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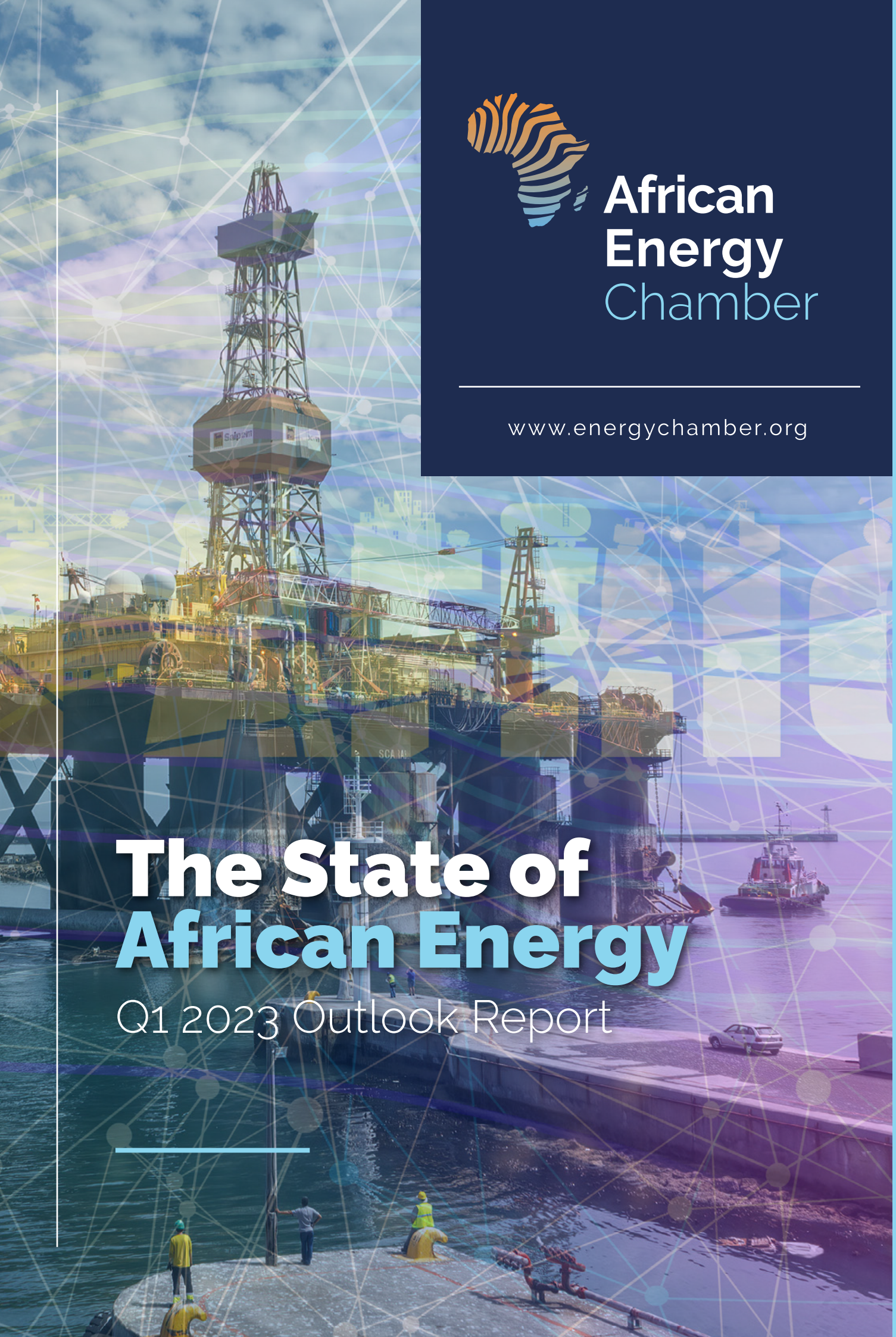

The State of African Energy

Q1 2023 Outlook Report

African Energy Week 2023

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Cape Town, South Africa
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Key Highlights

- 2023 global liquids (crude + condensates) month-on-month outlook expected to stay flat and stable with annual average at 83.4 million barrels per day (MMbbls/d)
- Africa liquids supply expected to add up to 8% of the global volumes over the year at an annual average of almost 7 MMbbls/d
- Top five producers – Nigeria, Libya, Algeria, Angola and Egypt contribute to over 80% of Africa's 2023 liquids output
- While majority of the production from Nigeria and Angola is from offshore projects, Algeria, Libya and Egypt's production comes from their respective onshore fields
- Production from Nigeria and Angola is in decline, whereas Algeria and Egypt production trend has been relatively flat since 2015. Libya's now subsiding civil war impact is expected to result in increased production in 2023
- Regulatory cuts in the form of OPEC sanctions are expected to result in outages in Algeria's crude oil output throughout the year
- Africa natural gas output is majorly driven by the North and West African projects
- 2023 annual output is expected to reