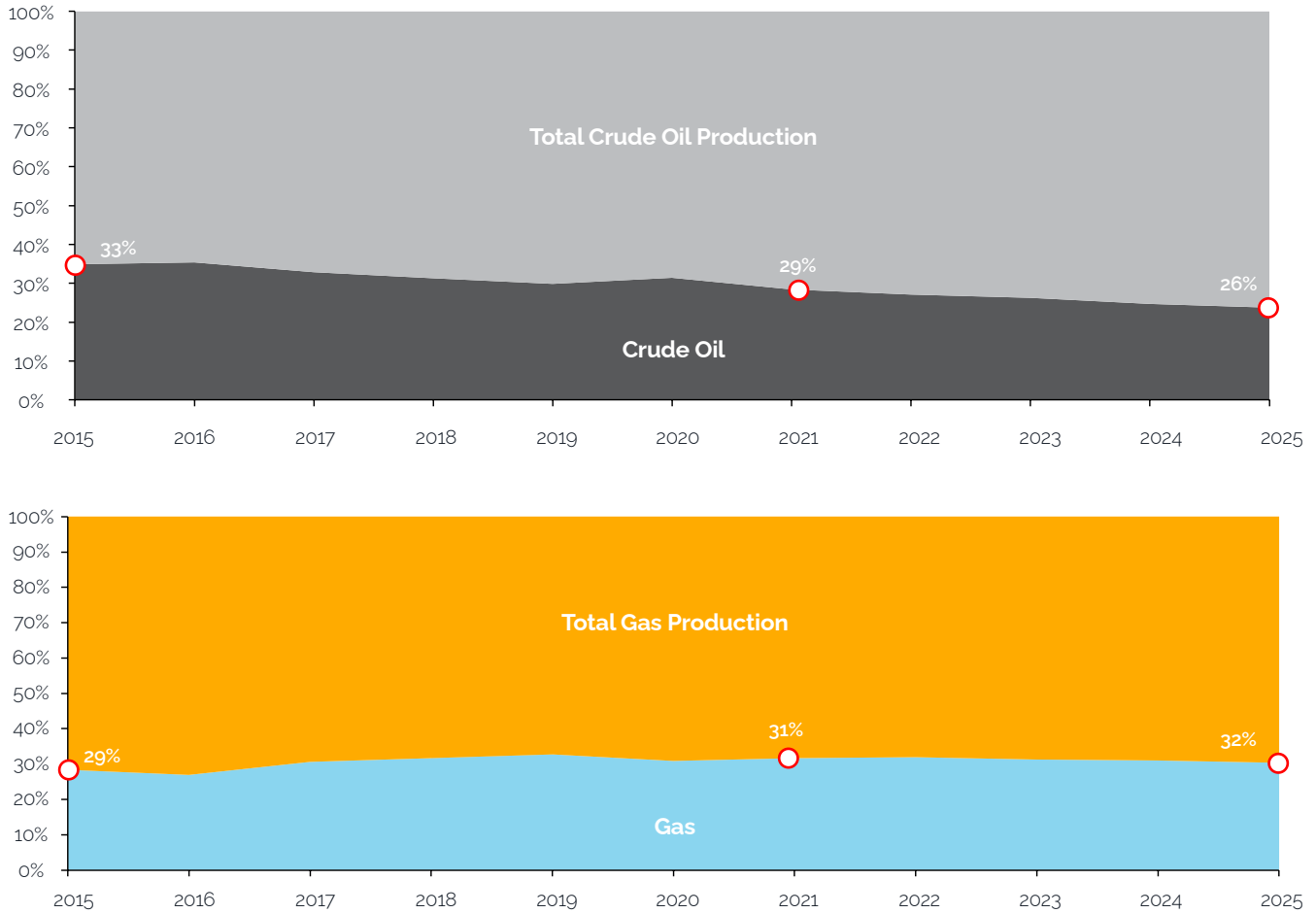
The shift away from crude oil is influenced by historical regulatory challenges and the growing influence of stakeholders in shaping future strategy, related to the heavily publicized shift away from less clean fossil fuels. The shift is in line with current M&A activity, as oil fields are offloaded in

favour of gas fields. Further justification of such a shift can be observed in the fact that natural gas accounts for more than 75% of the hydrocarbons discovered in Africa over the last 10 years. This puts Africa as a gas driven industry, where said monetization can cause socio-economic

growth, allowing for a reduction of energy imports, and greater access to electricity. Overall Figure 3.3 projects that for crude oil, the Major's contribution from 2015 – 2025 falls from 33% to 26%, whilst gas production rises from 28% to 31%.

Figure 3.3: Major's Contribution to oil production (top) and gas production (bottom)
Total African production – % oil, % gas

Source: Rystad Energy UCube August 2021



With the European governments imposing binding emission targets, and the European Investment Bank announcing an end to investment in African oil and gas, the majors follow their footsteps. In addition, organizations such as Greenpeace and Friends of the Earth continue to cause project

disruptions in Africa, impacting potential opportunities for sectoral and economic growth. These organisations commonly protest outside oil refineries, or events hosted by large oil producers (e.g., Shell in 2018, Johannesburg in 2021). This coupled with the fluctuating oil prices amidst the global

pandemic, and the uncertain future of fossil fuels, is causing gradual divestment away for crude oil amongst the majors. On the other hand, natural gas is central for the transition that Africa needs to power and progress sectoral development with employment in new forms.

Italy-headquartered ENI is in discussions with advisers to offload a set of its operated assets in Congo, following the dip in oil prices. ENI also sold a production sharing contract (PSC) to SNPC (Congo), with projections that an overall

drop in production of 33% will occur in the coming decade. Similarly, Exxon-Mobil recently pulled out of a deep-water oil prospect offshore Ghana.

Shell, meanwhile, will offload the last

of its Nigerian assets to move towards cleaner energy, and avoid litigation arising from oil spills. Its divestment could deal a fresh blow to the fiscal plans of the Nigerian government, where about 90% of revenue comes from oil, as it

rebalances from the oil crash of 2020. Shell is currently under examination of the Dutch court, which announced that it must reduce its greenhouse gas emissions by 45% by 2030. Low investment levels threaten currently producing oil fields in Angola, which face a sharp decline in production as fields mature, threatening the nation’s ability to meet Opec+ allowances.

In the past, the African market presented challenges due to policies that barricade entry into the market, with high tariffs, and political tension. As of late, there has been a drive for amended policies, restructured regulatory frameworks and investor attractive initiatives, making it easier to do business. This restructuring has been led by Nigeria, Republic of Congo, Angola, and Senegal. Unfortunately, the majors have lowered their view of investment prospects despite it being easier, with the current shift towards LNG being the main driv-













er behind M&A activity. Ultimately, the majors may be looking to monetise the gas in the form of LNG. One example is Shell, TotalEnergies and Eni selling 45% interest in OML 17, valued at \$1.1 billion. The large onshore license consists of 15 oil and gas fields, allowing the majors to pivot their investments to assets offshore the nation. The CEO of TotalEnergies in Nigeria – Mike Sangster – tells The Africa Report that going forward, the company is focusing more on gas and oil projects with a ‘low break-even point’. This could shift focus towards gas production, as stated by chairman and CEO of Total, Patrick Pouyanné, claiming it as the “transition energy”.

The independents operating in Africa, including APA Cooperation, ConocoPhillips and Perenco, showcase transitioning, like the majors. Cairn Energy, recently sold its Sangomar assets to Woodside Petroleum, previously being

sold to Lukoil. This should allow Woodside Petroleum to start production in Africa in 2024. However, despite this, the independents productive outlook in Africa for oil and gas is similar to the majors. Production is expected to decrease slightly in 2022, following by a gradual but consistent decrease in the coming years.

With majors selling large crude oil assets in Nigeria, Angola, Algeria, and Ghana, despite there being large potential for growth, NOCs and INOCs are acquiring the largest proportion. Together, NOCs and INOCs are expected to produce 51% of Africa’s oil and gas in 2021, 43% coming from NOCs with leading companies Sonatrach, NOC (Libya) and NNPC. Exemplifying the Majors view, BP’s Africa new ventures vice president, Jonathan Evans, stated BP would limit its oil extraction projects on the continent going forward, in view of carbon reduction requirements.

Figure 3.4: High level Summary of 2019 - to date Majors M&A activity in Africa as Sellers

Buyer	Seller	Title	Date	Deal value (MUSD)	Country	Field type category
		SNPC (Congo) takeover PSC in Congo from Enion contract expiry	17/04/2020	235	Congo	<div style="display: flex; justify-content: space-between;"> ■ Oil ■ Gas </div> <div style="display: flex; justify-content: space-between; width: 100%;"> <div style="width: 64%; background-color: #28a745; height: 15px;"></div> <div style="width: 36%; background-color: #dc3545; height: 15px;"></div> </div>
		Qatar Petroleum acquires stake in 3 licenses in South Africa	04/07/2021	Unknown	South Africa	<div style="display: flex; justify-content: space-between;"> <div style="width: 44%; background-color: #28a745; height: 15px;"></div> <div style="width: 56%; background-color: #dc3545; height: 15px;"></div> </div>
		Conoil acquires operating stake in OMLs 86 and 88 in Nigeria	20/08/2020	43	Nigeria	<div style="display: flex; justify-content: space-between;"> <div style="width: 67%; background-color: #28a745; height: 15px;"></div> <div style="width: 3%; background-color: #dc3545; height: 15px;"></div> </div>
		Dragon Oil acquired BP soil concessions in Egypt	29/05/2019	600	Egypt	<div style="display: flex; justify-content: space-between;"> <div style="width: 60%; background-color: #28a745; height: 15px;"></div> <div style="width: 40%; background-color: #dc3545; height: 15px;"></div> </div>
	 	TNOG acquired 45% stake in OML 17 in Nigeria from Shell, Total, ENI	15/01/2021	533	Nigeria	<div style="display: flex; justify-content: space-between;"> <div style="width: 60%; background-color: #28a745; height: 15px;"></div> <div style="width: 40%; background-color: #dc3545; height: 15px;"></div> </div>
		ExxonMobil announced to the Ghanaian government that it was exiting the country’ supstream petroleum sector	17/06/2019	N/A	Ghana	<div style="display: flex; justify-content: space-between;"> <div style="width: 75%; background-color: #28a745; height: 15px;"></div> <div style="width: 25%; background-color: #dc3545; height: 15px;"></div> </div>

Source: Rystad Energy M&A Dashboard, annual reports and news articles

Figure 3.5: Analysis of likely operator “types” who will be willing to acquire assets in Africa



The biggest acquirers of assets are SNPC (Congo) and TNOG, two NOCs operating in Congo and Nigeria, respectively. In fact, the largest acquisition in 2021 came from TNOG in relation to the aforementioned OML 17 license in Nigeria, acquiring a 45% stake from ENI, Shell and Total. The field has the potential to double production in the short to medium term through enhanced production initiatives and workovers. SNPC purchased a PSC in Congo for \$600 million from ENI, Qatar petroleum (QP) and Total, where approximately 95% of its total production is oil. Another notable acquisition of assets in 2021 occurred in Egypt, where Chevron Petroleum and Cairn acquired Shell's 13 onshore concessions and 50% stake in Badr El-Din Petroleum Co. for \$646 million with additional payments of up to \$280 million between 2021 and 2024.

QP is responsible for purchasing \$91 million of equity and assets from the leading majors ENI, Total and Shell. Forecasts display QP remaining in oil, and slowly increasing exposure to gas post 2023. Since 55% of QP's annual output is gas in 2021 (excluding natural gas liquids and condensate), with oil only accounting for 19%, diversifying with more oil fields could be expected. Perenco, also purchased assets from TotalEnergies in Gabon, with the ambition of maintaining gas production levels amidst currently falling oil production.

Spending cuts from the majors in crude has caused oil dependant countries like Angola to suffer from declining production levels, expected to achieve 1.2 mbb/d in 2021, a 35% decline in the past decade. However, the largest major in Africa, ENI, is interested in investment in Angola through a joint venture with BP. Both companies are looking to restructure hydrocarbon portfolios (and increase renewable energy output) to achieve greater efficiency in their operations and to create synergies aiming to reduce costs. Such a strategic move fits neatly into ENI's reported plan to cut debt and fund transitional

projects towards low-carbon energy. In fact, ENI aim to spin off their oil and gas assets in West Africa and the Middle East into new joint ventures with BP and TotalEnergies. An example is ENI's current deal with Egyptian Electricity Holding Company and the Egyptian Natural Gas Holding Company, for the production of green hydrogen in Egypt using renewables, with the aim of extending this project to the North African powerhouse Algeria. ENI and BP's joint venture in the Nour and Shorouk fields in Egypt, along with ENI's Coral South project in Mozambique, are all initiation points in the LNG market.

Shell acquired stakes in assets offshore in São Tomé & Príncipe, Suriname, Namibia, and South Africa from Kosmos energy for \$128 million, with the intention to start drilling in 2021. Despite this, current production in these countries altogether is low, however it is expected to observe large growth in coming years, especially in Suriname and South Africa. Gas production is expected to grow seven times the current production from 2020 to 2030. Moreover, in 2019, TotalEnergies made the Brulpadda gas-condensate discovery in South Africa, containing approximately 500 million barrels of oil equivalent (mboe). Partners are considering a fixed platform development for the project, with TotalEnergies claiming it as "world-class...offshore gas play". ExxonMobil also acquired assets in São Tomé & Príncipe, with production commencing in the coming years.

In Nigeria, Chevron Nigeria Limited (CNL) acquired the Escravos gas-to-liquid (GTL) asset. According to Chevron, "with the expected rise in demand for diesel, GTL technology provides an option to make a fuel with qualities that make significant reductions in emissions possible." With similar motives for lower emissions, TotalEnergies expanded in Algeria by acquiring a stake in a wet gas field from Repsol, supporting the shift towards a cleaner natural gas source. This renewed focus on natural gas in Africa is observed by looking at the final investment decisions









that are anticipated for major projects. The top African projects by resources that are expected to be sanctioned for development in the 2020s include 12 gas projects in Mozambique, Tanzania, Mauritania, Senegal, Nigeria, and Libya. The African Energy Chamber estimates that about 55% of the African resources expected to be sanctioned for development in the next 10 years will be gas projects, with a further 13% being condensate and natural gas liquids, compared to just 38% for crude oil.

The NOCs could engage in new environments via diversification, reallocation of resources to enable increased competitiveness in the market. The north African companies, including Sonatrach, Sonangol, SNPC etc., have all shown interest and commitment to allocating investments towards carbon capture and storage. In fact, Eni and Sonatrach signed a series of agreements in March 2021 for the upstream, research and development and decarbonization sectors. This should allow NOCs to shift from volume to value, by focusing on high-value projects, which are socially acceptable through the reduction of carbon emissions. Ramping up downstream activities is a diversification route that can be lucrative; venturing into petrochemicals and refining could generate new revenue streams from potentially higher margin products.

Global pressure mounts to divest from fossil fuels with greenfield oil developments becoming less attractive in the media, forcing majors to explore opportunities in renewables. Majors' investment strategies involve "prioritising near-term capital spend on the most advantaged assets with the lowest cost of supply in the portfolio", as per Preba Arkaah, a spokesman for Exxon in Ghana. Many Majors now have targets for Zero routine flaring by 2030, as illustrated in Figure 3.6. This opens opportunities for local companies to exploit, either specializing in reducing flaring, or processing gas into hydrogen production to add to continents renewables portfolio.

Figure 3.6: Flaring reduction targets by majors

Flaring intensity and reduction targets, selected companies

Company	Equity flaring intensity 2020 (kg co2/boe)	Flaring reduction target	Quote
	10	Zero routine flaring by 2025	"Eni has committed to eliminate process flaring by 2025, five years ahead of the Global Gas Flaring Reduction 2030 initiative"
	6	Zero routine flaring by 2030	"Total was the first company to join up the Zero Routing Flaring initiative"
	5	Zero routine flaring by 2030	"BP participates in a number of World Bank's flaring reduction initiatives, including the Global Gas Flaring reduction partnership"
	5	Expects to reduce flaring by 25% by 2020	"Our Upstream Flaring and Venting Reduction Environmental Standard for Projects has a goal of avoiding routing flaring in new Upstream projects"
	3	Zero routine flaring by 2030	"We are working to reduce flaring, which wastes valuable resources and contributes to climate change"
	3	Reduce flaring by 25-30% by 2023	"We have developed internal country specific plans to minimize gas flaring and we are a member of the World Flaring Reduction Partnership"
	3	Zero routine flaring by 2030	"In Norway we do not have routine flaring in our operations. Our aim is to stop routine flaring in our operations by 2030 at the latest"
	3	No clear target	"Although post combustion flaring emissions represent less than 7% of our GHG emissions, flare reductions continues to be a priority"

Source: Company reports, Rystad Energy research and analysis

*Relative to 2017 **Relative to 2016

In the short term, the Majors plan on reducing carbon intensity by increasing efficiency measures, eliminating flaring, and optimising operations to minimise their carbon footprint. The current and future joint ventures between the majors, and the synergy that can arise from streamlined operational excellence, can go a long way towards reducing carbon intensity. Investment in renewables is the next step in a carbon neutral future, and reliance on lower carbon intensity LNG projects with the key projects outlined in Figure 3.7.

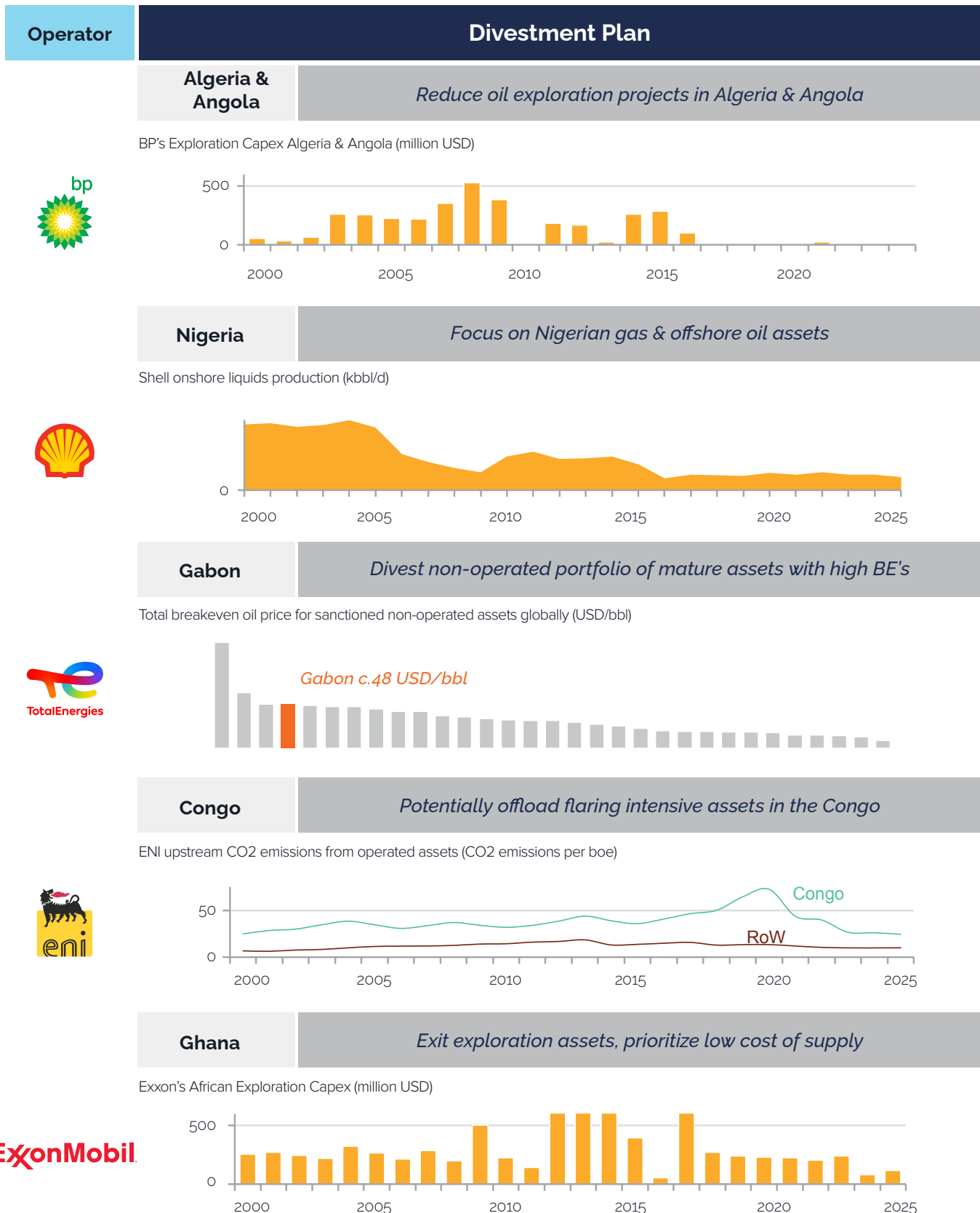
Photovoltaic solar power plants are currently the most prominent renewables energy source in Africa. TotalEnergies

has 150 MW of installed capacity in Africa, currently in operation in Egypt (2 x 63 MW), Burkina Faso (15 MW) and Uganda (10 MW), with the aim of further expansion. ENI, has the “Adam” photovoltaic plant, in Tataouine Governate, producing 5 MW, reducing gas consumption and saving the equivalent of 6,500 tonnes of CO₂ emissions each year. In fact, ENI and Sonatrach, the Algerian state oil and gas company, inaugurated a photovoltaic plant at Bir Rebaa North (BRN). It also teamed up with Sonangol, forming a joint venture to develop a PV plant with a total (phased) capacity of 50 MW in Angola.

The Africa Renewable Energy Fund II (AREF II) raised €130 million from sev-

en investors to finance renewable energy in sub-Saharan Africa. TotalEnergies also announced an investment of about \$60 billion in renewable energy projects between now and 2030. Geothermal energy projects in East Africa, have seen a \$95 million investment from the European Investment Bank (EIB). This shift can see further investment from the majors, as currently all of them are engaged in the geothermal activities. However, these projects have high room for error, and profits are thin. Without interest from the majors “geothermal is a pricier lottery ticket than oil, without much of a jackpot”, as per Doug Hollett, a geologist, and former US Department of Energy official.

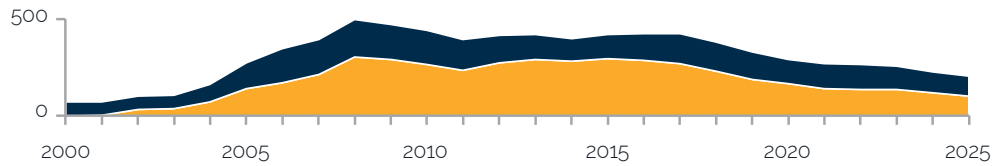
Figure 3.7: Major Oil Companies Divestment Strategies for the Energy Transition



Source: Rystad Energy UCube, GasMarketCube, RenewableCube August 2021

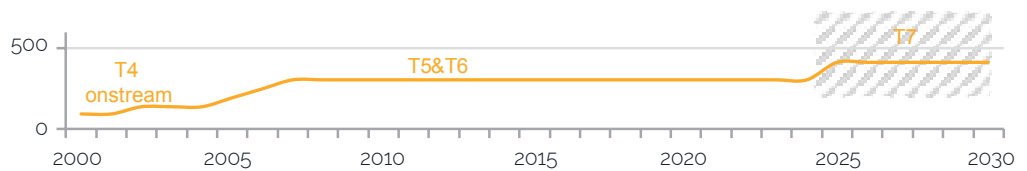
Operator	Energy Transition Strategy
Angola	<i>Potential merger with ENI for improved capital allocation, cost & business synergies to de-risk exposure</i>

Combined ENI & BP portfolio production in Angola (kbb/d)



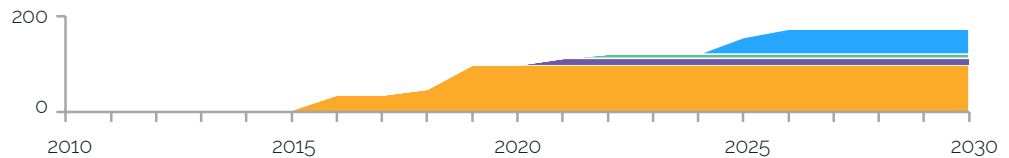
Nigeria	<i>NLNG train 7 (T7) FID to increase cleaner LNG output</i>
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NLNG LNG production capacity (BCM)



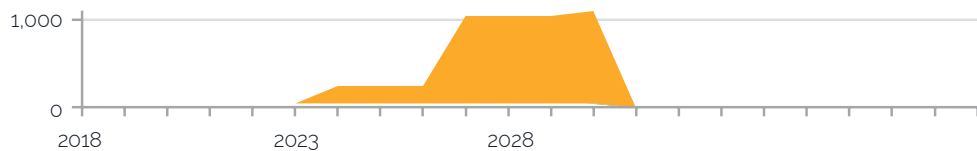
Africa	<i>Invest \$1.5 - 2 billion USD in lowcarbon electricity</i>
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Total Solar PV installed plant capacity split by development status, Africa (MW)



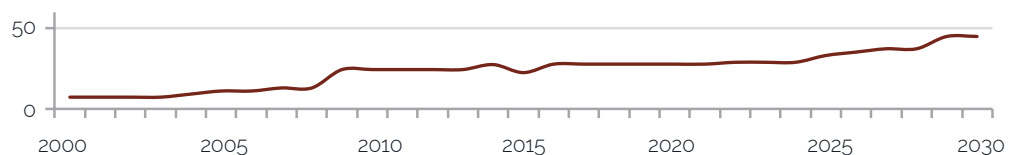
Africa	<i>Build out solar capacity to produce and export green hydrogen</i>
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ENI Solar PV installed plant capacity split by development status, Africa (MW)



Global	<i>Focus on building out further LNG capacity i.e. Rovuma</i>
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Exxon equity LNG production capacity (BCM)



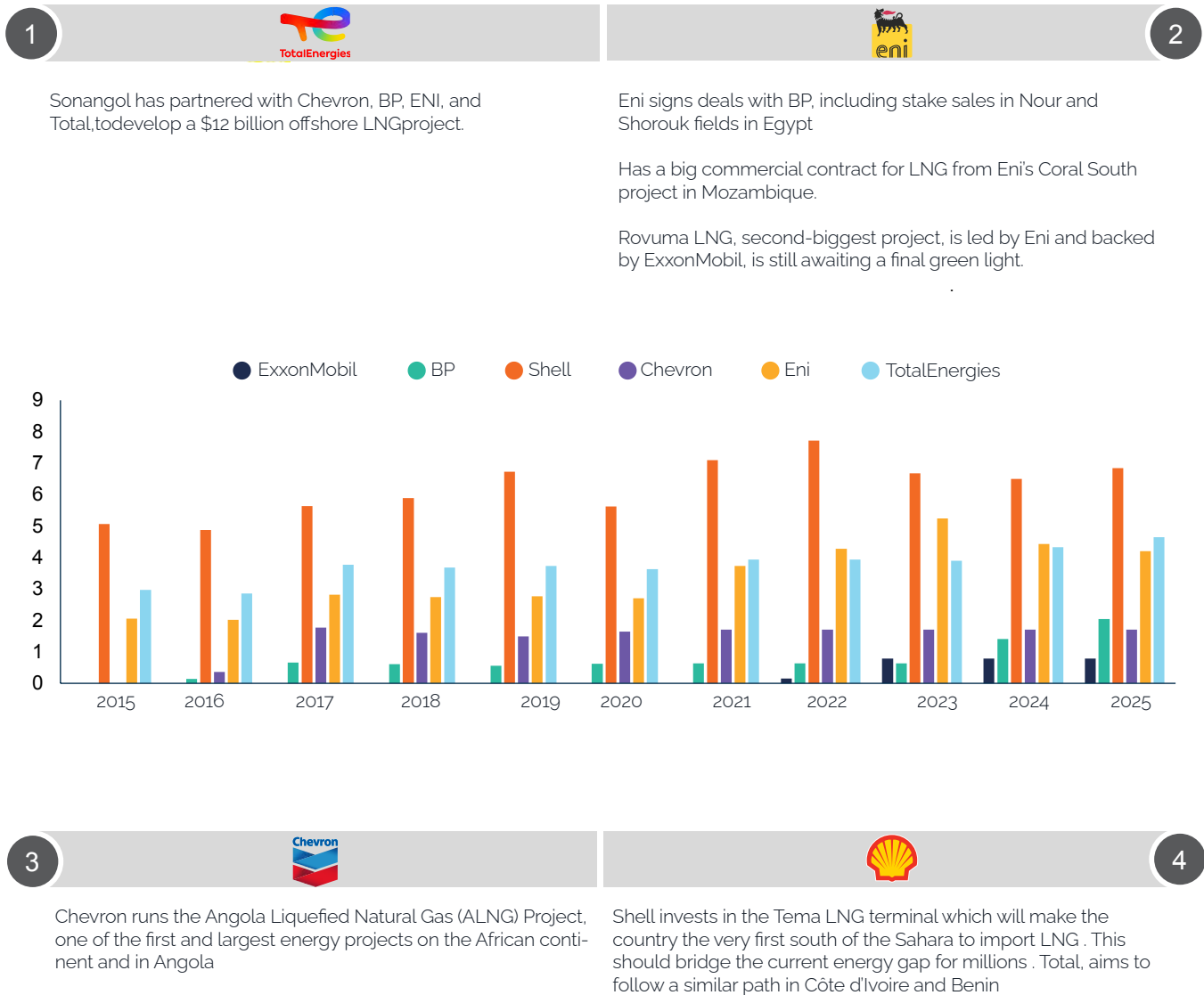
In African countries, Cameroon brought the continent's first floating liquefied natural gas (FLNG) project on stream in 2018. Senegal and Mauritania are together building a new LNG export hub with a capacity of approximately 30 million tonnes per annum (tpa).

In Nigeria, Shell and TotalEnergies, are in partnership with the semi-public joint venture Nigeria LNG (NLNG), each holding a 25% and 15% interest in a \$4 billion LNG processing unit, known as Train 7, on Bonny Island. The plant will increase its current LNG capacity of

22 million tonnes per annum (tpa) by at least 35%. BP and Kosmos Energy meanwhile jointly develop the Greater Tortue Ahmeyim (GTA) offshore LNG project in Senegal and Mauritania, with expected production to come in 2023.

Figure 3.8: Majors LNG Production

Source: M&A Dashboard, annual reports, and news articles



Mozambique is home to three megaprojects, representing a total investment of \$55 billion. Although, TotalEnergies recently suspended its largest project in the country, Mozambique LNG, due to attacks on the nearby town of Palma. Small and medium-sized local enterprises have already lost \$90 million since the attack on Palma, a huge financial setback for a continent already experiencing declining investment. This highlights the importance of risk factors such as security, as attacks on African oil and gas pipelines (e.g., Nigeria, Libya, Mozambique) do not give international investors' confidence to finance large economically impactful projects. The second biggest LNG project, Rovuma LNG, led by Eni and backed by ExxonMobil in Area

4, is awaiting approval. Addressing one of the critical elements affected growth across the African continent, energy poverty, the project in Mozambique as well as in Senegal, will fuel power plants, rather than being exported to demand centres in Asia.

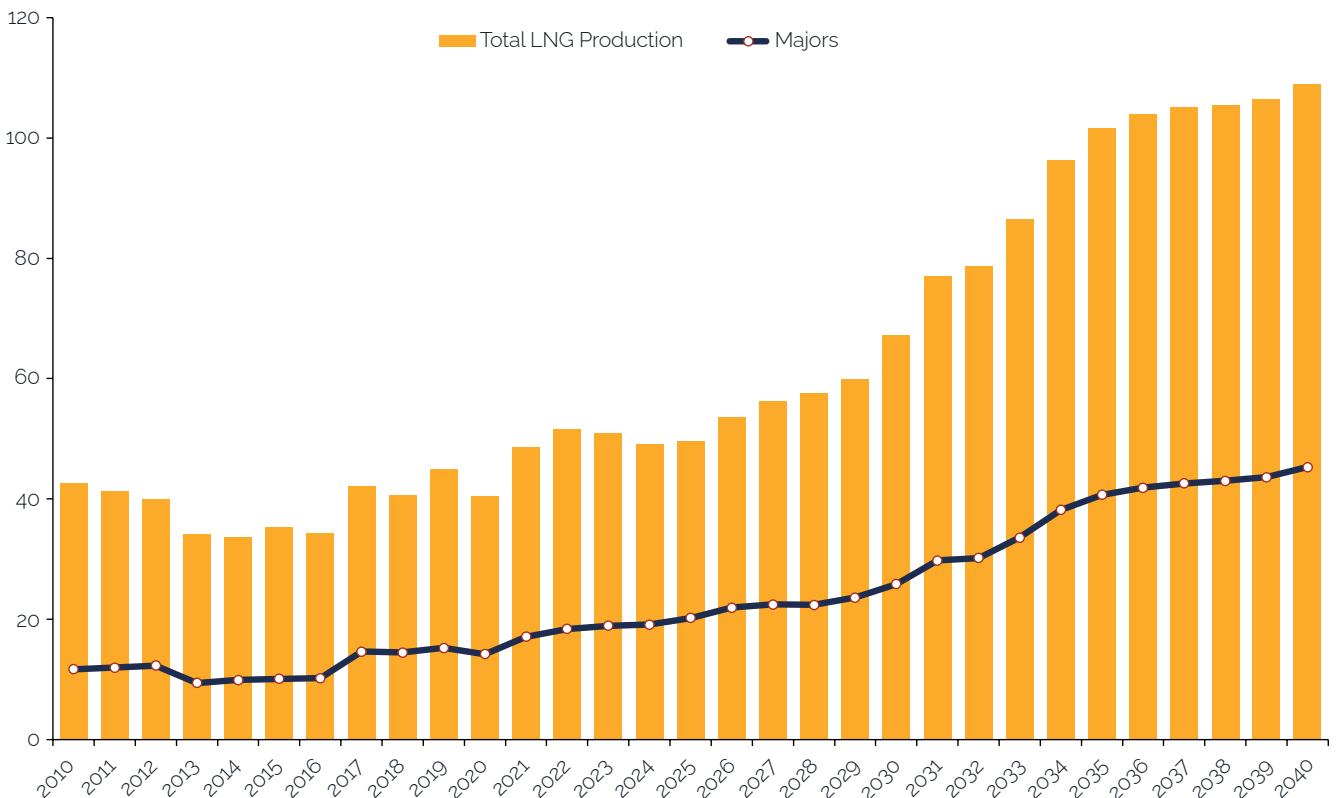
In Angola, the government has formed a consortium with five international oil companies including Eni and Chevron and is discussing an investment of \$2 billion, in the Soyo terminal. This plant will produce 5.2 million tons per annum capacity and supply natural gas to a 750 MW power plant, a step in electrifying the African continent. The consortium aims to start production from this project by 2022. Chevron who has 36% per-

cent interest in the Angolan LNG plant, discusses the benefits of its associated gas, which is natural gas produced as a by-product of crude oil production. In Equatorial Guinea, the government is undergoing discussions with companies for the development of offshore and stranded gas reserves for production of LNG.

NOCs are intrigued by the LNG market, since currently none of Nigeria's LNG (the largest producer) goes to Africa. Their main objective would be gas-to-power infrastructure to assist Africa's energy requirements. The majors focus is on monetizing gas and reducing their carbon footprint, which will require establishing infrastructure and reducing flaring.

Figure 3.9: LNG Production in Africa
Unit: Million Tonnes LNG

Source: Rystad Energy UCube August 2021



Chapter Four

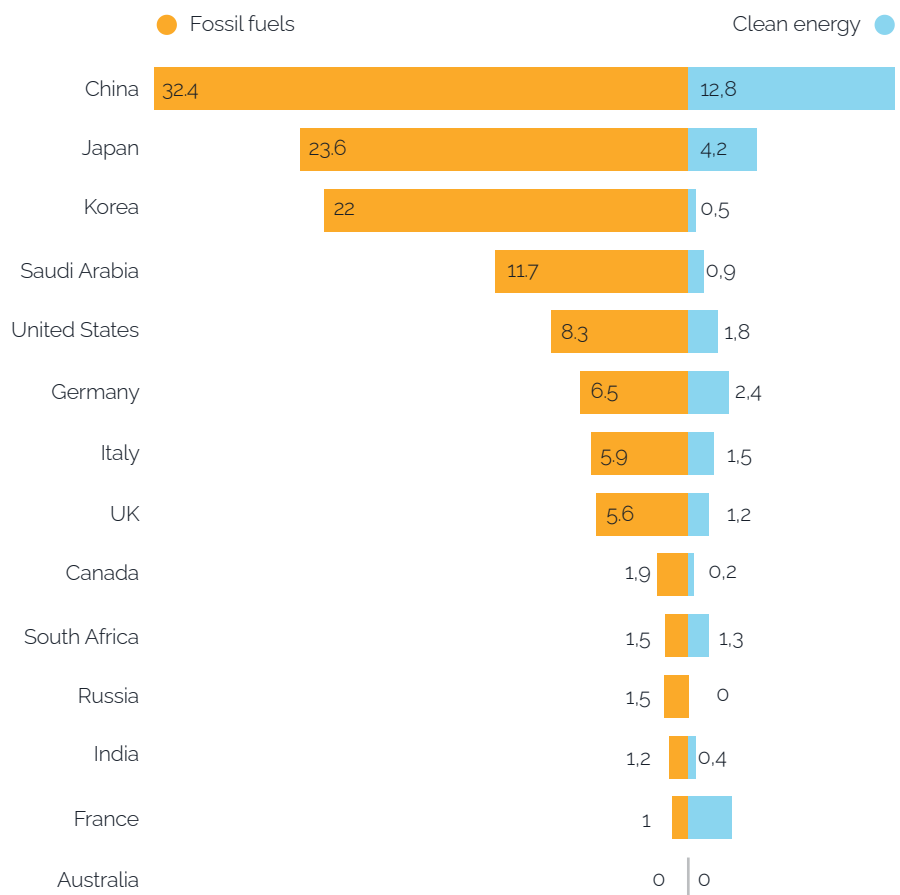
African E&P Financing Could Become More Reliant Upon Asia

G20 governments allocates US\$ 123 billion in public sector financing to Africa and Middle East from 2013-2019

European finance institutions demonstrate strongest reluctance to invest in fossil fuel related projects

Asian financing institutions likely to remain as key sources of financing for fossil fuel projects in Africa

Figure 4.1: to Africa and the Middle East, 2013-19
Public energy finance* issued by G20 governments**
USD billion



*Includes payments from export credit agencies or development finance institutions
**Excludes Argentina, Brazil, EU, Indonesia and Turkey as no payments were observed

Source: Oil Change International, April 2021

Despite the international forum of G20 governments making commitments to limit average global temperature increases to 1.5°C above pre-industrial levels, billions have been invested in fossil fuel projects between 2013 to 2019. Africa and the Middle East (MENA) has been on the receiving end of such financing from the G20 nations, as illustrated in Figure 4.1 compiled by Oil Change International. The financing illustrated represents trade and development financing, verified as directly related to fossil fuels. The funding is associated with export credit agencies (ECAs) and development finance institutions (DFIs), rather than private institutions. Examples include the China Development Bank funding a \$6.6 billion loan to Sonangol in 2016 and a \$5 billion export credit loan from the US Export-Import Bank related to a Mozambique LNG liquefaction terminal in 2020. ECAs and DFIs often offer either very competitive or non-commercial based terms and as such provide substantial support for raising further financing from additional sources, such as from banks or asset managers, by reducing project risk and boosting investor confidence.

In order to contextualize the spending levels, it's useful to compare fossil fuel financing related to clean energy projects in MENA over the same period. Overall, out of the G20 US\$123 billion

was directed towards fossil fuel projects whilst \$30 billion was spent on clean energy. Clean energy is defined as any payment supporting renewable energy in the form of biofuels, geothermal, hydropower, hydrogen, solar and wind. The only country to fund more clean energy projects than fossil fuel was France with \$2.7 billion allocated.

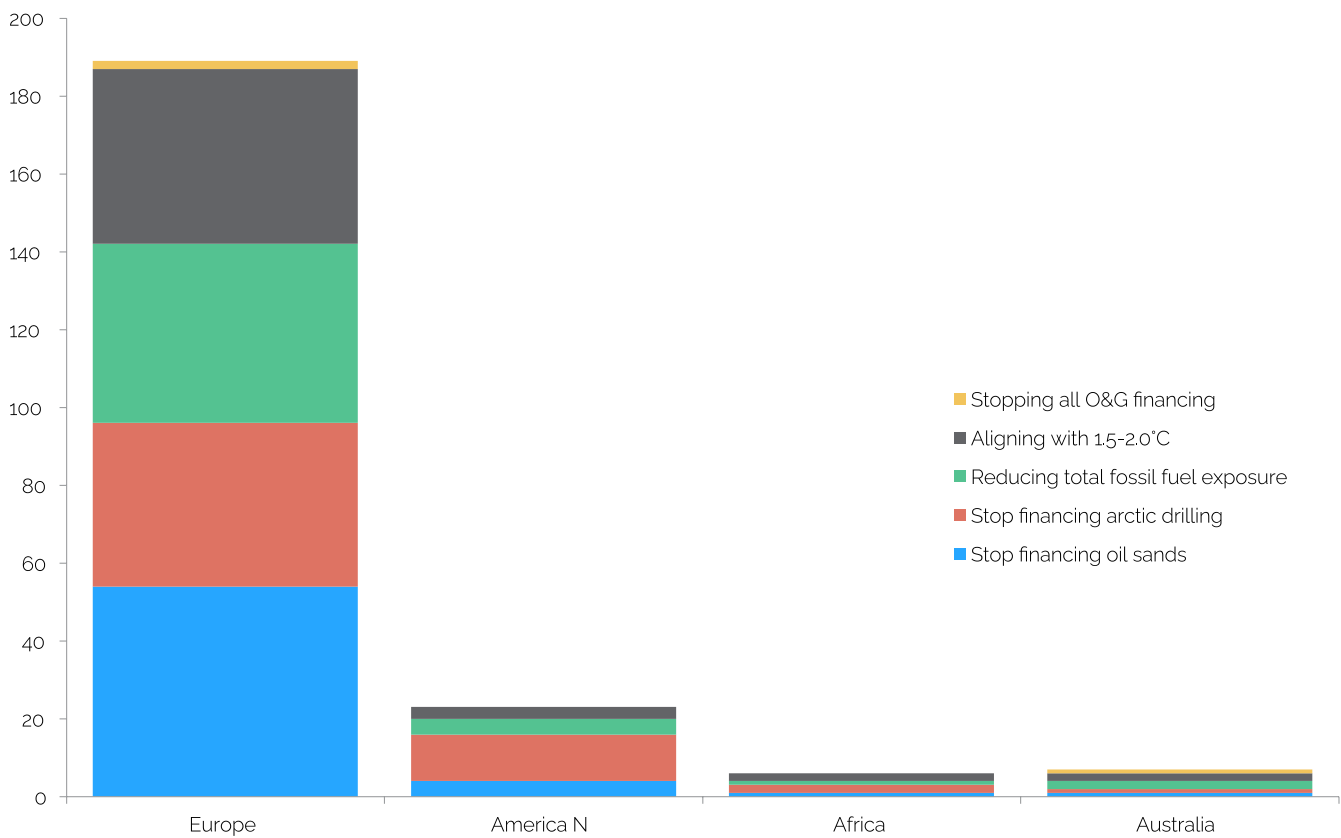
Overwhelmingly, the large Asian economic centers contributed in excess of 60% of the financing towards fossil fuel projects, led by China. Such arrangements enable countries to secure access to fossil fuel reserves, often hedging themselves against future volatility in commodity prices, which is of heightened importance for the primary hydrocarbon importing countries, where GDP is more exposed to fluctuations. Hydrocarbon demand associated with manufacturing and in particular petrochemicals is very high in such countries, amplifying the importance of protecting established industries to keep feedstock costs low, enabling them to remain competitive. Furthermore, through providing international funding, institutions aim to support domestic job creation related to the projects that are being financed. It is therefore likely that the Asian nations, primarily associated with the G20, will provide the pivotal sums of public finance via ECAs or DFIs that form the larger portions of debt that often pro-

vides sufficient confidence for additional institutions to finance projects.

When taking a more holistic view of the global financing industry and the associated appetite for funding fossil fuels, the past two years have witnessed a pivot in mentality across the financial industry, with institutions on mass making commitments towards restricting finance for fossil fuel projects and reducing overall exposure levels. No continent exhibited such a shift like Europe. Figure 4.2 outlines the number of globally significant institutions per commitment category split by continent, representing currently active policies. In terms of financial restrictions, the majority of institutions imposing restrictions applied them to oil sands and arctic drilling, rather than an absolute ban of oil & gas financing. However, amongst the European institutions this picture may soon shift as COVID-19 accelerates the green agenda. The European Investment Bank announced the commitment to banning fossil fuel funding from the end of 2021, a policy that the UK also pledged to follow. Following suit, France announced they will end export financing for oil exploration and production by 2025 and gas exploration production by 2035. Additionally, the Biden administration also indicated the ongoing development of a plan for ending international financing of fossil fuel projects with public funds.

Figure 4.2: African E&P financing trends – Overview
Globally significant banks, insurers* and asset managers restricting fossil fuel funding**
Number of institutions per commitment category

Source: IEEFA, August 2021



*IEEFA defines globally significant financial institutions as banks and insurers / reinsurers with AUM>US\$10billion.

**IEEFA defines globally significant asset managers / owners as having assets under management (AuM) greater than US\$50 billion.

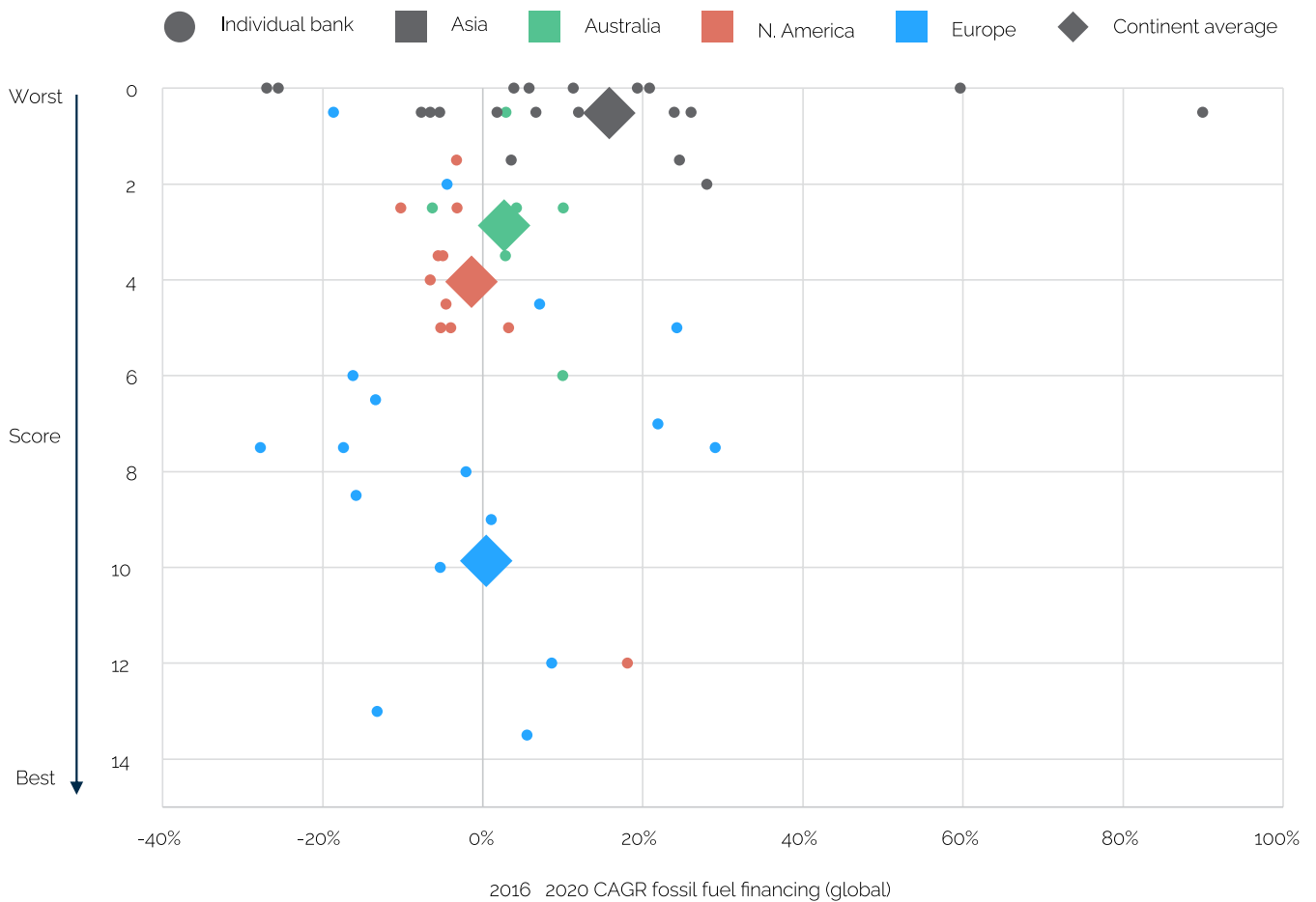
Overall, fossil fuel financing restrictions are centred on European institutions as recognition of the potential financial impact of climate change is reflected in the risk appetite of various lenders in the continent. In order to optimally

manage the risks inherent with climate change a variety of policies aiming to limit exposure have been adopted. Institution types include insurers, asset managers and banks, where concern lies in the risk to future cashflows and

the ability to service debt, or by the extent of provisions required to insure high liability assets. For the public entities, net zero commitments spearheaded by governments push funds to be directed towards clean energy.

Figure 4.3: African E&P financing trends – Overview
 Growth in bank financing for fossil fuels (2016-2020 CAGR, x-axis); Total fossil fuel policy score* (y-axis) each dot represents a bank, colored by continent

Banking on climate chaos, 2021



*Internal policy score towards reducing fossil fuel financing, Banking on climate chaos report, 2021

In order to provide insight into where African E&Ps may be able to secure project financing from in the future, it is important to analyse the trajectory of historical financing from different regions, where government and fiscal policy ultimately shapes the decisions made by financial institutions. Whilst it is clear that key Asian financial centres

are likely to be the sources of ECA and DFI related public financing, Figure 4.3 outlines the picture from the perspective of the wider banking sector. The data illustrated is sourced from the Banking on Climate Chaos report 2021 and includes the 60 largest relevant banks by assets. The x-axis represents the annual compound growth rate in

financing directed towards fossil fuel projects from 2016-2020 whilst the y-axis represents the total fossil fuel policy score as provided by the Banking on Climate Chaos report. The scoring is largely related to the extent of exclusion imposed across the different fossil fuels within the policies of the various banks.

On average, European banks were broadly flat in terms of growth in fossil fuel financing from 2016-2020 and scored the highest in terms of overall policy. This mirrors the conclusion of the public funding analysis, where European institutions are the least likely to be involved in future fossil fuel projects. North American and Australian banks as a whole were in line with Europe in terms of growth in financing, however scored much lower in terms of policies towards reducing fossil fuel financing. Lastly Asia is the standout continent both in terms of growth in fossil fuel financing and in terms of lowest policy

scoring. Overall, this indicates that the fossil fuel financing in the future and for Africa is likely to be at least in part supported by Asian financial institutions. Historically, China has played an important role in Africa's energy industry through providing significant investment and loans across various energy infrastructure projects. Such financing generated economic, social and environmental impacts across the various countries and communities.

In Sub-Saharan Africa over the past decade, Majors have divested onshore assets in favour of offshore counter-

parts as a risk mitigation strategy. In addition to this, increasing pressure from shareholders resulted in an increase in the relative weighting of gas in Majors' portfolios. One example of this is the recent divestment by Shell, Total and ENI of 45% interest in Nigerian oil mining lease 17 to Heirs holdings. The deal serves as a prime example for how innovative financing structures can be utilized to de-risk investments and attract investment from a range of institutions, including multi-lateral financing institutions, national and international banks, and asset managers of various forms.

As a background to the license, the mature fields contributing to production have been in decline after producing for decades. However, with significant volumes of reserves remaining, in addition to exploration upside, further potential exists in the block. The license also boasts a comprehensive infrastructure network, facilitating export of crude and natural gas.

Four key innovative agreements are in place that have enabled the transaction to take place. Firstly, a technical agreement with Schlumberger provides access to the highest level of technical competence, ensuring execution of an expedited field development plan and accelerated revenue generation required to service debt. Schlumberger will also provide a facility for working capital, further de-risking production expansion – this represents the capital solutions offerings now available from major OFS companies. An agreement has been struck with the Trans-Niger pipeline and Bonny crude oil terminal on a fixed tariff basis, offering further cost visibility required for financing arrangements. A long-term offtake

agreement with Shell and Total provides security of payment, which can also be utilized as an additional facility from which further financing can be raised. Lastly, a gas handling sale and purchase agreement is in place for a portion of the production from the asset providing further visibility on revenues.

The result of the innovative agreements is enhanced confidence in project cashflows for financing institutions, enabling tranches of debt to be portioned off to various institutions, allocated in line with internally accepted risk tolerances. With the reduced appetite from European and American financing institutions for funding fossil fuel projects, it is likely that the use of hybrid financing that maximises and incentivises performance whilst de-risking the investment across the spectrum of counterparties will become more prevalent. Such a movement is supported further by the ongoing hunt for yield by asset managers in an economic environment shrouded in inflation fears due to monetary policies resulting from the global recession. The higher yield offered by emerging markets will likely attract

more capital into new areas, albeit on a case-by-case basis. Overall, the OML 17 transaction can largely be summarized as a mature project, de-risked from an export, payment, and technical perspective, hence representing a prime example of the kinds of assets that can be expected to be financed in Africa.

As conventional financing for fossil fuel projects in Africa becomes harder to come by the door opens for alternative sources of capital and adjusted deal structuring to account for higher perceived risk. In general, larger numbers of financiers involved in individual projects will distribute risk, however this comes with increased complexity when creating agreements as the various parties seek to maximize potential returns and strike the optimal risk-reward balance. Ultimately this will increase the cost of capital for E&Ps through higher interest rates, reduced repayment periods and reduced capture of upside opportunities. Nevertheless, this will encourage project financing, facilitating new developments to take place and for redevelopments to be support.



Figure 4.4: African E&P financing trends – Overview
Production from assets contained within Nigerian license OML 17
Kbbld

Source: Rystad Energy UCube, August 2021

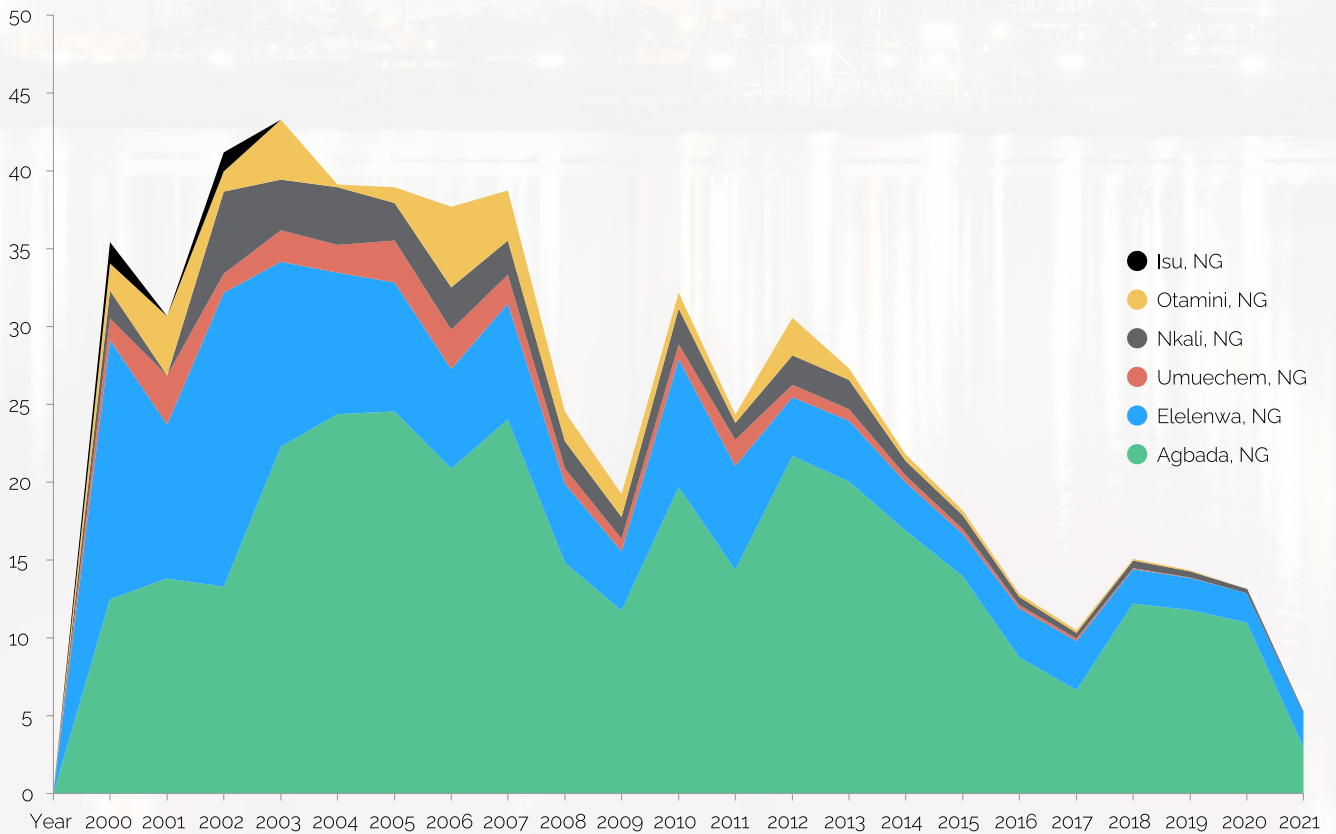
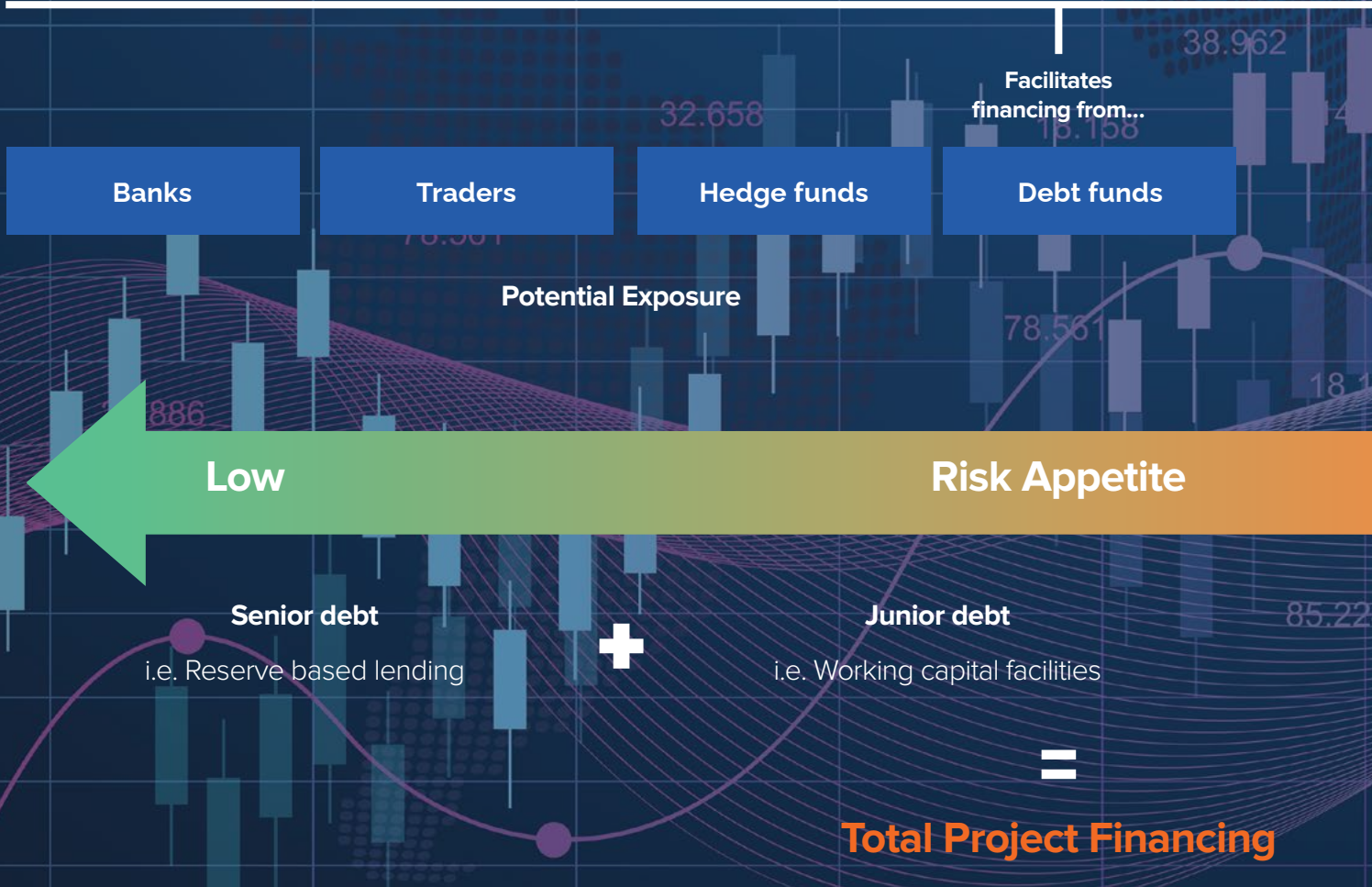
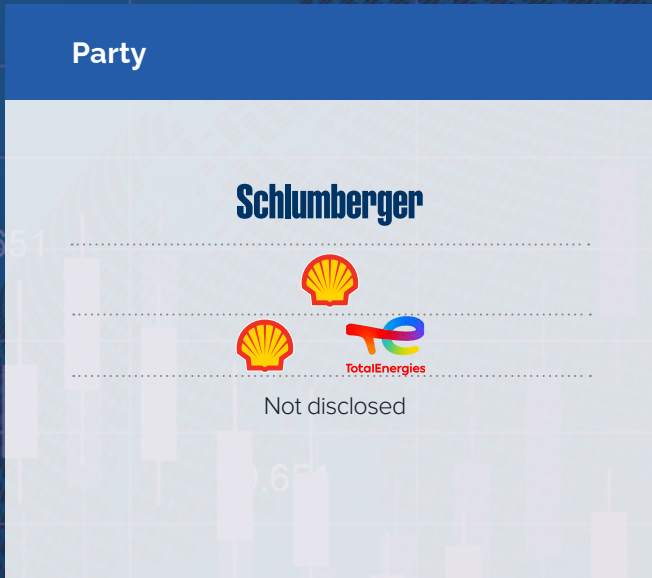


Figure 4.5: African E&P financing trends – OML 17 case study
 An outline of the agreements employed to secure project financing in Africa

OML 17 Agreements	Details
1 Technical services	Strategic cooperation & working capital Access to adequate finance
2 Infrastructure	Fixed tariff for pipeline & terminal
3 Crude offtake	Long -term agreement for agreed volume
4 Gas offtake	Sale & purchase agreement for agreed volume



Source: Rystad Energy research and analysis; Acquisition Financing In An Era Of Energy Transition, Project Finance International



De - risks project from export, payment and technical factors



Potential Exposure



Subordinated debt

i.e. High



Chapter Five

Power & Minerals

Key Highlights

- Total electricity generation in Africa declined by 2.5% in 2020 from 863 terawatt-hours (TWh) in 2019 to 844 TWh. This decline in electricity generation was mainly attributable to the ongoing COVID-19 pandemic, which caused a dip in electricity demand across the board. In 2021, Africa is on track to produce 900 TWh as economic recovery has picked up momentum.

- Conventional fuels such as coal, oil, and natural gas collectively accounted for three-quarters (75%) of Africa's power generation between 2019 and 2021. A deeper dive into Africa's regional electricity generation mix, however, reveals the need for extreme caution not to paint the picture that the whole continent needs to decarbonise. Many countries on the continent are using the energy resources at their disposal and should not be punished for doing so

- Conventional fuels will continue to play a significant role in reducing the energy access deficit on the continent in 2022. Africa needs to make concerted efforts in harnessing its massive hydrocarbon reserves — particularly natural gas. This needs to go alongside new hydropower and renewables.

- Over 580 million (almost 46%) of the continent's population lack access to electricity. To "make energy poverty history by 2030", Africa's electricity generation capacity needs to expand rapidly by over 6% a year to support

strong economic growth, foster industrialisation, and safeguard livelihoods. Natural gas has a proven track record in Africa of enabling access and should continue to be the main instrument against energy poverty.

- Africa's abundant natural gas reserves, with discovered volumes standing at around 600 tcf, can help satisfy continent's future energy demand and play a key part in electrification of sub-Saharan regions due to its accessibility. Development of untapped natural gas potential of sub-Saharan regions will bring the security of supply and independence to countries with economic hardship.

- Gas-to-power generation will help to move away from more polluting fossil fuels and assist in fueling the energy transition. Clear regulations are essential to achieve a widespread distribution of natural gas and construction of gas-to-power facilities.

- Under IEAs Net Zero Emission (NZE) scenario, oil & gas production could drop by 67% in Africa by 2050

- Oil & gas sector employment could fall by over 60% in IEAs NZE scenario

- Africa's renewable power generation expanded noticeably in 2020 and 2021, with wind and solar PV installed capacity growing by 12.2% and 14.5%, reaching 6,491 megawatts (MW) and 9,505 MW, respectively. This trend of growing renewable energy supply during the pandemic is also the case globally and expected to continue in 2022.

- Solar PVs are currently the largest renewable energy source in Africa and generation is expected to grow even larger. From 2010 – 2019, 320 assets were constructed with 14 GW of electricity added. However, between 2020 – 2030, 648 assets are forecast to be constructed generating 77 GW of electricity.

- Rapid moves to attain net-zero at all costs will severely negatively impact Africa's energy sectors, which are a critical source of employment and foreign exchange earnings. Africa remains among the least CO2 — and other greenhouse gases — emitters globally. The transition is less about technological and fuel choices than sustainable livelihoods for the millions of people who live on the African continent

- The increase in demand for battery metals will disrupt global supply chains and open new market opportunities for countries worldwide, particularly Africa. Over half of countries in Africa have at least one of the critical metals needed for the energy transition. Africa retains only 10% of the total value chain leaving other countries such as China and the United States as the primary beneficiaries. The Africa Energy Chamber advocates for an increase to at least 50% by 2030 and 75% by 2040.

- Finally, deepening Africa's critical minerals value chain linkages calls for some radical changes: (1) improve infrastructure and stimulate investments further downstream in the value chain, and (2) provide reliable and cheap electricity for EV deployment, among others.

5.1. A challenging year for Africa's economy and power industry

Total electricity generation in Africa declined by 2.5% in 2020 from 863 terawatt-hours (TWh) in 2019 to 844 TWh. This decline in electricity generation was mainly attributable to the ongoing COVID-19 pandemic, which caused a dip in electricity demand across the board.

In 2021, Africa is on track to produce 900 TWh as economic recovery has picked up momentum.

The pandemic slashed FDI inflows into Africa by 16%, significantly affecting energy value chain infrastructure projects, which were either deferred or cancelled.

Rapid moves to attain net-zero at all costs will have severe impacts on Africa's oil and gas and power sectors, which are a critical source of employment, foreign exchange earnings, and are key to providing affordable and reliable power to the entire economy.

The past one and half years (and counting) have been particularly challenging for many countries worldwide, more so in Africa. Several African economies saw a sharp slowdown in economic activity in 2020, with the continent's first recession in decades. According to IMF estimates, overall real GDP growth on the continent in 2020 was negative 1.9%, one of the worst on record. Although the continent has seen a rebound in economic activity to 3.4% real GDP growth in 2021 as well as a forecast of 4% real GDP growth in 2022, this renewed growth momentum still lags other regions such as Emerging and Developing Asia (8.6% and 6% real GDP growth 2021 and 2022) and the United States (6.4% and 3.5% in 2021 and 2022).

Also, estimates from various agencies indicate that per capita output is not expected to return to 2019 levels until after 2022, as Figure 5.1.1 below shows.

Reasons for the relatively modest growth projections on the continent include continued lack of access to vaccines (vaccine inequity) and the weaker fiscal position of most governments on the continent. So far, less than 5% of the continent's adult population have received either one vaccine dose or been fully vaccinated, according to Africa CDC and World Health Organisation data . While the African continent has recorded relatively lower cases of the virus (including deaths), the unintended socio-economic consequences remain dire. Several studies indicate that people living in extreme poverty globally increased by 120 million during the pandemic. Between 40-50 million or a third of this number, most of them under 18 years were in Africa. As

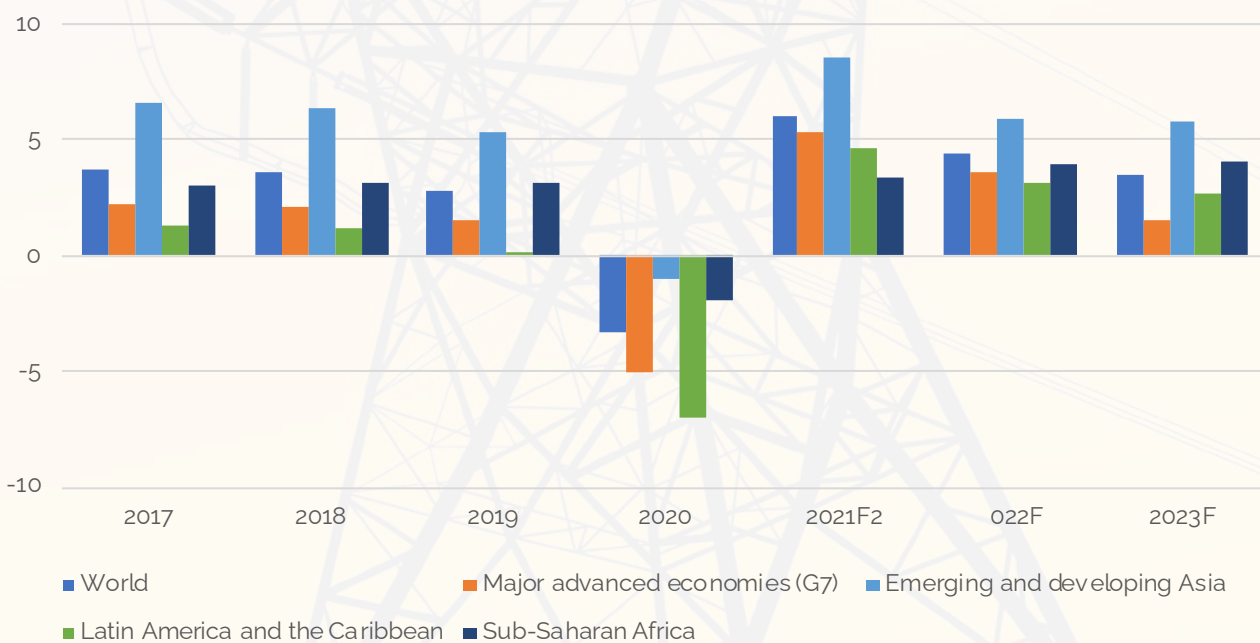
a result, the continent remains in danger of losing a decade's worth of progress in poverty reduction , including increasing energy access.

The economic policy responses to the COVID-19 pandemic by several governments, including those in Africa, encompassed two dimensions: firstly, on the **fiscal front**, which included providing credit/financial policies and support packages for people and businesses; tax policies such as reduction in VAT, CIT, among others; and redirecting savings to COVID-19 related spending such as food stamps, electricity, and water subsidies, among others. Second is the **monetary and macro-financial dimension**, which included reductions in policy rates, lowering the primary reserve requirement and capital conservation buffers of banks, and REPO arrangements to support exchange rate and balance of payments.

Additionally, most countries received COVID-19 emergency financing from multilaterals such as the IMF, World Bank and Africa Development Bank (AfDB) as well as debt relief through schemes as the Debt Service Suspension Initiative (DSSI) , the G20 Common Framework for Debt Treatments beyond the DSSI and the new allocation of US\$650 billion in IMF Special Drawing Rights (SDRs). Despite these interventions, the impact of COVID-19 is likely to linger for longer on the continent as these flows are unlikely to plug the large financing deficit. IMF estimates indicate that Africa requires US\$290 billion (11.16% of the continent's 2019 GDP) of additional financing between 2021 to 2023 just to provide an adequate COVID response.

Figure 5.1.1 Real GDP growth rate (2017-2023 Forecast, %)

Source: IMF World Economic Outlook (April 2021)



The pandemic not only shocked the region but also exposed its fragile energy systems and energy poverty issues. Africa’s rapid economic development is directly linked to the reliable modern energy services provision, primarily electricity. The continent’s rapid economic growth since 2010 has been driven by the expansion of the services and extractives sectors. Statistics show that this development has been catalysed by rising electricity demand, which is estimated to grow

at between 3-5% per annum. However, access to reliable power continues to rank as one of the most significant constraints to doing business on the continent, as captured in the World Bank’s Doing Business Surveys. Furthermore, despite the continent’s vast energy resources, access to modern energy services in Africa remains limited. Over 580 million (almost 46%) of the continent’s population lack access to electricity, and about 730 million lack access to clean fuels and facilities

for cooking, according to IEA and World Bank statistics.

The regional picture is, however, varied: North Africa has a 99% electricity access rate with West Africa (52%), Southern Africa (48%), East Africa (37%) and Central Africa (27%). This lack of access to clean fuels and facilities became more pronounced during the COVID-19 pandemic: multidimensional energy poverty increasing in several households.

This lack of access to clean fuels and facilities became more pertinent during the COVID-19 pandemic, with multidimensional energy poverty increasing in several households.

An IEA study indicates a 2% increase or an additional 13 million people on the continent did not have electricity during the pandemic in 2020. This percentage of the population in sub-Saharan Africa who hitherto already had electricity access could not afford basic electricity services during 2020. Citizens in Nigeria, the Democratic Republic of the Congo and Niger were amongst the hardest hit, IEA data shows. This was due to the reprioritisation of financial resources, some of which were for network expansion and rural electrification programmes, to address the public health emergencies of the pandemic. As such, most of the estimated 70% of the rural population that do not have electricity continued relying on traditional biomass and wood fuel for meeting their domestic needs, deepening energy poverty and health

inequalities. Further compounding this was that the COVID-19 pandemic slashed FDI inflows into Africa by 16%, with the continent's commodity-dependent countries such as Angola, Nigeria and Zambia being more severely impacted than the non-resource-based economies. Some of these were investments into various greenfield and brownfield energy value chain infrastructure projects that were deferred or cancelled.

Interestingly, there was a 28% increase in international project finance for renewable energy deals from USD9.1 billion in 2019 to USD11 billion in 2020, UNCTAD data shows. This increasing trend is consistent with the increasing global decarbonisation push, especially in the post-COVID-19 context. For example, while primary energy demand from

all fossil-based sources decreased in 2020 (gas: -4.99%; coal: -7.73% y/y; oil -9.12% y/y) compared to 2019, renewables grew by 0.79% during the pandemic. Moreover, during the pandemic, the IEA and other influential international organisations released various reports calling for a total ban on oil and gas activities if net-zero is to be attained by 2050. Likewise, various Western nations provided support for their post-pandemic recovery anchored on a “green transition”. For example, U.S. President Joe Biden in April 2021 hosted a virtual summit of world leaders to stimulate global action to reduce carbon emissions. The U.S. Government also announced that it would use part of its fiscal stimulus to achieve a 50%-52% reduction in GHGs by 2030 from 2005 levels under the ‘building back better’ theme.

These rapid moves to attain net-zero at all costs will have severe impacts on Africa's oil and gas and power sectors, which are a critical source of employment, foreign exchange earnings, and are key to providing affordable and reliable power to the entire economy.

The Chamber is of the firm opinion that African governments and other stakeholders can and must do everything in their power to lift the many people on the continent out of poverty by creating sustainable livelihood opportunities, catalysed by the avail-

ability of all forms of energy, including oil and gas, and renewables. However, this must not be forced on the continent as a binary choice as portrayed by certain interest groups and some financiers. Energy poverty remains one of the biggest impediments to

inclusive economic growth on the continent. To that extent, the African continent must leverage all its available energy resources to safeguard energy security and affordability and aggressively fight poverty.

African governments and other stakeholders can and must do everything in their power to lift the many people on the continent out of poverty by creating sustainable livelihood opportunities, catalysed by the availability of all forms of energy, including oil and gas, and renewables.

5.2. Market developments: **Africa's electricity sector** in 2020 and 2021

There is no one-size-fits-all approach to the energy mix as different regions (and the constituent countries) are using the energy resources available at their disposal to drive their economies.

Africa's energy intensity must drastically improve if the continent is to become a major economic behemoth and lift many people out of poverty.

For Africa to achieve its SDGs for electricity access and clean energy, the region would require annual power sector investments to more than double up to 2040.

Africa's abundant 600 trillion cubic feet (Tcf) of natural gas reserves can help meet the continent's future energy demand and play a key part in electrification in various countries due to its accessibility. Development of untapped natural gas potential of sub-Saharan regions will bring the security of supply and independence to countries with economic hardship.

Gas-to-power generation will help to move away from other more polluting conventional fuels and assist in the energy transition. Clear regulations are essential to achieve a widespread distribution of natural gas and construction of gas-to-power facilities.

5.2.1. Supply

Total electricity generation in Africa was 844 terawatt-hours (TWh) in 2020, a 2.5% decline from the 2019 estimate of 863 TWh. This decline in electricity generation was mainly attributable to the ongoing COVID-19 pandemic, which caused a dip in electricity demand across the board, meaning some dispatchable power was not put on the grid based on the merit order. However, despite the disorder of the COVID-19 pandemic in 2020, Africa's renewable power generation expanded noticeably with installed wind and solar capacity reaching 6,491 megawatts (MW) and 9,505 MW signifying a growth of 12.2% and 14.5%, respectively, over the previous year's figures. This trend of growing renewable energy supply during the pandemic is also the case globally. For example, whereas conventional fuels such as nuclear, oil, coal, and even gas recorded year-on-year declines in 2020 compared to 2019, renewable energy deployment recorded a 0.79% growth during the pandemic. This was catalysed by the 28% increase in international project finance for renewable energy deals from USD9.1 billion in 2019 to USD11 billion, as UNCTAD data show. In Africa's context, many of these new renewable energy additions to the mix were projects that had already received final investment decisions pre-pandemic.

Conventional fuels will continue to make up the most share of Africa's power generation mix in 2022 as it did from 2020-21. Natural gas (39%), coal (28%) and oil (8%) collectively account for three-quarters of total power generation by fuel type (Figure 5.2.1.1 and Table 5.2.1.1). Hydro accounted for 17% and nuclear (2%), while renewables, principally solar, wind and geothermal, accounted for the remaining 6%. However, it is helpful to stress the importance of the heterogeneity of electricity generation by source in other regions. For example, North America's electricity generation is comprised of natural gas (38%), nuclear energy (18%), coal (17%), hydro (13%) and renewables (12%). In Europe, the mix is made up

of renewables (24%), nuclear energy (22%), natural gas (20%), hydro (17%), and coal (15%). On the other hand, in Asia Pacific, coal dominates the electricity mix at 57%, followed by hydro (14%), natural gas (11%), renewables (10%) and nuclear (5%). The data clearly illustrates that

there is no one-size-fits-all approach to the energy mix as different regions (and the constituent countries) are using the energy resources available at their disposal to drive their economies. While renewables account for the largest share of the electricity mix in Europe, coal

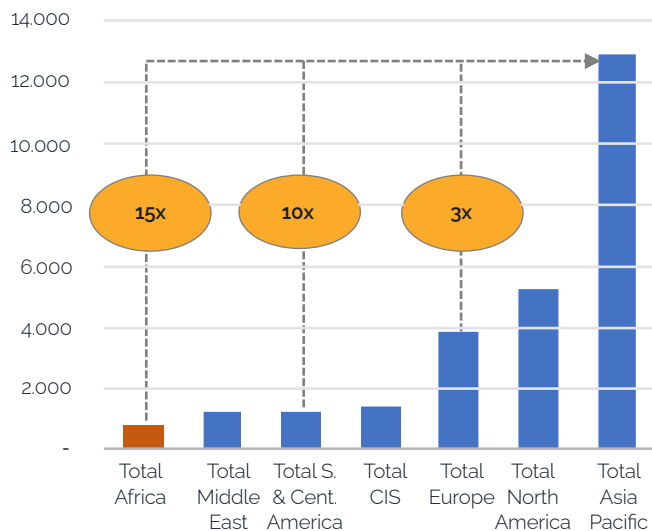
dominates in Asia Pacific, natural gas in Africa, the United States and the Middle East, and hydro in South and Central America. As noted, natural gas has a proven track record in Africa of enabling access and should continue to be the main instrument against energy poverty.

There is no one-size-fits-all approach to the energy mix; different regions (and the constituent countries) are using the energy resources available at their disposal to drive their economies.

Natural gas has a proven track record in Africa of enabling access and should continue to be the main instrument against energy poverty

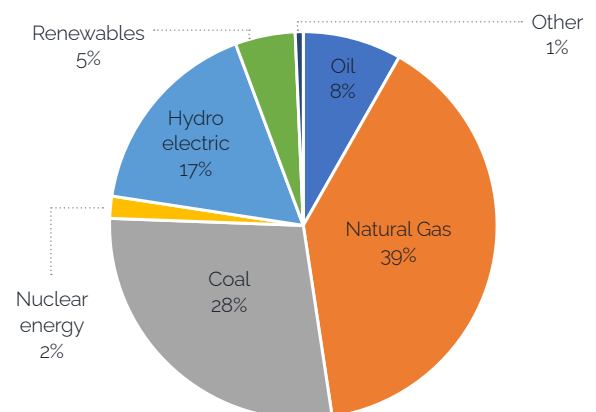
Figure 5.2.1.1 Africa's electricity compared to the world, and generation mix by fuel in 2020

Electricity generation by fuel (Terawatt-hours, TWh)



Source: BP Statistical Review 2021

Africa's Electricity Generation Mix by Fuel, 2020-21



Source: BP Statistical Review 2021

Table 5.2.1.1. World regional electricity generation by fuel (%)

Region	Oil	Natural Gas	Coal	Nuclear energy	Hydro electric	Renewables	Other	Total
Total North America	1%	38%	17%	18%	13%	12%	0%	100%
Total S. & Cent. America	7%	18%	6%	2%	51%	15%	0%	100%
Total Europe	1%	20%	15%	22%	17%	24%	2%	100%
Total CIS	1%	47%	16%	16%	19%	1%	0%	100%
Total Middle East	28%	66%	2%	1%	2%	1%	0%	100%
Total Africa	8%	39%	28%	2%	17%	5%	1%	100%
Total Asia Pacific	1%	11%	57%	5%	14%	10%	1%	100%

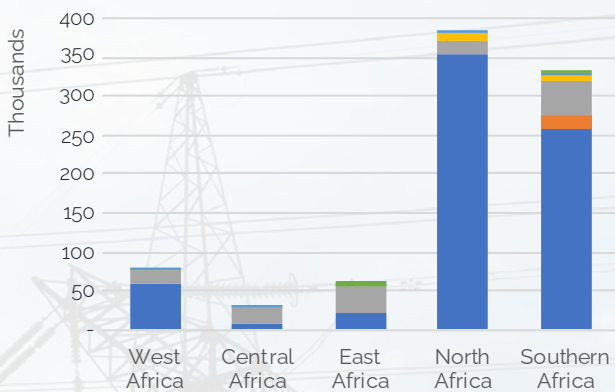
Source: BP Statistical Review 2021

Again, a deep dive into Africa's regional electricity generation mix reveals the need for extreme caution not to paint the picture that the whole continent needs to decarbonise its electricity mix. For example, while 75% of electricity generated in West Africa comes from conventional fuels, this is principally resource driven. That is, it is based on an abundance of environmentally friendly natural gas found in the region (Figure 5.2.1.2). The remaining share of West Africa's electricity mix are hydropower (23%) and renewables (1%). In Central Africa, again the share of the electricity mix is driven by the fuel resource availability as hydropower makes up the most significant share at 72%, followed by conventional fuels (principally oil and gas fired thermal power generation) at 28%. Renewables make up less than 1% of the power

mix in Central Africa. The story in East Africa, is however, slightly different when it comes to renewables – they constitute about 11% of the mix, which is the highest in all the regions of the continent. This breaks down into solar, wind, tide, wave, and other sources (2%), biofuels and waste (2%) and geothermal energy (7%). The remainder of the electricity mix is made up of conventional fuels (36%) and hydropower (53%). Northern Africa's electricity mix is also resource-driven, being heavily dominated by natural gas and oil (93%), hydropower (4%), and solar, wind, tide, wave, and other sources (3%). Finally, 79% of the electricity mix in Southern Africa is from conventional fuels (mostly coal) followed by hydropower (14%), nuclear power (5%), and solar, wind, tide, wave, and other sources (2%).

Figure 5.2.1.2 Regional breakdown of mix

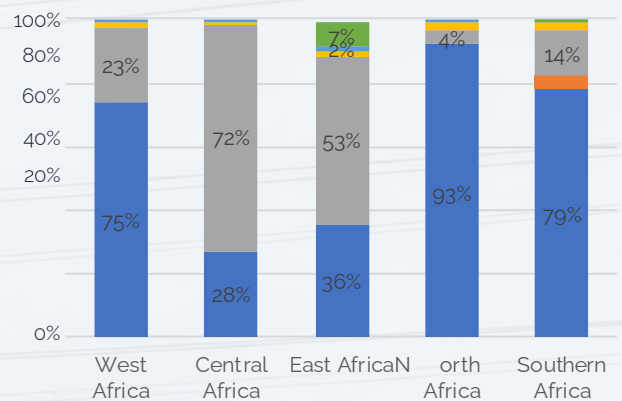
Regional electricity generation by mix (GWh)



- Electricity generated from geothermal energy (GWh)
- Electricity generated from biofuels and waste (GWh)
- Electricity generated from solar, wind, tide, wave and other sources (GWh)
- Electricity generated from hydropower (GWh)
- Electricity generated from nuclear power (GWh)

Source: IRENA database, AFREC Database, Tracking SDG7/WBG

Regional electricity distribution % mix



- Electricity generated from geothermal energy (GWh)
- Electricity generated from biofuels and waste (GWh)
- Electricity generated from solar, wind, tide, wave and other sources (GWh)
- Electricity generated from hydropower (GWh)
- Electricity generated from nuclear power (GWh)

Source: IRENA database, AFREC Database, Tracking SDG7/WBG

Regarding the diversification of the mix, Southern Africa has the most diversified mix with electricity coming from six (6) sources. This is followed by East Africa with five (5) sources, and then West Central and North Africa with four (4) sources. This again highlights the

heterogeneity of Africa’s power mix and any discussion of the energy transition needs to take this into account, especially at regional and country levels. Ultimately, changing the power mix remains country level responsibilities subject to their own developmental imperatives

and other international commitments such as the nationally determined contributions (NDCs) under the Paris Agreement. The Africa Energy Chamber strongly asserts that the two must not be made to be mutually exclusive, as some other organisations seek to do.

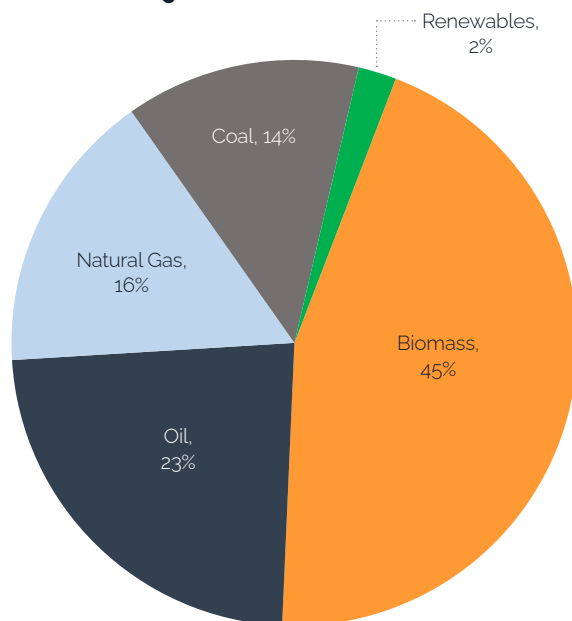
Ultimately, changing the power mix remains a country level responsibility subject their own developmental imperatives and other international commitments such as the nationally determined contributions (NDCs) under the Paris Agreement.

5.2.2. Demand

At a regional level, Sub-Saharan Africa’s per capita electricity consumption has barely increased during the last decade and presently around 665 kWh per capita. The value is much lower in most parts Africa: below 100 kWh per capita in Niger, Ethiopia, and Benin. Africa’s electricity demand is estimated to have fallen by over 2.5% in 2020 due to the impacts of the COVID-19 pandemic. Natural gas is set to become a mediator between the ambitious energy transition targets set out by policymakers and the security of African energy supply. Comprehensive energy access across the continent remains a central target, with some 600 million people without access to electricity today. Moreover, households themselves, facing low and inadequate supply of electricity, often rely on highly polluting traditional energy sources such as hard biomass which constitutes 45% of total primary energy demand in Africa (Figure 5.2.2.1).

The bulk of electricity consumption comes from the North African economies (44%) and Southern Africa economies (38%), accounting for over 80% the total. In comparative terms, Central Africa has the least consumption followed by East Africa, West Africa, Southern Africa and finally Northern Africa. Overall, the continent’s electricity demand is set to grow between 3%-5% annually over the next decade driven by economic recovery, industrialisation, and renewable power scale-up – including hydropower, wind, geothermal and solar PV.

Figure 5.2.2.1 Total primary energy demand in Africa 2019



Africa’s energy use per capita must drastically improve if the continent is to become a major economic behemoth and lift many people out of poverty (Figure 5.2.2.2). For example, Both Nigeria and Ghana’s electricity consumption are a paltry 0.13 and 0.54 megawatt-hrs per capita (MWh/capita) whereas Germany, the industrial giant in Europe, is 6.77 MWh/capita. Also, China and the United States are doing 5.12 and 13.02 MWh/capita respectively. Thus, for Africa to reduce poverty, access and thereby productive uses of electricity must be priority. Hence, why we have a clarion call to “Make Energy Poverty History” by 2030 and also advocated for “Africa’s Common Sense Energy Agenda”. Recent figures show that sub-Saharan Africa is recovering slower from COVID-19 than the rest of the world . There are worrying signs that the wealth gap is increasing as many African nations don’t have the necessary economic cushioning to take on the hit of the global pandemic. While the rest-of-the-world’s per capita GDP has already returned to its pre-pandemic levels, in sub-Saharan Africa the recovery could last until 2023, with the gap further widening in the following years. Providing power to the low-income countries can be crucial to speed up the revival of their economics and battle unemployment rates.

Africa’s energy intensity must drastically improve if the continent is to become a major economic behemoth and lift many people out of poverty.

Source: Africa Energy Outlook, IEA 2019

Establishing universal access to power remains one of the strongest drivers for new energy projects. Only 56% of the continent’s population has access to electricity today (Figure 5.2.2.3). Whilst North Africa has succeeded in recent years to provide security for its energy supply, it is still a heavy task for many sub-Saharan regions with lower income. In 13 countries the share of the population with access to electricity is below 40%. National energy programmes (NEPs) are crucial to set up a robust system

in place. Several countries are taking swift actions to complete full electrification in the next 3-5 years (Table 5.2.2.1).

However, despite their best efforts, when taking into consideration Africa’s booming population growth, current rates are not enough to reach full electrification. It is estimated that the continent’s population will double in the next 30 years and two thirds of it will be urbanized. These growth numbers possess an additional challenge

to meet the energy demand in the future. The current electrification rates will have to be tripled, connecting 60 million people each year to reach a goal of universal access by 2030. The African Single Electricity Market (AfSEM) launched in June 2021 is a significant first step towards universal access. There must be further investments into infrastructure to bridge more interconnectors across different power pools and allow higher electricity volumes to be exchanged between the regions.

Figure 5.2.2.2 Electricity consumption per capita vs population size

Electricity consumption per capita vs population size

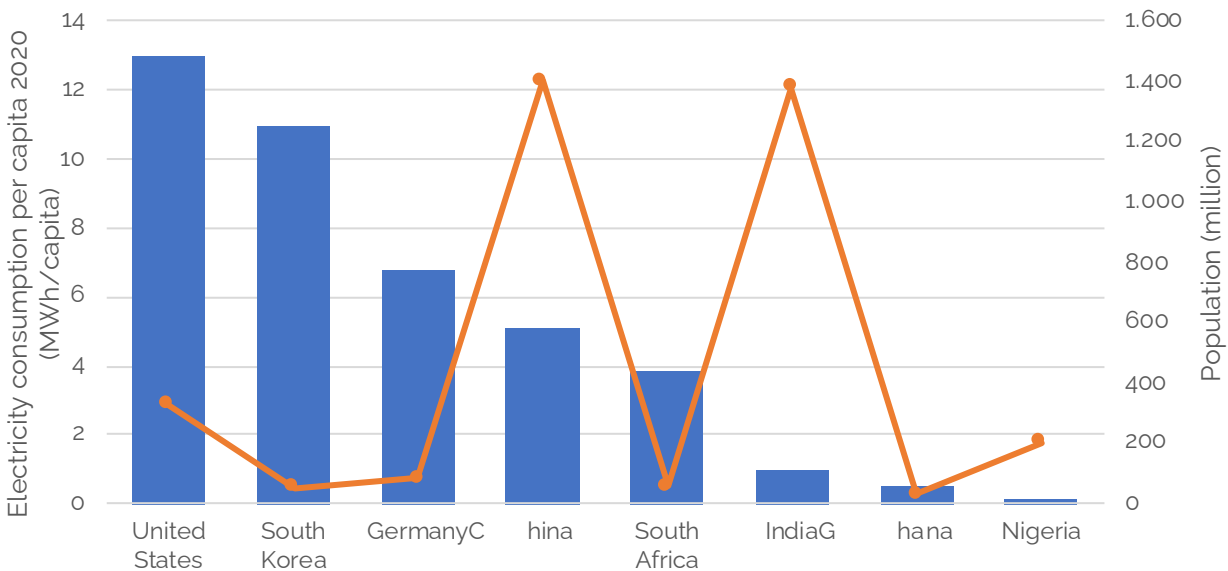


Figure 5.2.2.3 Population access to electricity, 2019 % of population

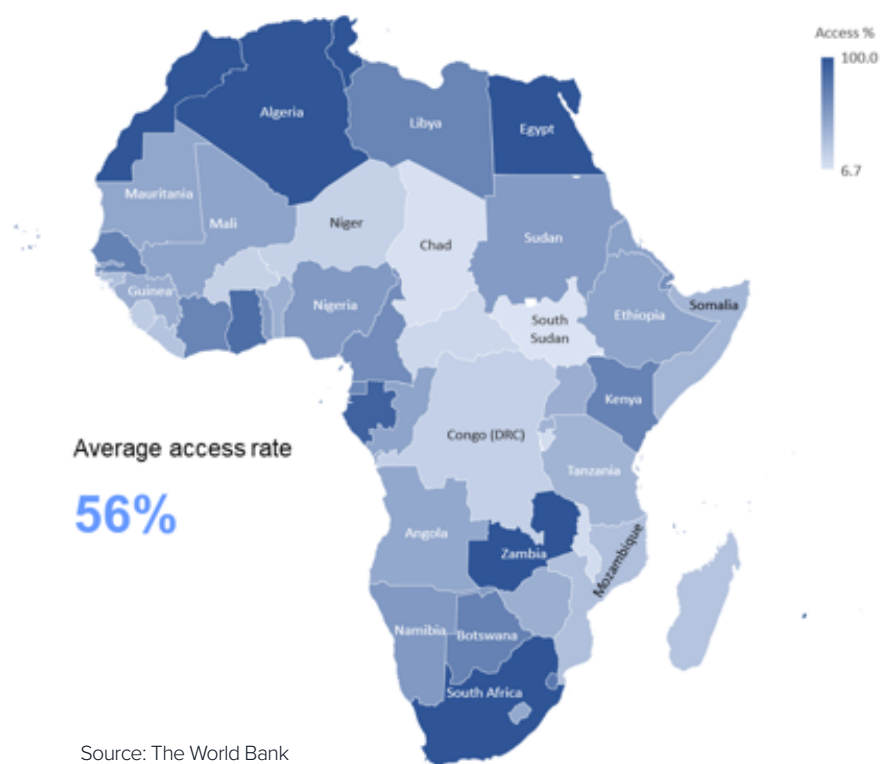


Table 5.2 Selected country electrification programmes and timelines

Country	State Programmes	Target
Kenya	Kenya National Electrification Strategy (2018): investment of \$2.8 billion from 2018-22. Kenya Off-grid Solar Access Project: distribute 250 000 solar home systems to power households, schools, health facilities and agriculture by 2030.	Full access by 2022
Ethiopia	Electrification Program (2017): geospatial least-cost roll-out plans, fast paced extension of the grid to reach 65% of the population with the grid and 35% with decentralized systems by 2025; public-private off-grid programme for 6 million households.	Full access by 2025
Côte d'Ivoire	Programme Electricité pour Tous: electrify 1 million households. Programme National d'Electrification Rurale: connect all towns above 500 inhabitants by 2020, and all areas by 2025. Tariff reductions for poor households.	Connect all areas by 2025
Rwanda	Energy Sector Strategic Plan and Rural Electrification Strategy: connect 52% households to the grid and 48% to decentralized systems by 2024; connect all productive users; cut by half the duration and number of interruptions; introduction of appliance efficiency standards.	Full access by 2024
Senegal	National Rural Electrification Program (PNER), aiming to electrify 95% of rural clients through grid extension, 4% through solar only or solar-diesel hybrid mini-grids, and the rest through solar home systems.	Full access by 2025

Source: Modified from IEA

5.4. Investment climate and projects pipeline

The economic downturn has negatively affected the progress that had been made on electrification in Africa. For Africa to achieve its SDGs for electricity access and clean energy, the region would require annual power sector investments to more than double up to 2040.

Major projects in African countries depend on FDI and foreign workers, which given the travel restrictions, resulted in delays, and rescheduling of projects in the region.

The economic decline driven by the COVID-19 pandemic had dramatic effects on investments in the economic sector in Africa into 2022. The economic downturn has negatively affected the progress made on electrification in Africa, as utilities — working to improve electrification— also faced severe financial difficulties due to a freeze in investments. Progress on several projects stalled as firms re-evaluated the viability of their project development plans due to the economic effects of the pandemic and resulting travel restrictions. Expected start dates for several projects have had to be changed due to the uncertainties of the pandemic, as seen in the case of Mozambique’s LNG project in East Africa. Total’s Tilenga project on Lake Albert in Uganda has also experienced some delay. The commissioning of the PETN wind plant in Senegal, West Africa, due in 2020, had to be de-

layed due to the pandemic. The Greater Tortue Ahmeyim gas megaproject located in the maritime border of Mauritania and Senegal, West Africa, which was to be completed and commissioned in 2022, will not come on stream before 2023. FIDs on the gas project’s Yakaar and GTA Phase 2 satellite fields will likely be postponed until 2023. The shift in starting dates for energy projects is bad news for some of these countries that were looking forward to becoming significant producers in the long run. There is a further risk of outright cancellation for certain projects whose operating costs would be incompatible with oil prices below US\$40 per barrel resulting in portfolio reviews by many firms. Africa would require annual power sector investments to more than double up to 2040 to achieve the Sustainable Development Goals on electricity access and clean energy (SDGs 7 & 13).

The economic downturn has negatively affected the progress that had been made on electrification in Africa. For Africa to achieve its SDGs for electricity access and clean energy, the region would require annual power sector investments to more than double up to 2040

Nevertheless, some regional projects progressed during 2020 and 2021: The first filling of the lower section of Ethiopia’s Grand Renaissance Dam was completed. The first two turbines of the 6 gigawatts (GW) plant will likely be commissioned by end-2021. The dam will be a major driver

for the East African Power Pool interconnection project. The construction of 2GW 1,055 kilometre bipolar HVDC interconnector between Ethiopia and Kenya is expected to be completed in late 2020. Investments in Africa in 2020 was led by renewables, according to the IEA. Sever-

al solar PV, wind plants and geothermal projects were announced, and contracts were signed in 2020 in Morocco, South Africa, Togo, and Tunisia, among others. Table 5.3 below shows some power projects that have been affected by the COVID-19 pandemic in Africa.

Major projects in African countries depend on FDI and foreign workers, which given the travel restrictions, resulted in delays, and rescheduling of projects in the region.

Table 5.3 Project announcements

Sub-region	Country	Project	Type of project	Project Mix	Level of Project Development	Project Backers
East Africa	Ethiopia	Grand Renaissance Ethiopia Dam	Generation	Renewable (Hydro)	First filling of the lower section of the dam	
West Africa	Senegal	Parc Eolien Taiba N'Diaye (PETN) wind plant	Generation	Renewable (Wind)	Getting the final capacity online has had to wait for the effects of the pandemic and the resulting travel restrictions to ease. Was to be commissioned in 2020.	Lekela Power
West Africa	Border between Mauritania & Senegal	Greater Tortue Ahmeyim gas megaproject	Generation	Conventional (LNG)	Will not come on stream before 2023 (though its start-up date was originally 2022) because the coronavirus outbreak prevented the company using 2020's weather window to build a breakwater for the scheme.	British Petroleum Company Limited (BP)
East Africa	Seychelles	Floating solar power plant	Generation	Renewable (Solar)	Delayed tender process due to travel restrictions in Seychelles. Was to be commissioned in 2020.	Qair
East Africa	Mozambique	Mozambique LNG project	Generation	Conventional (Natural Gas)	Expected start date (2021) has been rescheduled for before 2025.	Total
East Africa	Mozambique	Rovuma LNG project	Generation	Conventional (Natural Gas)	ExxonMobil indefinitely postponed its Final Investment Decision (FID) on the project	ExxonMobil
East Africa	Uganda	Tilenga project on Lake Albert	Generation	Conventional (Crude oil)	Production start date has been moved from 2019 to 2022	Total
North Africa	Egypt	West Delta Deep Marine project's 10th phase	Generation	Conventional	An outbreak among workers hampered efforts to take the BP-led Raven gas field on stream. The project was experiencing significant delays and would not come fully online as anticipated	
Southern Africa	South Africa	Brulpadda and Luiperd gas discoveries	Generation	Conventional (Gas)	COVID-19 has delayed South Africa's plans for a new upstream bill. Media reports indicate that Total postponed its application for additional drilling in a South African offshore gas block	

5.5. Scenarios of electricity supply outlook

Three scenarios of electricity production outlook and break-down by mix to 2040 are presented:

Scenario 1 - Business as Usual (BAU);

Scenario 2 - making energy poverty history by 2030;

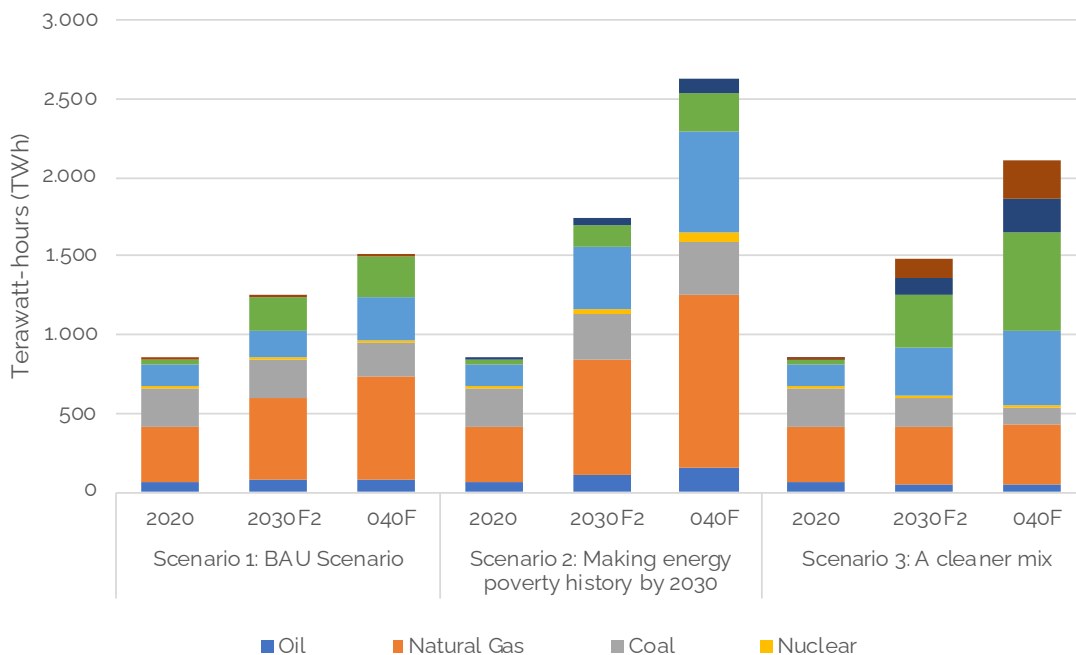
Scenario 3 - A 'cleaner' mix.

This section of the outlook offers succinct scenario-based modelling of different electricity production pathways, capturing primary fuels, technologies, cost, and generation outlook spanning 2020 to 2040. Three scenarios are analysed: firstly, our Business as Usual (BAU) Scenario 1 investigates the continuation of current electricity generation trends. Scenario 2 explores the possibility of eliminating energy poverty by 2030

using all forms of energy without any climate constraints. Finally, Scenario 3, encompassing a more 'cleaner' electricity mix, examines the principal role of expanding renewable energy and efficiency in improving the electricity supply system in Africa. Figure 5.5.1 and Figure 5.5.2 show the electricity generation outlook and mix under the three various scenarios. These are fully discussed in the next section.

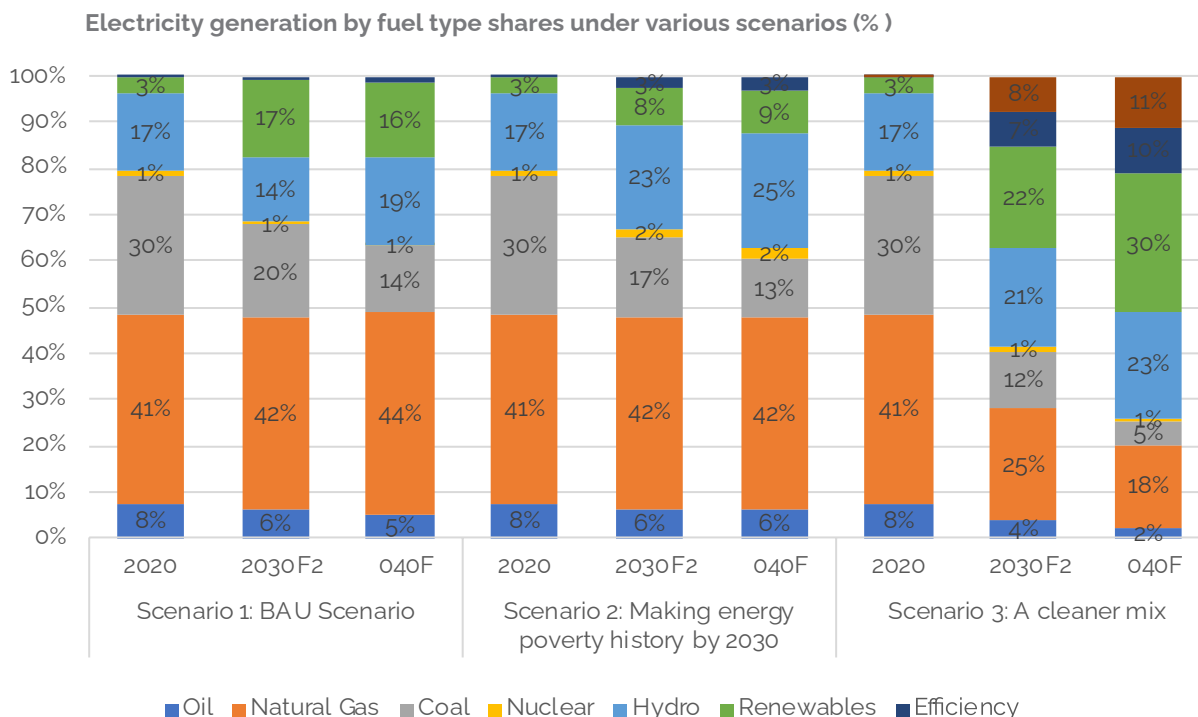
Figure 5.5.1 Electricity generation outlook and mix – various scenarios

Electricity generation by fuel type under various scenarios (TWh)



Historical data: BP Statistical Review (2021). Forecasts independently produced

Figure 5.5.2 Electricity generation by fuel type shares under various scenarios (%)



Historical data: BP Statistical Review (2021). Forecasts independently produced

5.5.1. Scenario 1: BAU Scenario – normal investment flows

In the BAU scenario, Africa’s electricity generation reaches 1,512 terawatt-hours (TWh) in 2040, denoting a 78% growth in electricity supply over the next two decades. This raises the share of natural gas in total electricity generation from below 40% in 2020 to 44% in 2040. Electricity generation from coal and oil is progressively declining but still significant to account for 14% and 5% respectively of the region’s power mix by 2040. Hydropower to continue as the second major electricity source in Africa with utilisation increasing at an annual average rate of 5.0% to reach almost 282 TWh in 2040, given catalogue of ongoing hydro projects

including 18 MW Gourbassi projects at Senegal-Mali border, 6,350 MW, Great Ethiopian Renaissance Dam (GERD), Uganda’s 600 MW Karuma hydropower project coupled with several others ongoing across the continent in countries ranging from Nigeria and Mozambique to Zambia and Morocco.

The contribution of renewables, notably solar, wind and geothermal, are also expected to rapidly expand in notable African countries endowed with high quality solar, wind and geothermal resources, most especially South Africa, Namibia, Kenya, and Senegal. Furthermore, the contri-

bution of nuclear power and other sustainable and efficient sources increased slightly to maintain their share of approximately 1% each by 2040. Nonetheless, with United Nations estimates that about 579 million people in sub-Saharan Africa lack electricity access and overall population predicted to double by 2050, there exists a significant generation deficit under BAU scenario, thus underlining the crucial need for power generation capacity to be doubled by 2030 and possibly tripled by 2040 to the bridge access gap and accelerate the pace of electrification in rural/remote communities of the region, particularly in Sub-Saharan Africa.

5.5.2. Scenario 2: Making energy poverty **history by 2030**

In the making energy poverty history by 2030 Scenario, Africa's electricity generation capacity expands rapidly by about 6% a year to support strong economic growth, foster industrialisation, and safeguard livelihoods. This results in a sharp decline in poverty levels and uses all forms of energy without any climate constraints. The Chamber estimates that Africa's power generation capacity in 2020 needs to be tripled, increasing by 209%, from 848.6TWh in 2020 and 2021 to 2,622 TWh in 2040 to develop its economy and lift its teeming population out of poverty. Based on this scenario, conventional fuels, which account for about 61% of total electricity generation, are expected to play a huge role in alleviating poverty in Africa and can contribute to energy access improvement across a range of economies, sectors, and communities. Conventional fuels deployment scales from around 665 TWh in 2020 to more than 1,126 TWh

by 2030 and 1,587 TWh by 2040.

The share of hydro in power generation, about a quarter of the electricity supply in Africa, overtakes coal by 2040. Modern renewables: solar PV, wind and geothermal together provide 9%, to compensate for the sharp fall in coal-fired power generation with a further 3% emanating from other sustainable energy sources and technological advancement, including carbon capture, utilisation, and storage (CCUS) and hydrogen fuel cells. Nuclear power will continue to play a minute role in Africa's electricity generation landscape due to technical constraints and lack of know-how, and limited expertise in most countries. To achieve this lofty ambition of making energy poverty history, the scenario calls for accelerated efforts and huge investment in fossil-powered generation (natural gas led) combined with renewable technologies to meet Africa's rising power de-

mand for urbanisation, industrialisation, population growth and sustainable economic growth.

Africa is expected to become one of the fastest growing continents in the world by 2040. Fossil fuel still dominates the power mix of leading African economies, including Nigeria, South Africa, Ethiopia, Kenya, and Ghana, supplying around 60% of their electricity in 2020. Oil and natural gas will account for around a quarter of the supply, and remainder from renewables, especially hydro and solar PV. Given the urgency of achieving universal access, Africa needs to make concerted efforts in harnessing its massive hydrocarbon reserves, particularly oil and natural gas in Nigeria, Algeria, Egypt, and Libya, combined with coal consumption for industrial activities and power generation, particularly in South Africa and Morocco, alongside new hydropower development and higher penetration of variable renew-



5.5.3. Scenario 3: A 'cleaner' mix

Under this scenario, electricity generation output from renewable sources is expected to increase exponentially owing to significant potential, declining cost, low operating costs and rising public support for cleaner power sources. In aggregate, this implies that cleaner energy sources will by far outstrip oil, coal, and gas-fired generation in Africa and continue to expand beyond 2040. This pathway becomes feasible given that all African countries have enormous potential (although in varying magnitude) of biomass, geothermal, hydropower, solar and wind resources with remarkable growth already witnessed in South Africa, Morocco, and an array of East Africa economies with escalating renewable energy project deals and ongoing constructions across the continent.

Based on recent expansion in cleaner energy and efficiency-measures deployment to boost power supply (at affordable costs) in Afri-

ca, electricity generation is expected to increase by 148% to 2,103 TWh by 2040. As such, this cleaner portfolio of generation by 2040 involves a wide range of technologies, including modern renewables – principally solar PV, wind and geothermal, which collectively accounts for 30%, followed by hydro (23%), gas (18%), other innovations (11%), energy efficiency (10%) whilst the remaining 8% is supplied by coal, oil and nuclear, thus making the proposed generation mix well diversified and less susceptible to supply disruptions. Countries such as South Africa, Morocco and Senegal are envisaged to champion the realisation of this goal, considering their records of aggressive pursuit of storage projects and other innovations to bolster generation systems flexibility.

As the generation capacity is lesser in 2030 in this scenario than it is in Scenario 2 (making energy poverty history by 2030), this estimate will not be enough to meet the

electricity needs of the continent's rapidly expanding population. As of 2020, only 55% of Africa's populace had access to electricity – thus requiring doubling the capacity to achieve 100% access by 2030 and beyond. Given the rising global shift towards energy transition and renewable energy, Africa could take advantage of the vast renewable energy potential, energy efficiency and other minerals such as cobalt and platinum to fast-track the growth of clean energy industries. For instance, South Africa and the Democratic Republic of the Congo produce roughly 70% of cobalt and platinum, which constitutes integral component used batteries and hydrogen fuel cells production, respectively. Overall, Africa can draw on rich energy mineral resources and technological advancement to meet its 2040 electricity requirement expected to be three times larger than 2020 levels with appropriate policies, planning, investment, infrastructure, institutions, and collaborations.

Chapter Six

The Energy Transition, **Africa's Energy Markets:** Challenges And Opportunities

Africa's greenhouse gas emissions are among the lowest in the world, and a rapid transition as being envisaged will have asymmetric effects on the continent.

The energy transition in Africa should not be just about decarbonisation; instead, it should be about using all forms of available energy resources to diversify its economic base.

Solar expected to represent the key renewable energy source after 2030.

Under IEAs Net Zero Emission (NZE) scenario, oil & gas production could drop by 67% in Africa by 2050

Oil & gas sector employment could fall by over 60% in IEAs NZE scenario

Oil and gas, and other critical minerals such as copper and lithium, must continue to play a key part in Africa's transition story

The increase in demand for battery metals will disrupt global supply chains and open new market opportunities for countries worldwide, particularly Africa.

6.20. Energy transition and Africa's energy markets

The global energy system is under pressure to reform shaped by the ever-growing energy transition narrative. The energy transition, often described as a transition from the current fossil fuel-based economy to one powered by cleaner, low or no-carbon renewable energy sources, is considered critical to curbing the increase in global temperatures observed over the last decades due to the exploitation of fossil fuels for industrialisation mainly by developed nations. By and large, efforts are geared towards emission reduction strategies to limit global warming to well below 2 degrees Celsius, compared to pre-industrial levels. Moreover, the energy transition continues to spur a rethink of how energy is extracted, converted, stored, transmitted, and distributed – the power sector, a key target due to its contribution to emissions growth. As such, decarbonisation of the sector, particularly on the generation side, is considered one of the most effective mitigation strategies to reducing CO₂ levels and ultimately addressing climate change.

The momentum behind the transition globally is driven by economic, social, technological, and regulatory factors (Figure 6.1.1). On the economic side, supply and demand issues regarding fossils and renewable energy are central. The well-known issues around extreme fluctuations in the price of oil over the last decades, including sustainability issues, have driven the demand for renewable energy, which in many places is increasingly competitive. Social pressures from climate change activists and communities in advanced economies are also a strong driver to prioritise climate change in policy and set ambitious renewable energy targets. On the technology front, positive development in renewables and other supporting technologies, including business models, moves renewables from niche to mainstream and ensures that power solutions can be deployed rapidly and at scale. Undoubtedly, technological challenges still exist on many fronts, but the horizon looks promising considering innovation and ongoing research. Lastly, regulation changes in reporting standards for various businesses and corporations where shareholders request identification and quantification of the financial impacts of climate-related risks are increasing. A summary of these drivers is shown in the chart below.

Figure 6.1.1 Energy transition drivers



Economic factors

- Price volatility: Supply and demand issues regarding fossil fuels
- Issues of sustainability/SDGs compliance and net zero pledges



Social factors

- Climate activism – planetary crisis encompassing global warming, air pollution, loss of ecosystems and new pandemics
- Socially driven ambitious targets for RE
- Energy access and energy security in especially developing countries



Technological factors

- Cost-competitiveness: significant drop in cost of RE technologies due to innovation
- Deployment of RE at scale



Regulatory factors

- Changing investor priorities: environmental, social and governance issues (ESG) by stakeholders and investors
- Changes in reporting standards for various businesses – climate benchmarking and reporting

Source: Author's construct

Africa remains among the least CO₂ (and other greenhouse gases) emitters globally (Figure 6.1.2). The continent emitted 1,308 Million tonnes of CO₂ in 2019, representing a 2% growth in the decade between 2008-18, representing only 2% of the global energy-stimulated CO₂ emissions, as shown in the chart below. However, the impacts of climate change are being felt, and they are unevenly distributed across the continent in the form of drought-induced conditions and reduced rainfall for hydroelectric power generation, among others. Similar to the issues with O&G, there are capacity issues in Africa due to weak sector planning and management. Regulatory and legal frameworks are often missing, making investments in renewables more expensive. Above all else, the electricity grids present challenges, often suffering from high loss rates, and limited capacity in addition to being financially unsustainable with limited opportunities for expansion or required maintenance. It's important to note that each country has different socio-economic starting points and political ambitions, which will take them down different paths in the energy transition. The transitional pace is dictated by each country's current dependence on fossil fuels, existing industrial productivity, future technology choices and depth/diversity of domestic supply chains.

Carbon emissions are shaping

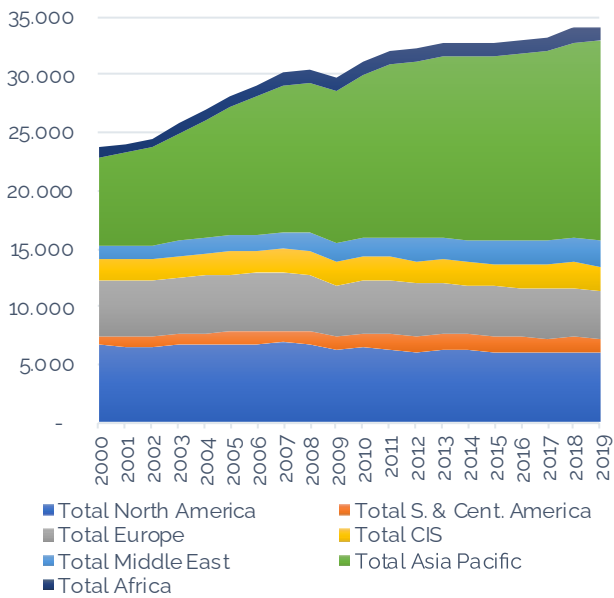
the portfolios of the world's biggest energy companies, whom are "screening assets for divestment", since oil price risks and carbon neutral goals are shrinking the pool of buyers for oil and gas (O&G) assets. Rising energy demand in Africa, set to double by 2040 due to rising population, requires a broader portfolio than the currently declining O&G sector. Focusing on renewables over fossil fuels allows job creation, economic growth, social and health benefits, and climate change mitigation. In fact, according to the IRENA, Africa's estimated potential to generate renewable energy from existing technologies is 1,000 times the projected demand in 2040. They also project that renewables would create 45 million jobs by 2050, and global GDP would rise 2.4%. However, equal growth needs to be observed in annual investments, as the African energy system must see double the investment by 2030 to \$40 – \$65 billion. In 2021, 12% of Africa's total primary energy demand was met by renewables, with 42% of that being Solar, 38% onshore wind and 15% pumped storage. With this figure on the rise, relatively higher emitting countries, largely dependent on their hydrocarbon resources for example, Angola, Equatorial Guinea, and South Sudan are vulnerable to energy transition risks due to the carbon neutral goals of the world's major companies. Demand for O&G may still be growing, with

prices still likely to hit peaks in the future, however investment in O&G projects is a risk, justifying the drop in investment in the last few years. The energy transition is observed in the projections of the renewables energy sectors, as each one observed growth in the coming decade.

The falling cost of renewable technology, coupled with fresh investments, such as by the African Development Bank (AfDB), the Korean Ministry of Economy and Finance and the Export-Import Bank of Korea provision of \$600 million on renewable energy solutions, is pushing this sector forward. The World Bank announced a \$465 million fund to improve renewable energy integration in West Africa, and \$168 million financing towards Burkina Faso's efforts to increase access to electricity in rural areas and support the country's transition to clean energy. Similarly, the International Finance Corporation (IFC) and The Rockefeller Foundation (RF), a partnership which aims to mobilize \$2 billion of private sector investment in distributed renewable energy solutions, including scaling a mini-grid program and battery energy storage. Africa Renewable Energy Fund II (AREF II) raised €130 million to finance renewable energy in sub-Saharan Africa. The European Investment Bank (EIB) also approved \$95 million for funding geothermal energy projects in East Africa.

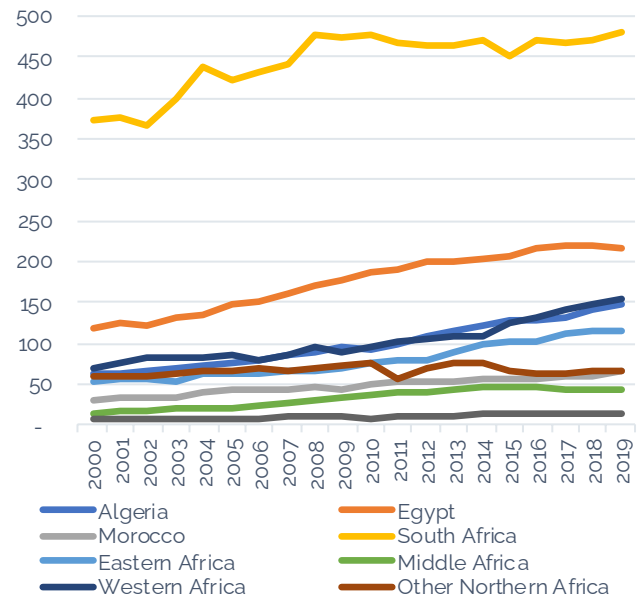
Figure 6.1.2 Global CO2 and Africa's emissions

Global CO2 emissions (Million tonnes of carbon dioxide)



Source: BP Energy Statistics 2020

Africa CO2 emissions (Million tonnes of carbon dioxide)



Source: BP Energy Statistics 2020

6.21. The impact of IEAs Net Zero Emissions scenario on **Africa's energy industry**

The International Energy Agency (IEA) concludes that overall oil demand under Net-Zero Emissions (NZE) falls by 4% annually between 2020 – 2050. If capital investment in oil stops altogether, supply falls by 8% per annum, meanwhile, if investment in discovering new fields stops, supply falls by 4.5% per annum. These dynamics reflect in the price of oil, set to drop to \$35/barrel by 2030, and \$25/barrel by 2050. Similarly, global natural gas demand

falls 5% per annum, and post-2040 most natural gas will be used to produce hydrogen in facilities with carbon capture, utilisation and storage (CCUS). Uses for coal also disappear, as in 2020, 5,250 million tonnes of coal equivalent (Mtce) are reduced to 2,500 Mtce in 2030 and to less than 600 Mtce in 2050. This accounts for a 90% drop from 2020 to 2050, with oil falling 75% and natural gas 55% at the same time. Under NZE the IEA predicts the hydrocarbon use to de-

crease 5% on average post-2030, a higher decrease percentage than African Energy Chamber data. This implies that after 2022, there will be an oversupply of hydrocarbons, over what is necessary to reach the NZE conditions by 2050. The implication of this for Africa is not significant for the near future; however, overall production of hydrocarbons decreases by 43% from 2021 to 2050 (Figure 6.2.1). In absolute terms this falls, from 13.8 mbbbl/d to 7.0 mbbbl/d. Under

NZE, this effect is greater, indicating that Africa will need a 67% drop in oil and gas production to 2.3 mbbbl/d by 2050.

Declining O&G and coal markets are trouble for sub-Saharan Africa countries, where 75% of the world's population lives without access to electricity. However, according to the IEA, 45% of those lacking electricity gain it "via connection to a main grid, while the rest are served by mini grids (30%) and stand alone solutions (25%)". These off-grid and mini-grid rely on 100% renewable energy sources, such as the ones listed above. All diesel generators used in decentralised systems "are phased out later and replaced with solar storage systems". If done with the appropriate sources, the IEA deems that full electrification will only "add less than 0.2% to CO₂ emissions". Africa is also home to 910 million inhabitants (in 2020) with no access to clean cooking options. Under NZE conditions, these individuals gain access using biomass cookstoves, "fuelled by modern biomass, biogas or ethanol, 25% through the use of liquefied petroleum gas (LPG) and 20% via electric cooking solutions".

Due to energy poverty in Africa, net zero targets are not at the forefront of the minds of most countries, rather providing sufficient energy to fulfil the basic requirements of the population is foremost. With the lack of investment currently, any source of electricity will take priority over green energy production. According to the IEA and BP, in 2020, South Africa was responsible for 1.3% of global emissions mostly from its coal fired plants, and contributing to roughly half of Africa's total emissions (Figure 6.2.2). As a result, it's the only country with the goal of net zero by 2050, aiming to reduce its emissions by 28% by 2030, although it's "still not aligned with the

Paris Agreement temperature goal" according to Deborah Ramalope, former member of the South African delegation to UN climate. An estimated \$8 billion a year is needed to finance the decarbonisation and adaptation efforts in South Africa. Also, South African President Cyril Ramaphosa recently announced that Sub-Saharan Africa requires \$240 billion (14% of SSA's 2019 GDP) for the sub-region to transition to clean energy forms.

Employment in IEA's Net Zero Emissions outlook

Employment in oil, gas and coal will drop significantly, due to the falling demand and the gradual shift away towards renewable, low carbon emitting sources. The IEA claims that around 5 million jobs will be lost in oil, gas and coal, between now and 2030 globally. In the same period, few of those losses are expected from Africa, due to the continual production of oil and gas, and the low likelihood of adopting NZE targets until energy poverty is eradicated.

However, under NZE target, the employment in the O&G industry in Africa is set to decrease on average 12.5% per year between now and 2030. The pace of this drop increases, as it falls on average 30% per year between 2030 and 2040. By 2040, approximately two thirds of employment in the O&G could be wiped out. However, under NZE the millions in rural Africa living with lacking electricity and clean cooking options, will have a higher likelihood of employment in new business ventures from clean energy technologies to stimulate new industrial capacities. The IEA in coordination with the IMF show a surge in job creation which arises from private and government spending in clean energy, especially in engineering, manufacturing and construction industries.

Although valid for developed countries, most African countries have an energy deficiency, therefore, the importance of O&G for power generation, and job creation cannot be ignored. Another major issue with the energy transition for jobs are that some of skills are not directly transferable from the O&G sector to clean energy, again problematic for African countries. Other major industries which will observe a surge in jobs are energy efficient appliances, electric and fuel cell vehicles, PV panels and so on. Under NZE, global employment in solar and wind quadruples, certainly extending into Africa growing renewable industry. All these jobs require technical expertise, therefore a large investment in education is expected to be seen from the government and hiring corporations.

One post-pandemic recovery strategy would be to employ public employment programs (PEPs) to generate green jobs. PEPs specifically aim at casual workers in informal sectors (e.g., underemployed, working poor, elderly and youth) whom will be most affected by the pandemic and energy shortage. Likewise, the International Labour Organization (ILO) recommends focusing on (i) labour intensive public works (e.g., maintenance, forestry, communal works and sanitation), and (ii) labour intensive construction activities, relying on labour, rather than machinery. Overall, this is a manner of providing a predictable and stable income, while creating needed green public assets. This has previously worked, with Ethiopia's Productive Safety Net Program, which improves food security via land restoration and reforestation. In South Africa, the Working for Water Program, has a similar influence, supporting participants in exchange for protection of the natural river environments.

Figure 6.2.1 IEA Net Zero emissions scenario against Rystad Energy future production mmboe/d

Source: Rystad Energy UCube August 2021, IEA Net Zero Outlook

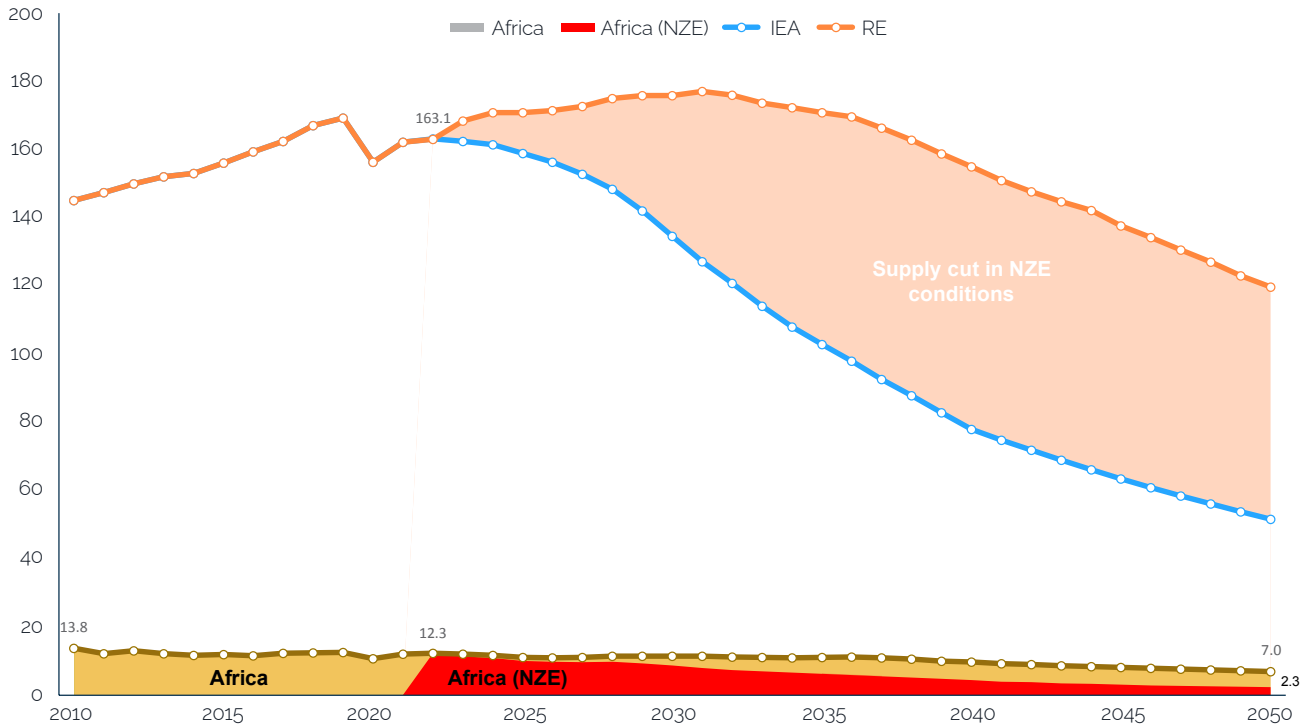
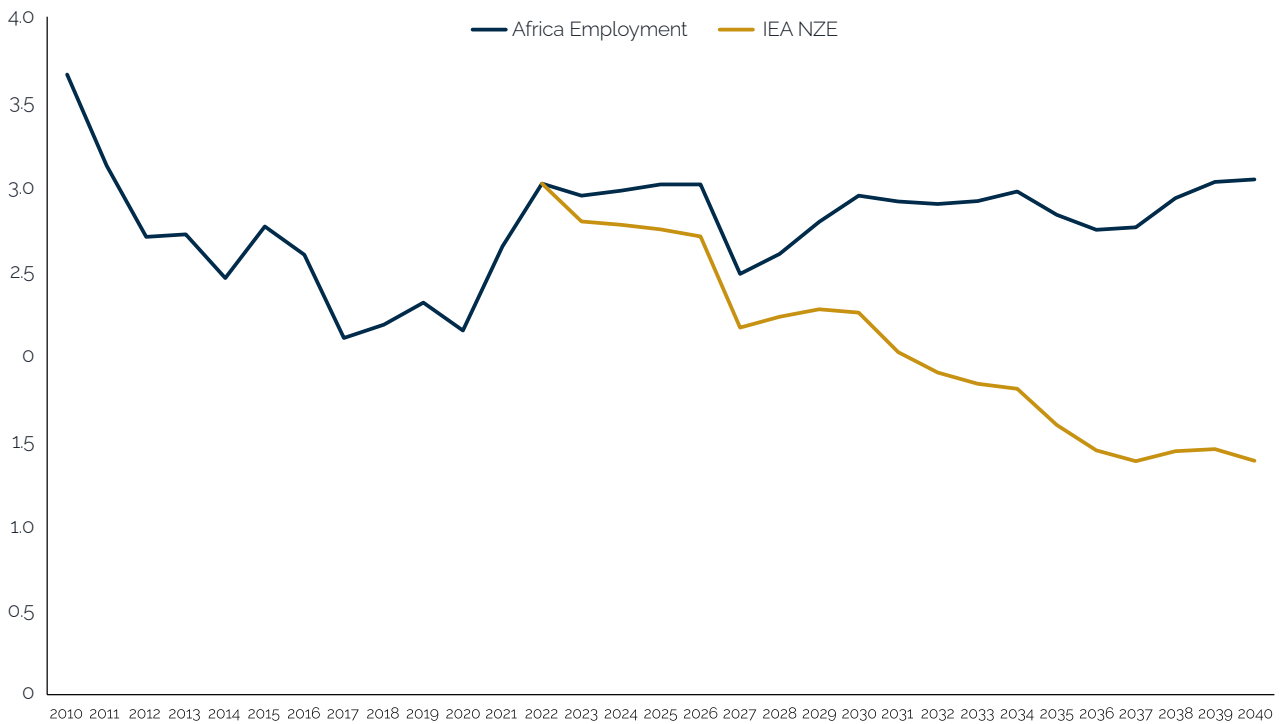


Figure 6.2.2 Africa energy employment with under IEA NZO, million jobs

Source: Rystad Energy research and analysis, IEA Net Zero Outlooks



6.3. Outlook of renewable energy sources

Photovoltaics (PVs)

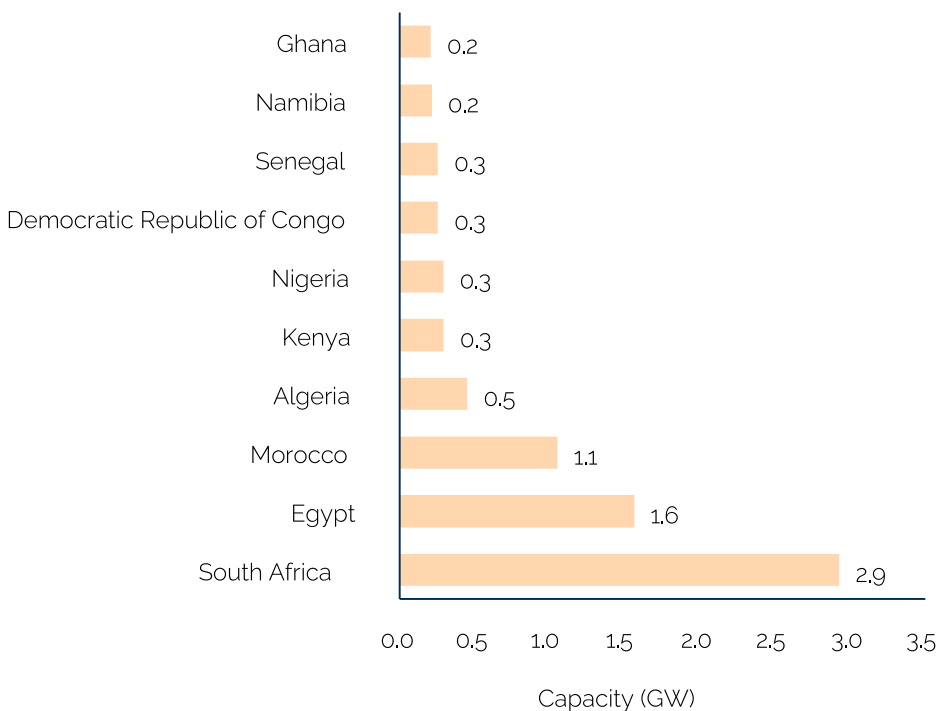
Photovoltaics (PVs) are currently the largest renewable energy source in Africa and generation is expected to grow even larger. From 2010 – 2019, 320 assets were constructed with 14 GW of electricity added (Figure 6.3.1). However, between 2020 – 2030, 648 assets are forecast to be constructed generating 77 GW of electricity. This indicates the efficiency rise, as double the assets generate roughly six times the energy. IRENA sees potential for 83 GW of solar installations in eastern Africa by 2040 and 62 GW in southern Africa. In West Africa, the ECOWAS Power Generation & Transmission Masterplan forecasts 36 GW in PV by 2033. According to José Donoso, chair-elect of the Global Solar Council, “PV is the ideal” as it is “the cheapest way of producing

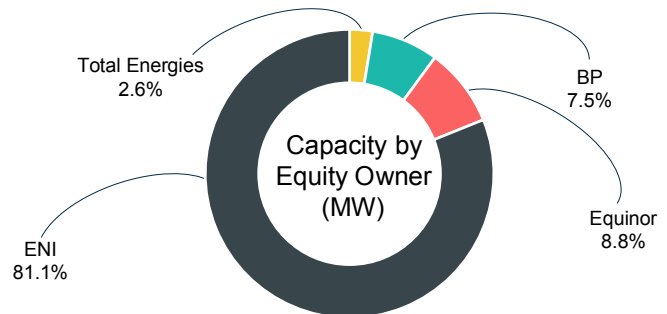
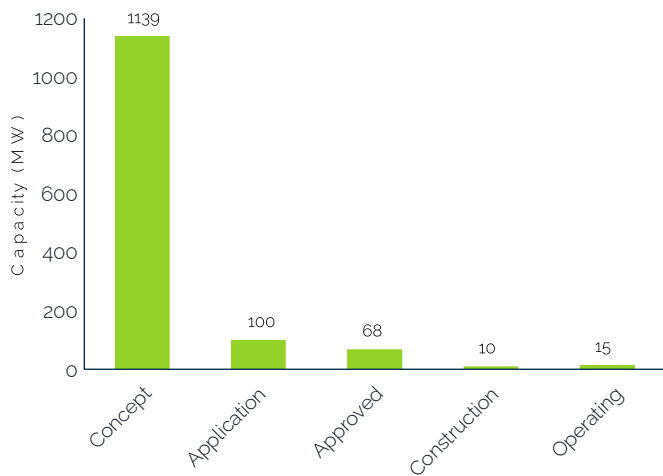
electricity and offers scalability combined with the possibility of tailored solutions”. With a large proportion of African residents living in rural areas, off-grid and mini-grid technologies are crucial to combat energy poverty. According to Geoffrey Kaila, Chairman of the Solar Industry Association of Zambia, outside investors should work with indigenous companies in unison, quoting that “we are looking for partnerships.”

Mini/micro grid sector is attracting investment, e.g., Enel Green Power and Power Hive partnered up to invest \$12 Million for mini grids construction in 100 villages across Kenya. The East African (EAC) records a third of all sales in solar systems, with Tanzania and Kenya leading the market for solar lighting products and comprising

the largest micro-grid markets, observing slight hiccups on manufacturing and logistics due to the pandemic.

PV has large potential in Africa, with even the majors (e.g., TotalEnergies, ENI) building large plants throughout the continent. However, to further this sector, efforts must be made to extend national grids and strengthen transmission infrastructure, to improve reserve margins of power systems. For decentralised or distributed systems, the potential is immense, under favourable policy environments (e.g., embedded generation, or the ability for individual electricity generation which is connected to the network) and stable grid connectivity. This must be coupled with minimum standards, and basic education for technicians to allow for high customer satisfaction.





Wind

Wind turbines contribute the second largest amount of green energy at 8.3 GW in 2021, coming mainly from South Africa, Egypt, Morocco, Ethiopia and Kenya (Figure 6.3.3). Between 2010 – 2030, 81 assets are set to be produced, providing a total power output of 9.357 GW, all of which is onshore, with 75% of these assets currently operating. According to Energy Live News, Africa is currently tapping only 0.01% of its wind energy potential, as its absolute limit is 59,000 GW. It is a rapidly expanding sector, as in 2020 – 2021, 17 assets were added contributing approximately 2.1 GW. 11 of these assets were in

South Africa, currently the largest producer of wind energy.

Egypt is currently home to the Gulf of Suez Red Sea Ph-I Project owned by Siemens Gamesa, currently the largest wind project in Africa, set to produce 500 MW, consisting of 173 wind turbines and a 33/220 kV substation. Kenya, meanwhile, has the Lake Turkana Wind Farm, owned by LTWP, set to produce 310 MW, and is the biggest Kenyan private investment at \$858 million. It will provide 16% of the electricity generated in Kenya and offset 16 million tonnes of CO² emissions.

The large consequences of wind energy are the high costs, and the

requirement of land. Previously, wind projects were funded by governments and foreign donors. However, private investors are also moving into the African wind market. Currently “over 50 percent of the projects being sponsored by the private sector,” according to African Development Bank economist Emelly Mutambatsere. To prevent occupation of more and more land for wind turbines, Africa can explore offshore wind. Currently, most of wind farms are onshore as “the land space is available, and it is cost-competitive”. The continent is likely to “see the first offshore development in 2030” according to Ntombifuthi Ntuli, CEO of SAWEA.

Figure 6.3.2 Photovoltaic Capacity distribution across Africa, with major upcoming projects MW

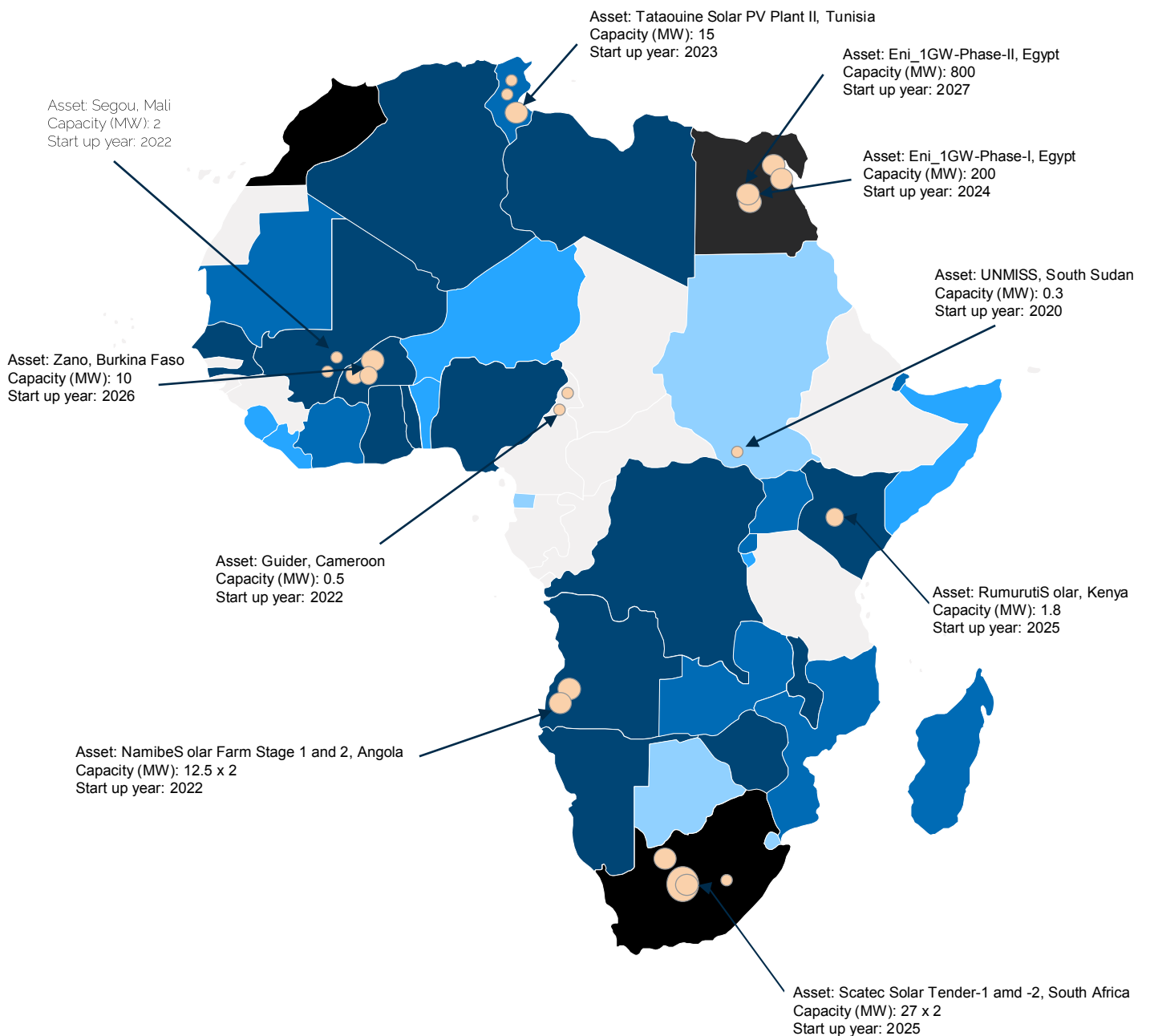
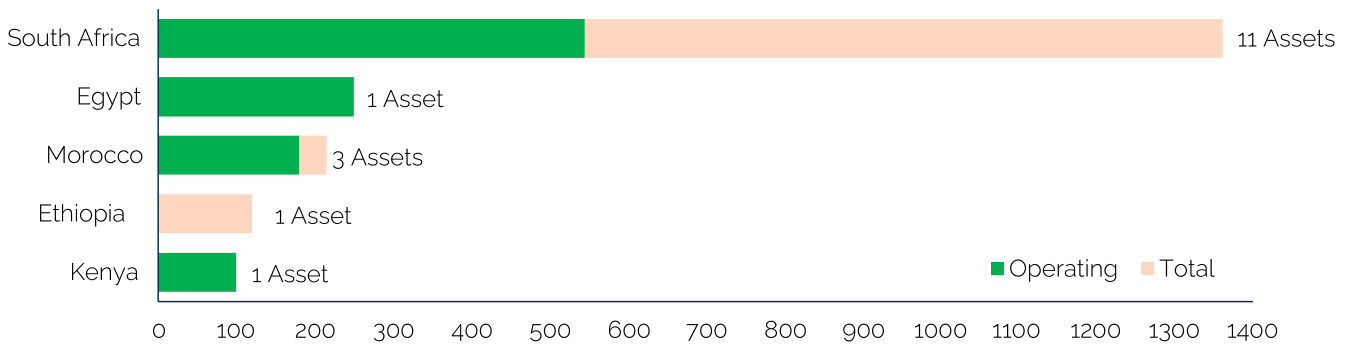


Figure 6.3.3 Total African Wind Assets Production in 2021, MW



Hydropower

Hydropower is the primary renewable source in Africa at over 38GW of installed capacity and 17% of the continent’s electricity generation. In some eastern and southern African countries such as Ethiopia, Mozambique, Namibia and Zambia hydro-

power accounts for over 90% of national electricity generation. Further developments are expected to take place, such as a 6GW Grand Ethiopian Renaissance Dam (GERD) on the Blue Nile (Table 6.1). This project will help address energy poverty in the region and satisfy the growing electricity demand. Regional pow-

er pools such as the East African Power Pool play an important role promoting regional cooperation to establish cross-border transmission lines. Large hydropower projects can provide electricity across the whole region, with the countries benefiting from lower costs of production and increased electrification.

Table 6.1 Selected recent, ongoing and future hydropower projects

Project	Capacity, MW	Country	Status
Lauca hydropower station	2,071	Angola	Fully operational from December 2020
Souapiti project	225 and 450	Guinea	Fully operational by end 2021
Grand Ethiopian Renaissance Dam	6,350	Ethiopia	Reservoir to be filled between 2024-2027
Karuma project	600	Uganda	Operational in May 2021
Kafue Gorge Lower project	750	Zambia	To be commissioned in 2021
Batoka Gorge project	2,400	Zambia, Zimbabwe	Began construction in 2021
Mambila project	3,050	Nigeria	Began construction in 2021
Abdelmoumen project	350	Morocco	To be commissioned in 2022

Development of hydropower projects come with significant socio-economic impacts such as helping address unemployment. For example, the Neckartal Dam located in southern Namibia has provided for 5,500 jobs in Keetmanshoop and nearby areas. The dam is a key piece of infrastructure in the region and is projected to irrigate 5,000 hectares of land, promoting agriculture and further employment. When the irrigation of the nearby areas will have reached its peak potential, an additional 4,000 direct and indirect jobs are likely to be created.

The outlook for hydropower in Africa largely relies on the ability of the governments to attract private investments into the sector. With the help of private capital African countries can bridge the energy infrastructure gap, establishing cross-border connections crucial

for the distribution of power to the countries with less fortunate economic and geographical opportunities. Large-scale power projects typically receive up to 30% of the capital required from private sector investors with the rest comprising international and local financial institutions and governments. Mambila hydroelectric power station, which is set to become the largest source of hydropower in Western Africa, is estimated to cost close to \$6 billion. The Exim Bank of China has agreed to lend 85% (\$4.93 billion) towards the construction, with the rest of the costs covered by the Nigerian government. Another large hydropower project – 2400MW Batoka Gorge power station will be jointly constructed by General Electric (GE) of the United States and PowerChina at an estimated cost of \$4.5 billion. The ownership will be reverted to Zambia and Zimbabwe after the

developers have recovered their investments under the PPP arrangement.

Nevertheless, the increased hydropower in the energy mix of African countries could have adverse effects on the power system, putting security of supply at risk. By 2030 70% of total hydropower capacity in eastern Africa will depend on areas with high rainfall variability according to a study by London School of Economics. Prolonged wet and dry periods can last several years, potentially leaving hydropower stations without enough water to operate. Concentration of dams in the same region can lead to their dependence on the same climate variations, such as drought. This makes it imperative for governments to plan a system of hydropower plants that will be resilient to the rainfall patterns and geographical limitations.

Geothermal

According to the African Development Bank, the continent has 15 GW of geothermal energy available, and unlike solar, wind and hydro, it is not influenced by geographical factors such as droughts, low winds, and cloudy days. The Great Rift Valley which extends from Djibouti to Mozambique is Africa's geologically active area, consisting of 30 active volcanoes and countless hot springs. Kenya is currently the largest geothermal energy producer in Africa, with 98% of the annual 1.5 GW supply, through 403 active wells in 2021 (Figure 6.3.4). The United Nations Environment Program (UNEP) has estimated a potential of 20 GW of geothermal energy across Eastern Africa, and

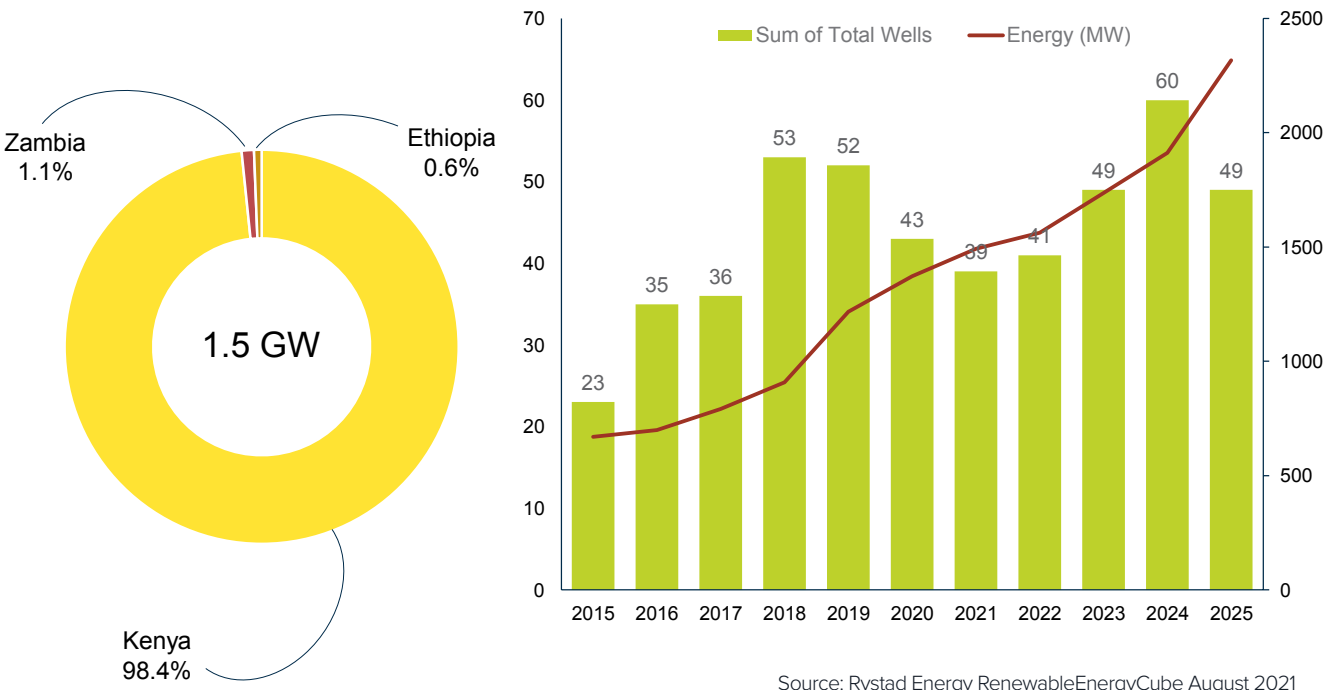
nations such as Tanzania, Uganda, Rwanda, Djibouti, Eritrea and Comoros have undertaken preliminary exploration for geothermal potential.

Kenya's Olkaria Geothermal Project, after its fifth extension Olkaria VI (86 MW) will be "the largest single geothermal plant in the world", at a total of 792 MW. KenGen, the parastatal company that operates Olkaria, states that this plant produces 27% of all the energy in Kenya. Additionally, geothermal power plants require less land than wind, solar or coal alternative. A consequence of geothermal wells, however, is the reinjection of water to generate steam releases "high concentrations of silica and salts and sometimes toxic elements, such as

arsenic, lithium, antimony, mercury, sulfur". In most cases, these pipes do not interfere with the aquifers, however, under leakages or poor construction, it can pollute sources of drinking water.

Zambia also produces geothermal energy, and currently Kalahari GeoEnergy, the main geothermal operator in Zambia, continues on its Bweengwa River geothermal power plant, after delays from the pandemic. As per the Peter Vivian-Neal, the CEO of Kalahari GeoEnergy "the long-term goal is to have 50 MW of power generation capacity in eight to ten years." However, since this output is insufficient for large scale electrification, its current objective is to assist in agro-processing, fish farming, and dairy processing.

Figure 6.3.4 Geothermal production and number of active wells, GW / MW / # geothermal wells



Source: Rystad Energy RenewableEnergyCube August 2021

Chapter Seven

Our Strategy To Provide Power That Drives Economic Development For All

GOAL: END ENERGY POVERTY BY 2030

Transitions tend to create winners and losers, and the energy transition can entrench inequalities if not pursued in a “just” manner. The idea of a just transition is generally understood as creating a lower carbon future that is equitable and just – that is, one where there is access to reliable energy, which leads to holistic development. In that sense, the transition is less about technological and fuel choices but about sustainable livelihoods for the millions of people who live on the African continent. Thus, there will be trade-offs between competing needs and priorities and, as such no one size fits all approach. The question of what is just and for whom must be considered within contexts with equity and justice as a guiding framework.

The transition is less so about technological and fuel choices but about sustainable livelihoods for the millions of people that live on the African continent

Balancing the inherent tensions brought on by the energy transition complicates the quest to manage the competing demands of the energy trilemma, which is energy security, energy equity, and environmental sustainability. Consid-

ering the continent’s contribution to global emissions, energy security and energy equity remain critical to development. The energy equity dimension captures a “country’s ability to provide universal access to reliable, affordable and abundant energy for domestic and commercial use” while energy security measures a “nation’s capacity to meet current and future energy demand reliably”. The two speak to the heart of the challenge in Africa, which is the “energy access challenge” and “security”, which provides the springboard to industrialise and create continued/sustainable economic development.

To achieve universal access by 2030 and enhance the security of supply, governments must work with key stakeholders, especially the private sector, to design and implement effective tailored responses to the challenge of energy access. Energy access is measured on a spectrum as shown in the Multi-Tier Framework spanning Tier 1 (lowest level of access) to Tier 5 (highest level of access). Higher tiers (4 and 5) of access are associated with higher power capacity and longer duration of supply, which should be the target for access efforts as this hold the ability to deploy productive uses of energy for development. According to ESMAP , “a

grid is the most likely source for delivering high access tiers, although a diesel generator or a large mini-grid may do so as well”. Thus, long term development-oriented access solutions for Africa must be developed bearing this in mind. Although lower-tier access solutions like solar home systems and small-scale mini-grids are critical to ensure that no one is left behind, African strategies must centre around higher tier access solutions. This is what the Chamber ascribes to.

A grid is the most likely source for delivering high access tiers

As highlighted earlier, about 600 million people in Africa still lack access to electricity, highlights the huge investment need in virtually all segments of the sector ranging from generation capacity (through microgrids and mini grids), T&D infrastructure, and metering over the next few decades. As we estimate, attaining universal access goal by 2030 requires over several gigawatts of new generation capacity. According to a report published by the Northeast Group, Sub-Saharan Africa’s power sector would need a massive investment of about USD141 billion between by 2028.

7.1. Providing Power That **Drives Economic Development** For All

Technical & Market-Based

- **Investment in grid infrastructure to reduce transmission and distribution losses and accommodate greater integration of variable renewable energy. Infrastructure should prioritise flexibility and must take into consideration long term plans both at the country and regional level.**
The grid infrastructure will play a crucial role in maintaining service as well as extending access. In many countries, the grid infrastructure can be described as weak, or ailing requiring upgrades to function properly and integrate more variable renewable energy. Thus, investment in grid infrastructure to reduce losses and accommodate greater integration of variable renewable energy. Additionally, uneven resources and demand suggest that strengthening regional and continental power pools will ensure a unified market for electricity trading at competitive prices for countries. Lastly, with many renewable energy mini grids planned for installation in Africa over the next few years, energy storage can prove effective in contexts where hybrid mini grids are unavailable. The costs of storage, although remain high shows promise of falling costs over the coming years.
- **Strengthening of regional infrastructure and interconnections between regional and continental power pools**
The grid infrastructure will play a crucial role in maintaining service as well as extending access. In many countries, the grid infrastructure can be described as weak, or ailing requiring upgrades to function properly and integrate more variable renewable energy. Thus, investment in grid infrastructure to reduce losses and accommodate greater integration of variable renewable energy. Additionally, uneven resources and demand suggest that strengthening regional and continental power pools will ensure a unified market for electricity trading at competitive prices for countries. Lastly, with many renewable energy mini grids planned for installation in Africa over the next few years, energy storage can prove effective in contexts where hybrid mini grids are unavailable. The costs of storage, although remain high shows promise of falling costs over the coming years.
- **Investment in energy storage as prices become competitive could improve the attractiveness of renewable energy mini grids are these in some cases show the least cost alternative to provide access in some settings**
The grid infrastructure will play a crucial role in maintaining service as well as extending access. In many countries, the grid infrastructure can be described as weak, or ailing requiring upgrades to function properly and integrate more variable renewable energy. Thus, investment in grid infrastructure to reduce losses and accommodate greater integration of variable renewable energy. Additionally, uneven resources and demand suggest that strengthening regional and continental power pools will ensure a unified market for electricity trading at competitive prices for countries. Lastly, with many renewable energy mini grids planned for installation in Africa over the next few years, energy storage can prove effective in contexts where hybrid mini grids are unavailable. The costs of storage, although remain high shows promise of falling costs over the coming years.

Regulatory Based

- **Setting realistic tariffs to enable cost recovery and competitiveness of utilities**
Regulatory risks due to unstable regulatory environments can pose a challenge to attracting the needed financing required for energy investments to bridge access. Many state-owned utilities on the continent are in a weak financial position due to a mix of factors, key amongst them being the under recovery of costs due to low tariffs and inefficiencies. Setting realistic tariffs will ensure the competitiveness of utilities and enhance capability to invest in grid expansion and other related activities. In some countries, sector reform is necessary to attract the necessary private capital. With mini grids forming a critical part of achieving access, clear policy on mini grid development is required where absent and this must address grid arrival risk which many mini grid developers highlight as a strong concern. Additionally, some countries may have to undergo some reform to enable private sector participation in their power markets. Finally, regulation must aid in the setting technical standards for product or equipment in the off-grid market to ensure safety and consumer protection.
- **Formulate clear policy for mini grid development including measures to address grid arrival**
Regulatory risks due to unstable regulatory environments can pose a challenge to attracting the needed financing required for energy investments to bridge access. Many state-owned utilities on the continent are in a weak financial position due to a mix of factors, key amongst them being the under recovery of costs due to low tariffs and inefficiencies. Setting realistic tariffs will ensure the competitiveness of utilities and enhance capability to invest in grid expansion and other related activities. In some countries, sector reform is necessary to attract the necessary private capital. With mini grids forming a critical part of achieving access, clear policy on mini grid development is required where absent and this must address grid arrival risk which many mini grid developers highlight as a strong concern. Additionally, some countries may have to undergo some reform to enable private sector participation in their power markets. Finally, regulation must aid in the setting technical standards for product or equipment in the off-grid market to ensure safety and consumer protection.
- **Setting technical standards (regulations) for quality and consumer protection**
Regulatory risks due to unstable regulatory environments can pose a challenge to attracting the needed financing required for energy investments to bridge access. Many state-owned utilities on the continent are in a weak financial position due to a mix of factors, key amongst them being the under recovery of costs due to low tariffs and inefficiencies. Setting realistic tariffs will ensure the competitiveness of utilities and enhance capability to invest in grid expansion and other related activities. In some countries, sector reform is necessary to attract the necessary private capital. With mini grids forming a critical part of achieving access, clear policy on mini grid development is required where absent and this must address grid arrival risk which many mini grid developers highlight as a strong concern. Additionally, some countries may have to undergo some reform to enable private sector participation in their power markets. Finally, regulation must aid in the setting technical standards for product or equipment in the off-grid market to ensure safety and consumer protection.
- **Reforms that attract private sector investment (IPPs or PPPs)**
Regulatory risks due to unstable regulatory environments can pose a challenge to attracting the needed financing required for energy investments to bridge access. Many state-owned utilities on the continent are in a weak financial position due to a mix of factors, key amongst them being the under recovery of costs due to low tariffs and inefficiencies. Setting realistic tariffs will ensure the competitiveness of utilities and enhance capability to invest in grid expansion and other related activities. In some countries, sector reform is necessary to attract the necessary private capital. With mini grids forming a critical part of achieving access, clear policy on mini grid development is required where absent and this must address grid arrival risk which many mini grid developers highlight as a strong concern. Additionally, some countries may have to undergo some reform to enable private sector participation in their power markets. Finally, regulation must aid in the setting technical standards for product or equipment in the off-grid market to ensure safety and consumer protection.

7.2. Spotlight on gas: Aggressively promoting **natural gas for Africa's** industrialisation drive

Gas as the main source of power production. Recent changes to the global energy landscape aimed at battling climate change could represent a turning point for Africa's natural gas. To meet the climate targets set out in the Paris agreement Africa must radically change its energy landscape, moving away from coal, which together make up over 40% of primary energy demand today, towards cleaner solutions. However, the phase out of coal is unlikely to be rushed due to the potential economic risks inherent relating to security of energy supply. Even though renewables are integral to reduce greenhouse emissions, other energy sources must be considered to ensure the security of supply across the continent and to meet the additional energy demand, which is set to triple in the next 20 years. For underdeveloped power grids the intermittency of renewables can put the stability of the systems at risk. At 15% of installed capacity from solar and wind Kenya is already suffering from severe voltage instability. The country is at the epicentre of Africa's energy transition, building momentum

in the renewable sector through the 310 MW Lake Turkana wind farm and 50 MW Garissa solar PV station. However, Variable Renewable Energy (VRE) has created unprecedented challenges in power system operations, a problem that will worsen as more VRE sources come online. Better system management and upgraded infrastructure is necessary, but for now, without a long-term power storage technology, complementary fuels such as natural gas are crucial to satisfy the growing demand for electricity.

The continent is estimated to have around 600 trillion cubic feet (Tcf) of gas at the end of 2020. This makes Africa the fourth-largest gas reserves holder globally after North America, according to the African Energy Chamber. Over 25 countries have proven natural gas reserves on the African continent. This represents strong potential for an increasing role of natural gas in the African energy mix. There are 13 countries in sub-Saharan Africa currently consuming gas for power generation. Ten of those countries generate power from

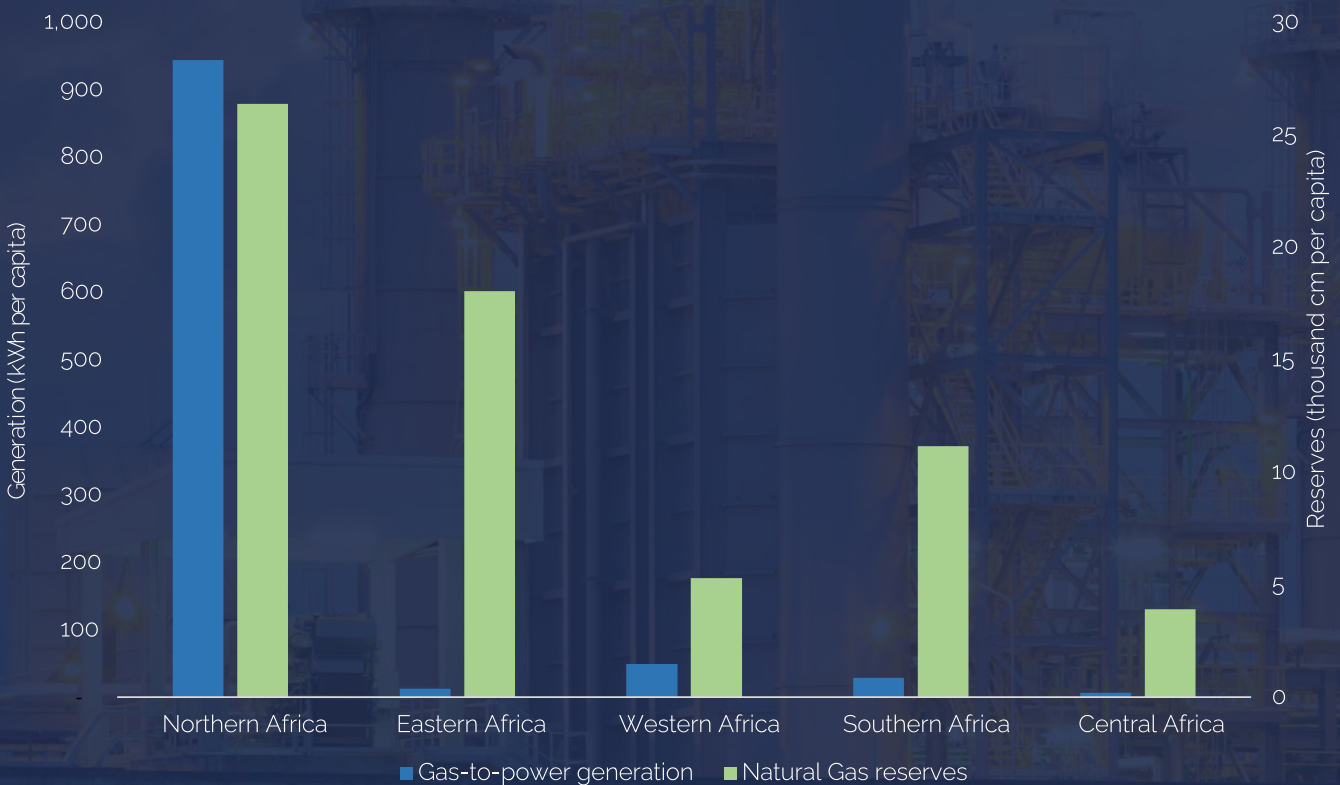
their own domestic gas production, two rely on pipeline imports (Togo and Benin) and one uses a combination of domestic supply and pipeline imports (Ghana). The abundance of gas reserves can help African nations satisfy future electricity demand, which is projected to grow from 700 terawatt-hours (TWh) in 2019 to 1600-2300 TWh in 2040 according to our forecasts and those from other organisations. Population growth and urbanization are the dominant factors responsible for the additional demand in the coming decades. Currently, 86% of gas-to-power production is concentrated in Northern Africa, 10% in Western Africa and the remaining 4% split between other regions (Figure 7.2.1). Egypt, Algeria, and Libya largely rely on the output of their hydrocarbon resources, which are utilized both for domestic supply and also to bring in export revenue, with high volumes flowing to Europe. Recent gas discoveries in sub-Saharan countries such as Tanzania and Mozambique put the Eastern African region in a favourable position to start developing their own gas-to-power infrastructure.



Figure 6.3.4 Geothermal production and number of active wells, GW / MW / # geothermal wells



Figure: 7.2.2 Natural gas reserves and gas-to-power capacity per capita by region





When considering both the gas reserve volumes and gas-to-power generation per capita there is an opportunity for African countries in bridging the gap between the resources they possess, and the power generated from natural gas. Tanzania has been particularly active in developing its gas-to-power infrastructure. The country has 600MW, or 45% of country's total installed capacity from gas sources. There are further projects such as the extension of Kinyerezi complex to a total of 1,625MW, aimed to satisfy the annual electricity demand growth of 10-15% and provide full electrification of the country by 2030. Mozambique – another sub-Saharan country with enormous natural gas resources – plans to harness its recent discoveries for electricity generation to boost domestic access, exports, and trade in Eastern Africa. It is currently developing the 400MW Temane power plant, which is set to come online in early 2023. Another project, delivered by GL Africa Energy (UK), will develop a 250MW gas power plant, which will source its feedstock from Mozambique's Rovuma basin. Construction of gas-to-power facilities can also deliver a strong economic boost. Almost 80% of East African young people are unemployed; increased industrialization of the region and widespread access to electricity

can open employment opportunities.

Africa Energy Chamber believes these changes highlight a potential new age for gas supply diversification in Africa as several new producers come on board. Gas supply on the continent comes mainly from domestic sources and via pipeline imports from other countries within the region. Angola, Nigeria, and Equatorial Guinea mainly export LNG, and there is the potential for Senegal and Mozambique to join this trend. Exports via pipeline are mostly in Congo, Nigeria, and Mozambique, which account for significant gas exports to South Africa. Pipeline Gas importers are mainly South Africa, Ghana, Benin, Togo, and DR Congo importing from Congo. Although the continent's 'old guards' like Algeria (159 Tcf), Egypt (78 Tcf), Libya (53 Tcf) and Nigeria (203Tcf) still account for significant (89%) gas reserves, it is worth noting that discoveries from the new entrants ('new guards') would potentially account for a more significant share of actual usage by 2030. For example, Mozambique is positioning itself as the world's next gas export country - it has about 99 Tcf of discovered resources. It is planning on exporting gas to neighbouring South Africa via pipeline.

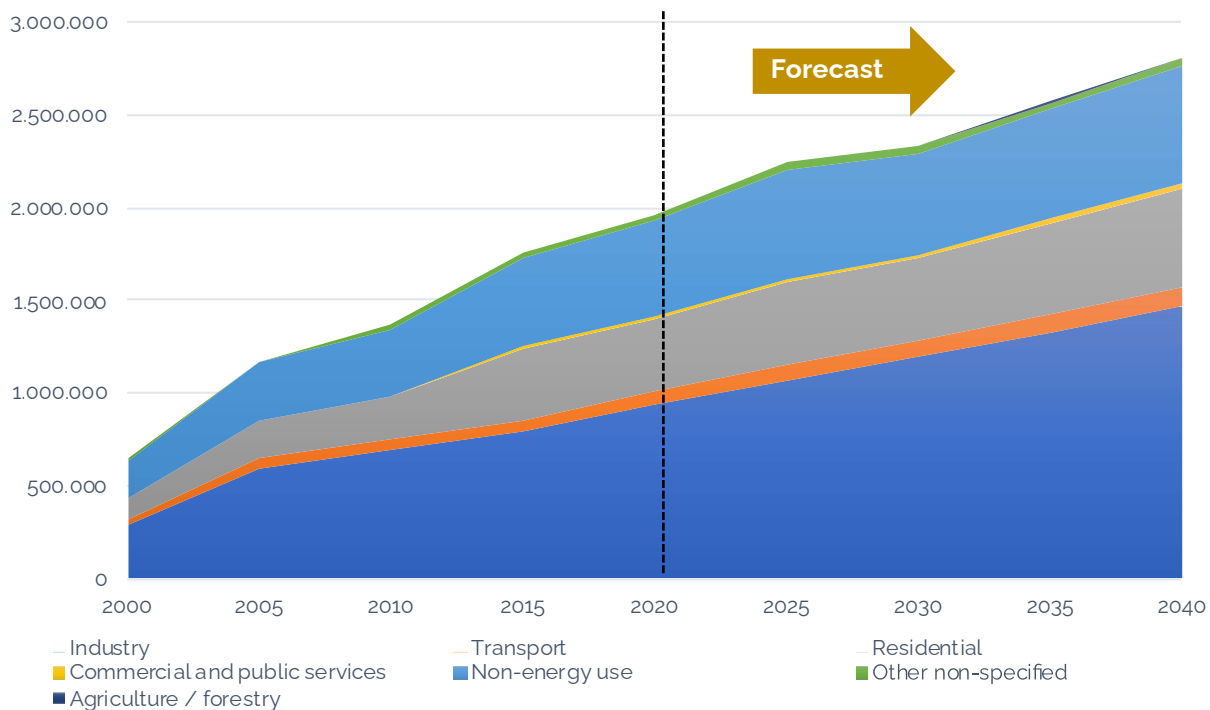
Recent developments in the African

LNG sector provide a strong foundation for resilient, low-emission power infrastructure across the continent. Projects such as Ghana's floating regasification unit will pave the way for the supply of 1.7 million tons of LNG per year for power generation, showcasing the potential impact of such investments on reducing energy poverty. Countries must cooperate to build more comprehensive energy systems such as the Nigeria-Morocco Gas Pipeline, which is set to run along the west coast of Africa and give gas access to nations where the share of the population with access to electricity doesn't rise above 40%. Creating a liquid power market across the whole continent will facilitate a more even distribution of electricity supply between countries.

The market opportunities for natural gas on the continent are primarily for gas-to-power and other industrial uses. Much like the 2020 situation, primary consumption sectors in 2040 will be industry (52% from 47% in 2020), other non-energy use (26% from 23% in 2020), and residential (20% from 19% in 2020) (Figure 7.2.3). Transportation, commercial and public services, and agriculture will account for the remaining 6% of natural gas final consumption in 2040.

Figure 7.2.3 Natural gas final consumption by sector, Africa 2000-2040F (TJ-gross)

Natural gas final consumption by sector, Africa 2000-2040F (TJ-gross)



Selected case studies

1. LNG-to-power in Ghana

floating regasification unit arrived from China in January 2021 and it will be able to deliver 1.7 million tons of natural gas per year for power generation. Ghana’s electricity consumption remains lower than the average over the sub-Saharan region and far below that of developed countries. Bridge Power project in Tema will have the capacity to produce 400MW of electricity from liquefied natural gas. This is equivalent to the power consumption of 1.6 million average Ghanaian homes. The construction of the terminal gives Ghana independency over its own energy supply making it less reliant on the West African Gas Pipeline. Demand for LNG in the West African region is expected to nearly double in the next decade as countries start to invest in further gas-to-power generation amid the transition from dirtier fuels.

2. Transition from coal in South Africa

South Africa's power sector is the 12th biggest producer of greenhouse gases worldwide. This is due to its predominant use of coal as the main energy source. The government aims to shift away from the dirtier fossil fuel and decommission 34GW of coal-fired power capacity by 2050. The country is currently experiencing its worst energy crisis following multiple power station breakdowns. This resulted in level 4 load-shedding meaning that 25% of grid users are without power at any given time. Many of the South Africa's power stations are nearing the end of their lives. An average of about 1,000 megawatts of capacity is set to be decommissioned annually over the next decade. This presents a fitting

opportunity to rejuvenate the country's energy system with cleaner solutions. Even though the government is ambitious in committing to renewable sources, many doubt that solar and wind projects can happen fast enough to replace the fading coal industry. With the recent gas discoveries in the neighbouring Mozambique, construction of gas power plants could be a game changer.

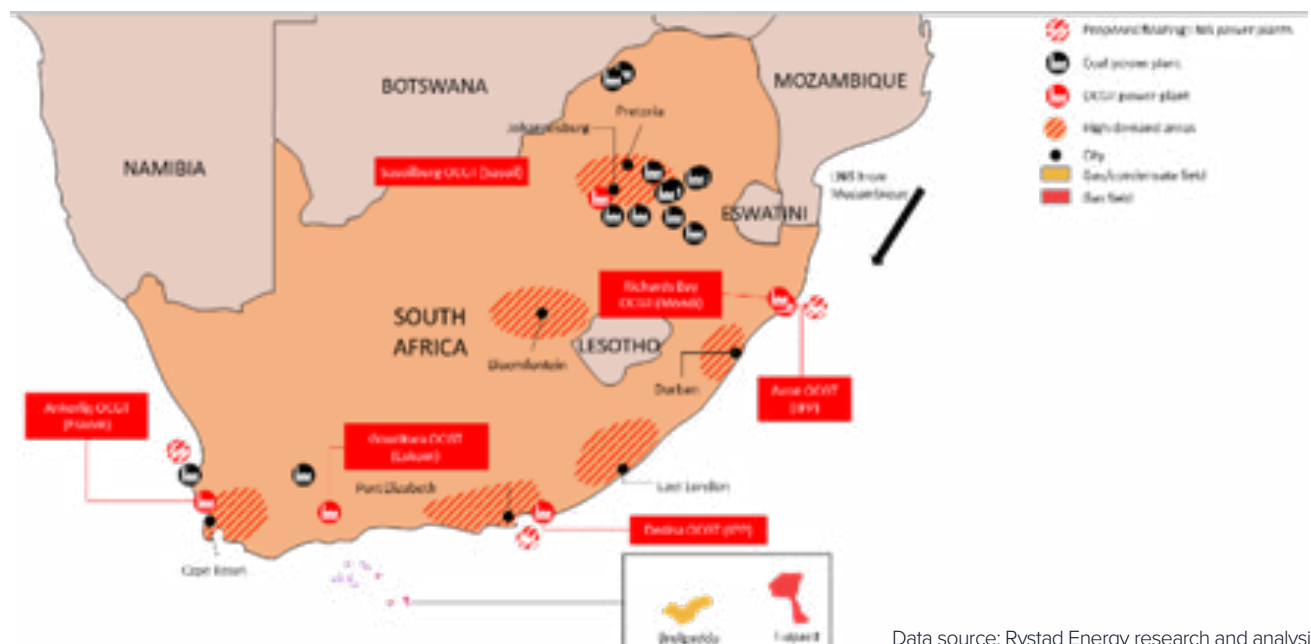
Current developments include an offshore project offering 1,220 MW in gas-fired capacity, which is set to be delivered by Karpowership, a Turkish construction company. The company aims to provide 800,000 households with electricity; however, the project is

currently bogged down in legal procedures over environmental disputes.

OCGT power plants in South Africa currently generate around 3.5GW, however they resort to running on expensive and polluting diesel fuel during natural gas shortages. Recent discoveries such as Brulpadda and Luiperd can provide the necessary security of supply for Eskom and other power producers to run their OCGTs on natural gas. There is a potential to increase the revenue from domestic supply if South Africa can guarantee an offtake of power under a sufficient load factor by building further transmission infrastructure from the plants to the high demand areas (Figure 7.2.4).



Figure 7.2.4 Schematic map of South Africa's gas-to-power sector



3. Gas infrastructure in Nigeria

Nigeria is an economic powerhouse of sub-Saharan Africa. Its hydrocarbon industry is also one of the most developed. Nigeria has the 3rd most proven reserves of natural gas after Tanzania and Mozambique and by far exceeds other countries in gas-to-power installed capacity at 12 GW, or 73% of the total power mix. On most days, however, it is only able to dispatch around 4 GW of electricity, which is largely insufficient for a country of over 200 million people. Current access rate stands at 60% with only 34% for rural areas. This could come as a surprise considering Nigeria's possession of rich hydrocarbon reserves. In fact, Nigeria has one of the highest rates of gas flaring in the world. Transmission constraints, lack

of proper maintenance of the infrastructure and major planning shortfalls are a few of the reasons why Nigerian power sector has produced sub-optimal electricity.

The government aims to shake up the country's industry sector by building Ajaokuta-Kaduna-Kano (AKK) gas pipeline, which is set to connect the eastern, western and northern regions of Nigeria. The main goal is to create a steady gas supply network between different parts of the country. The project broke ground in August 2020 and is expected to take 24 months to complete. The new pipeline will de-bottleneck approximately 2.2 billion cf of gas to the domestic market and add 3,600MW to

the national grid with further potential to revitalize the country's textile industry, which alone boasts over 3 million jobs. Domestic utilization of natural gas can spur socio-economic development of Nigeria's rural regions, providing clean cooking fuel and energy for productive uses. There are currently 3 lead developments of independent power plants along the AKK pipeline in Abuja, Kaduna and Kano. The AKK pipeline project forms part of a larger Trans-Nigeria gas pipeline, which is designed to transport between 385 and 840 million cf per day of natural gas.

Chapter Eight

Energy Transition, And Africa's Minerals Value Chains

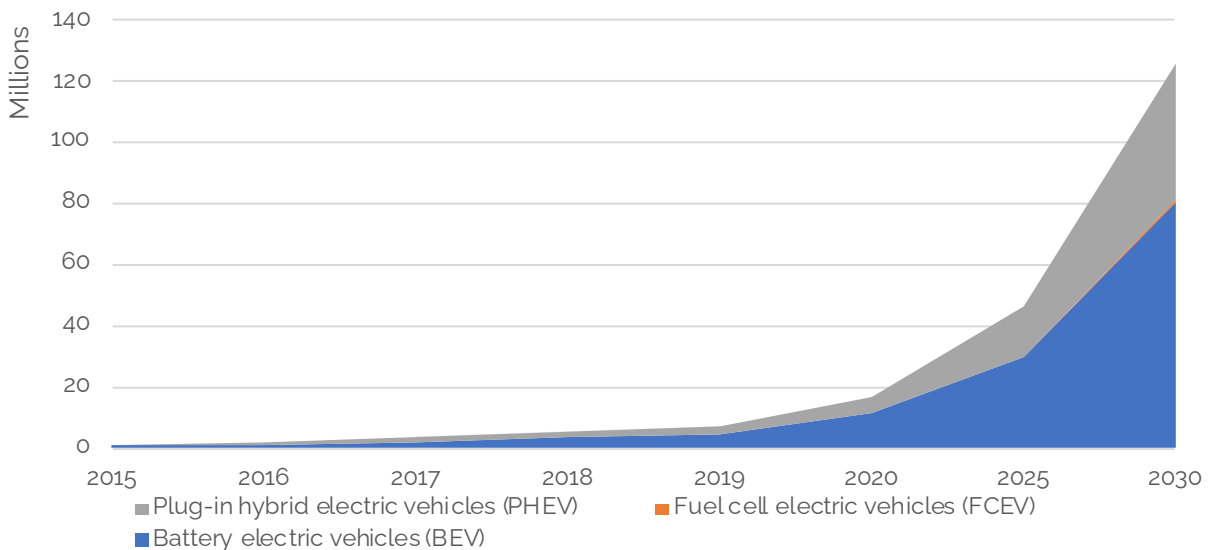
8.1. The growing demand

Electric vehicles sales reached a tipping point last year, according to research by McKinsey, after Europe took over from China as the fastest-growing market for the vehicle segment . The International Energy Forecasts that global electric vehicle stock will reach about 125 million cars by 2030, a significant increase from 2020 levels (Figure 8.1). The key factors driving this adoption are lithium-ion batteries getting cheaper, 89% drop since 2010 and an increasing number of countries, cities and regions announcing internal combustion phase out targets . Currently, 15 countries have announced a target to phase out internal combustion engines, in addition to 31 cities and regions.

Figure 8.1.1 Global electric vehicle stock for cars by 2030 under IEA's stated policies scenario

Global electric vehicle stock for cars by 2030

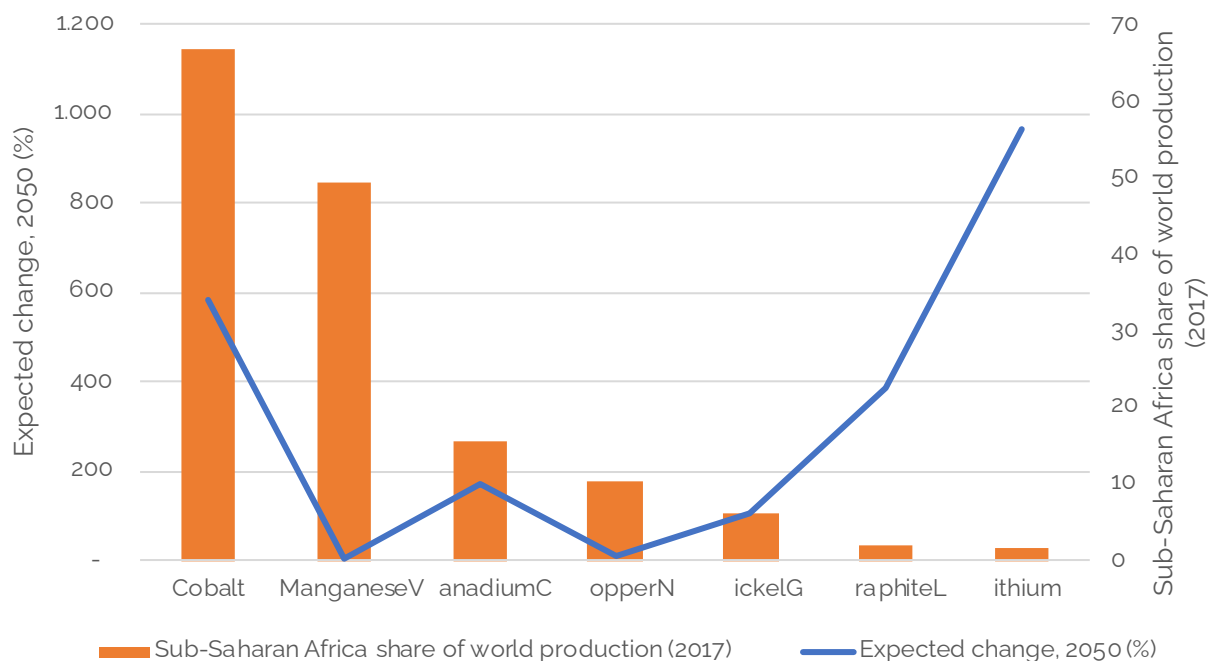
Data Source: IEA 2021



As battery demand for electric vehicles increases, annual metals demand from lithium-ion batteries will exceed 13 million tons by 2030. Copper and aluminium used in lithium-ion batteries will reach 3.9m tons and 3.1 million tons, respectively. Cobalt demand from batteries will be about 200,000 metric tons. Lithium demand will exceed 1.7 million tons lithium carbonate equivalent by 2030 and nickel about 1.4Mt, according to BloombergNEF and World Bank data (Figure 8.1.2). The increase in demand for battery metals will disrupt global supply chains and open new market opportunities for countries around the world, particularly Africa. Over a US\$100 billion must be invested in green and brownfield mining as well as new refineries to ensure there is enough supply to meet the exponential demand from battery metals.

Figure 8.1.2 Expected change and SSA share of mineral energy materials (MEMs)

Source: World Bank (2021)



8.2 Africa's Share of Global Supply

Over half of countries in Africa host at least one of the key metals needed for lithium-ion batteries. These include South Africa, Ghana, the Democratic Republic of Congo (DRC), and Morocco (Table 8.1). Despite Africa's mineral endowment in battery metals, majority of them are exported to other countries to be refined. For example, the DRC mines about 70% of global cobalt

and processes all of it in China into finished products such as cobalt sulfate used in batteries. South Africa mines about 40% of global manganese, but almost all are refined into finished products such as manganese sulfate used in the battery industry. With a significant focus on the upstream, Africa retains only 10% of the total value chain leaving other countries such as

China and the United States as the primary beneficiaries. The Africa Energy Chamber advocates for an increase to at least 50% by 2030 and 75% by 2040. Africa currently has no lithium production capacity, but significant resources have been discovered in Ghana and the DRC, which could lead to the continent's first production this decade .

Table 8.1 Some selected minerals

Cobalt



In 2020, Africa produced about 92,000 tonnes of cobalt out of the global production of 127,700 tonnes. In addition to the DRC, countries such as Morocco, Zambia, South Africa, and Madagascar also contributed to the production. About 10% of global production comes from artisanal sources located in the DRC.

Graphite



Africa has two main graphite producers across the continent: Madagascar and Mozambique. In 2019, Mozambique produced 14,000 tonnes of global graphite supply. However, in 2020, the country's only mine shut down its operations after the first quarter as a result of COVID-19 and low commodity prices. This led to a drop in Africa's market share of 2020 production down to 3%.

Manganese



South Africa is the leading producer of manganese globally with about 40% of production coming from the country. Gabon is the second largest producer followed by Australia. In addition to these African countries, Ivory Coast and Ghana also produce significant amount of manganese for export into the Chinese market.

8.3 Deepening Africa's critical minerals value chain linkages

Policy that drives adoption, improve infrastructure, and stimulate investments will be the key driver for Africa's growth to move further downstream in the value chain. Europe currently has the regulatory framework that encourages high electric vehicle adoption and cell manufacturing. Its market is currently the fastest growing in terms of electric vehicle market share. It is expected to be in the global leader of vehicle electrification by the end of the decade, overtaking China.

African countries can emulate EV policies adopted by countries like Indonesia in Southeast Asia, where a strong focus has been on leveraging its raw materials to encourage down-

stream investments by the private sector. To achieve that, governments must have a defined policy that stimulates downstream demand since auto-makers and cell manufacturers naturally move closer to their demand market. Another policy initiative will be to form industrial parks or exclusive zones closer to sources of raw materials with reliable transport infrastructure to ports and innovation centres to create an ecosystem for automakers and battery manufacturers to thrive. Furthermore, as countries such as Ghana formulate auto manufacturing policies to attract investment on the continent, it will be imperative for such policies to enable automakers invest next-generation technologies such as electric vehicles.

Asia, where a strong focus has been on leveraging its raw materials to encourage downstream investments by the private sector

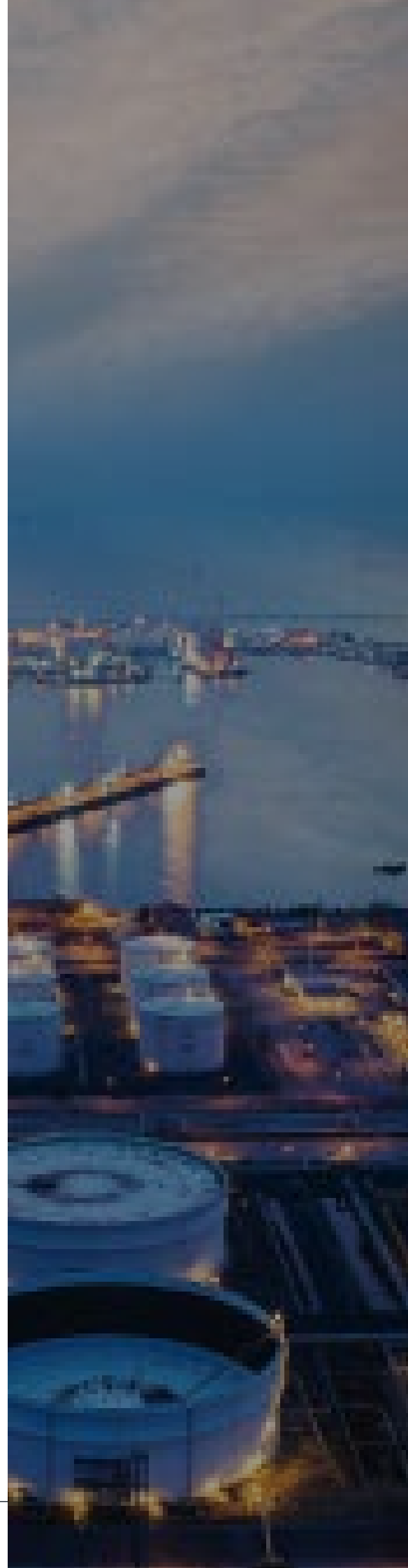
Reliable and cheap electricity is critical for the success of electric vehicle deployment across the continent. In the manufacturing of cells, electricity cost is one of the highest operational

costs. Developing reliable electricity generation capacity at competitive costs will improve Africa's chances of attracting a bigger portion of the value chain across the continent.

Reliable and cheap electricity is critical for the success of electric vehicle deployment across the continent.

The industry has attracted more than US\$400 billion in investments over the last decade—with about US\$100 billion of that coming since the beginning of 2020, according to McKinsey. The next decade will witness more capital deployed into the sector. A key strategy to attract these investments into Africa will be based on a growing

demand coupled with the right policy framework that safeguards and grows invested capital. Africa can seize this opportunity to ensure it plays a key role in a just energy transition where new opportunities are created as the world transitions towards low emissions technologies such as gas, solar, batteries and wind.





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25

**Movers
& Shakers to Watch**



1.

H.E. MACKY SALL
President
Republic of Senegal

As in-coming AU Chair, this President, who has been the MD of the National Oil Company and Minister of Petroleum, will be seen as a rational and conciliatory voice for the battle on fossil fuels between Africa and the developed world. Domestically, a bigger push on first Oil on SNE woodside and Sangomar with BP is going to be on the radar of every industry player, especially given the proximity of the projects to developed western markets. How the President navigates that will be looked upon by all of Africa. Success on these projects will open the MSGBC basin.

2.

H.E. GWEDE MANTASHE

Minister of Mineral Resources and Energy
TotalEnergies
South Africa



H.E. Minister Mantashe has been laser focused on creating the right legal framework for gas resources offshore South Africa to be developed in order to provide much needed energy in South Africa since Total discovered significant quantities of gas in February 2019. In 2022, we expect Minister Mantashe to finalise the long awaited new oil and gas law that will give clarity to investors, push it through parliament and get it signed into law. We also expect him to finalise the ongoing restructuring of oil and gas State Owned Enterprises in the oil and gas sector, in order to make them more efficient and viable entities going forward. Minister Mantashe is likely to strengthen his advocacy for positioning South Africa as a major gas player in 2022. He is a voice of reason on climate concerns around decarbonization.

He is also in charge of developing South Africa's capacity to increase value creation from battery minerals which will only grow in importance as demand for batteries increases globally.

5.

TONY ELUMELU

Chairman
Heirs Holdings



Mr Elumelu's Heirs Holding is likely to solidify its position as a rising star amongst African energy sector players, as it puts into action plans to increase the output of its recently purchased 27,000 barrels per day OML 17 asset from divesting IOCs. The market is watching Heirs Holding, to see if it will be successful in operating such an asset. Upon success, it is very likely that this will not be Heirs Holdings last deal with exiting majors.

Mr Elumelu's control over the 2,000 MW of installed capacity of power in Nigeria via recent acquisitions also makes him a force to recon in the power space, not only in Nigeria, but also in the entire region where the demand for power continues to grow and seems insatiable.

3.

HU XIAOLIAN

Chairman
Export-Import Bank of China



Chinese lending to Africa, including to African related energy projects, continues to be on the decline since its peak in 2013, however, China Exim bank continues to be the single largest lender or underwriter of debt to Africa, in line with the Chinese government's long-term initiatives. Loans to African projects from China Exim bank continue to be competitive in cost and therefore attractive, however, they are increasingly only available to commercially viable projects with Chinese involvement. China Exim is also a major provider of credit lines to African infrastructure focused lenders like the Afreximbank and the African Finance Corporation.

Backed by close over USD 800 Billion in assets, Ms Hu Xiaolian is expected to wield significant influence in Africa's energy sector in 2022, by deciding on the financing and refinancing of multibillion dollar deals in Africa, from strategic mineral projects in the DRC and Zambia, to oil backed loans in Angola and hydropower projects in Nigeria.

6.

ANDRÉ DE RUYTER

CEO
Eskom



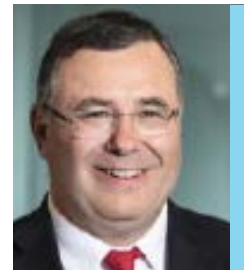
Mr De Ruyter heads South Africa's and Africa's biggest utility company Eskom which has a plan to end power generation with coal by 2050, in a country whose power is predominantly generated using coal. Eskom is a top 10 global emitter of carbon, with 90% of the power it produces coming from Coal. Mr De Ruyter has led the company to embark on a major transformation to renewables, at a time when Eskom is unable to meet existing demand even with conventional fuels like coal and gas. Eskom is currently in the market to secure USD 10 Billion dollars as part of the multibillion USD investment needed to finance such a transition

Given the strategic importance of Eskom to South Africa and to the entire Southern African Power Pool, the energy sector will be watching Mr De Ruyter's stewardship of Eskom to access the true

4.

PATRICK POUYANNÉ

CEO
TotalEnergies



TotalEnergies' likely resumption of its multibillion USD LNG project offshore Mozambique in Q1 2022 puts Mr Pouyanné in charge of arguably the most important energy project on the continent in 2020. Total's Mozambique LNG project is expected to attract USD 20 Billion in investment and will lead to multiple years of double digit growth for Mozambique once completed. Total continues to hold the largest individual share of oil and gas resources in Africa. Following up from the recent success like the completion of the Egina project in Nigeria, the oil major is flexing its muscles by lining up additional ventures for 2020 in Nigeria, Angola, and Uganda. Developing and operating these assets in 2022, in addition to other projects like OML99 Block (Nigeria) expected to produce 60,000 bpd, deploying USD 1.2 billion to develop Zinia 2 in Angola's block 17 will make Patrick Pouyanné yet again the most active IOC major CEO in Africa in 2022.

7.

H.E. MOHAMMED BARKINDO

SG
OPEC



H.E. Mohammed Barkindo might have left Africa for the world stage when he joined OPEC in 2016, however he continues to be a flag bearer for the industry in Africa. OPEC under Barkindo has seen African countries like Equatorial Guinea and the Republic of Congo join the exclusive club, giving those countries access to the organisations clout and technical knowhow that is key for running their oil sector. OPEC is scheduled to increase its activities on the continent in 2020 with an array of roadshows, technical workshops and meetings that are set to also include non-OPEC oil producers. This will make Mohammed Barkindo the go-to person in 2020 for most ministers and presidents on the continent when seeking for public policy advice on the sector.

8.

**H.E. BRUNO
JEAN-RICHARD
ITOUA**
Minister of
Hydrocarbons
Republic of Congo



Congo will takeover the Organization of the Petroleum Exporting Countries (OPEC's) rotating presidency in 2022, giving minister Itooua a key role in coordinating the activities of the world's major oil producers. An astute politician, with long experience in the sector and internationally, Minister Itooua is likely to seek consensus that will keep production increases and restrictions coordinated in a manner that keeps markets and ultimately prices stable.

It is likely that he will seek to strengthen cooperation between African OPEC and Non OPEC producers in an effort to keep prices upwards of USD 60 dollars per barrel. Internally, it is likely, that Mr Itooua will continue on a path of reforms to increase investment into Congo's oil and gas sector, in the face of proposed divestments from IOCs.

9.

**CLAUDIO
DESCALZI**
CEO
Eni

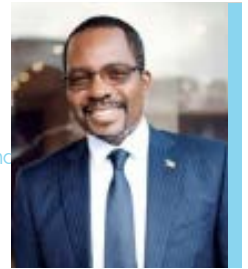


Eni's recent discovery offshore ivory coast, which it estimates at 2 billion barrels of oil and 2.4 Tcf of gas shows that it remains one of the most active IOCs on the continent, despite an overall reduction in exploration activity on the continent. M&A activity and additional field developments in Angola and Nigeria are likely to increase its portfolio, rather than reduce it as is the case with other IOCs.

ENI has also announced, that it is on track and will start the production and exportation of gas from its USD 7 billion LNG Rovuma project offshore Mozambique. This will be the first step in Mozambique's path to become a major LNG exporter and will give much needed confidence for Total's much larger project to resume.

10.

**H.E. GABRIEL
OBIANG LIMA**
Minister of Mines and
Hydrocarbons
Equatorial Guinea



H.E. Minister Gabriel Obiang Lima heads the sector of one of Africa's OPEC members. Credited with leading the industry in Africa on many fronts, he will be judged in 2022 on his ability to bring in policies that will see Equatorial Guinea attract new entrants into its prolific waters for new exploration and development projects. A strong proponent of the monetisation of gas in Africa, it is expected that minister Lima will expand the network of his LNG2Africa initiative in order to bring more countries and organisations on board and by creating a natural market for Equatorial Guinean gas. Many eyes are also set on the minister to see how he will manage the exit of willing seller IOCs from his country. His actions are likely to serve as a blue print for many other regulators seeking to manage the exit of IOCs in Africa

11.

**FLEETWOOD
GROBLER**
CEO
SASOL



South Africa's government has turned to the Johannesburg based Petrochemical giant to lead its efforts to develop a hydrogen economy in South Africa. Backed by numerous MoUs with state backed enterprises and local governments, professing their availability as offtakers of hydrogen, especially as a clean fuel for power generation, Sasol is expected to invest millions of USD in feasibility studies in 2022 to develop a business plan for Hydrogen in Africa that works. This, if successful, will define the age of hydrogen powered energy on the continent for decades to come.

12.

**HE CHIEF TIMIPRE
SYLVA**
Minister of State
for Petroleum
Resources
Nigeria



H.E. Minister Sylva is credited with achieving the passing of the much awaited Petroleum Industry Bill in Nigeria, which broadly improves the operating environment in the industry and is expected to unlock multiple billions of dollars for projects in the industry. Minister Sylva's challenge now remains guiding the implementation of the PIB in 2022 in order to fast track those projects that are already shovel ready. Minister Sylva is also expected to use his influence in 2022 to push for the creation of an African energy bank that will be able to provide much needed financing for energy projects.

13.

**SEBASTIÃO GASPAR
MARTINS**
CEO
Sonangol



Since his appointment in 2019 to lead Africa's second largest crude producer – Angola's- NOC, Mr Gaspar Martins has been in charge of Sonangol's restructuring, which has consisted primarily of reducing the company's exposure to non core E&P functions in order to focus on Exploration and Production. In 2022, Mr Gaspar Martins will be leading Sonangol to the market in order to refinance significant amounts of debt, and raise fresh funds for new E&P projects, as the company seeks to stem a decline in production below current levels of 1,1 Million barrels of oil per day.

14.

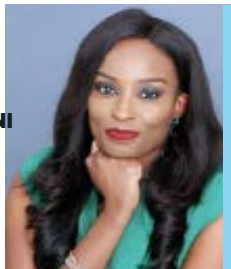
H.E. DR. MATTHEW OPOKU
Minister of Energy
Ghana



H.E. Dr. Opoku oversees an industry which despite its shortcomings, is seen as one of the most advanced on the continent with a clear framework that allows for investors and service companies to operate seamlessly without impairing the benefits that accrue to Ghanians. Compared to its peers, most of them producers with a longer history in the industry, Ghana has been able to promote strong and common sense local content regulations. Dr Opoku is expected to continue in the same vein in 2022, promoting initiatives like gas to power and advocating for a stronger participation of women in the industry. He is also expected to be a strong voice on eradicating energy pow-

15.

ROLAKE AKINKUGBE FILANI
Chief Commercial
Officer
Mixta Africa



An astute energy banker and current Chief Commercial Officer at Mixta Africa, one of Africa's leading infrastructure developers, Ms Akinkugbe Filani is an authority and well sought counselor on energy transition in Africa. She is a trusted advisor to DFI's, who play an important role in financing green energy projects in Africa, hence giving her a voice of influence in Africa's energy industry in 2022. Ms Akinkugbe Filani sits on the board of several funds, including Africa-focused climate and renewable energy fund Persistent which runs a \$120mn Energy Fund.

16.

MUSTAFA SANALLA
Chairman
Libya National
Oil Corporation



Libya's all-important oil sector has struggled to maintain previous levels of production and attract the investment that a 1.3 million bpd economy would usually command. Current levels stand at under 800,000 barrels per day. However, plans by Mustafa Sanalla, Chairman of Libya's National Oil Company, to ramp up production in the near term to over 1 million barrels per day in 2022 make him one of the most important figures in the industry in 2022.

Seen as a steady hand even in times of turmoil, it is unlikely, that Mr Sanalla will leave his position, no matter who wins the presidential and parliamentary elections scheduled for December 2022.

17.

PROSCOVIA NABBANJA
CEO
Uganda National
Oil Company



As CEO of Uganda's National Oil Company, Ms Nabbanja oversees UNOC, which is involved in and has the power to influence every step of the development of Uganda's nascent oil and gas sector, from upstream through to midstream and downstream. From the Tilenga and Kingfisher South projects, which together are expected at peak to produce 210,000 Barrels per day, to the building of the EACOP pipeline and a planned 60,000 barrel per day refinery, UNOC is set to be at the heart of major investments in East Africa. Ms Nabbanja will be tested on her ability to represent the state in the JV with IOCs to ensure that developments are fast tracked, whilst at the same time safeguarding the interests of the Ugandan state. Overall investments needed to de-

18.

VIVIENNE YEDA
Chairman / Director
General
Kenya Power /
East African
Development Bank



As head of the East African Development Bank's management team and Chairman of Kenya's power distributor, Ms Yeda is at the centre of the restructuring of Kenya's power sector. She was nominated to the Kenya Power Chairmanship in November in 2020 with the brief to steer the restructuring of the troubled state enterprise. Her long years of experience at the regional development finance institution also gives her a prime seat at the table when decisions are being made of financing energy deals in the region.

19.

MAJ GEN INNOCENT KABANDANA
Commander of
Rwandan troops in
Mozambique
Rwanda



Can the joint task force commander of Rwandan troops in Mozambique's northernmost province of Cabo Delgado quickly stabilize the area and pave the way for Total to deliver on Mozambique LNG? That is the question which is on the mind of everyday Mozambicans and Africa at large. The gas projects off the coast of Cabo Delgado are of critical importance not only to Mozambique, but to the whole region. It is very likely, that Gen Kabandana and his men, as well as other forces from the SADC region who are in country will in 2022 provide the necessary security for TotalEnergies and other contractors working on gas projects.

20.

**MAIXENT RAOUL
OMINGA**
CEO
SNPC



Mr Ominga is head of the Republic of Congo's National Oil Company and hence will play a major role in the re-allocation of assets in the country that IOCs are expected to drop, as they rebalance their portfolios. It is likely, that some of these assets will be passed on to SNPC to operate, hence raising SNPC's profile as an operator. This will also give Mr Ominga significant leverage to transform the industry in Congo, by using his increased leverage to increase congolese content and government take from production.

21.

TOUFIK HAKKAR
CEO
Sonatrach



As head of Algeria's National Oil Company, which is also one of the world's largest gas producers' Mr Hakkar, a Sonatrach veteran prior to his appointment in February 2020 shall play a major role in the sanctioning of new gas projects in Algeria in 2022, especially in light of the recent increase in the demand for gas globally and the resulting increase in prices. Given the position Sonatrach takes in the market, Mr Hakkar will be in charge of sanctioning services contracts in the industry in 2022 worth more than 10 billions of dollars, hence giving him a key role in the industry in Africa in 2022.

22.

DR KK SARPONG
CEO
GNPC



An agreement by GNPC and Kosmos Energy to buy out Occidental energy's share of the Jubilee and TEN fields in Ghana strengthen GNPC's position in the sector and shows that the National oil company is willing to put skin in the game and build capacity to take on projects of their own in the near future. It also shows that GNPC under Dr Sarpong is a deal maker and capable of making the tough calls needed to build GNPC's productive asset base. As Oil prices stay at a relatively high levels, it is likely that we will see GNPC embark on several projects in 2022, that will also help increase overall Ghanaian content in the sector.

23.

**OLAKUNLE
OLALEKAN
WILLIAMS**
CEO, QSL Gas &
Power Limited



Nigeria and Africa as a whole is betting big on gas to power in the next stage of its development and achieve energy security. QSL Gas and Power Limited and its CEO Mr Kunle Williams, have positioned themselves as facilitators of this growth by establishing themselves in a relatively short time as registered and reliable suppliers of gas to industrial complexes and power stations. Mr Williams has led the company to develop a combined supply and trading capacity of over 120mcf of gas daily and growing. They plan to increase this significantly by developing the infrastructure needed to get off-grid energy users connected to their supplies. This will not only give them a strong market position in 2022, it will enable them to raise the funds or atleast part of it for a continent wide expansion.

24.

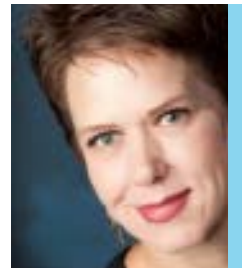
SCOTT EVANS
CEO
ReconAFRICA



As head of Africa focused explorer explorer in a basin that has been attested much potential but yet to be confirmed, questions are being asked if Mr Cowan and his team can meet expectations. So far, initial evaluations from early exploration work has been positive. However, can he maintain a thick skin and his cool amidst a radical onslaught by activist to continue in his quest to deliver Namibia an oil promise? His success is also likely to mean an opening of Namibia and other yet to be exploited acreages in neighbouring Angola. The Canadian-based independent has emerged as a major exploration player, particularly in frontier markets such as Namibia and Botswana. Just this year, the company's exploratory

25.

ANN NORMAN
President
Saqara Energy



As CEO of SAQARA Energy, Ms Norman's primary goal is to assist oil and gas companies eliminate and monetize their associated gas flares through the advent and introduction of Midstream on Demand to African markets. The lack of midstream options for offtake of products led her to found Midstream Africa.

Additionally, Ms. Norman has significant experience directing investments into sub-Saharan African economies across various sectors which include not only oil and gas (midstream and upstream), but agriculture, infrastructure, banking, hotels, the airline industry and renewable energy. With the



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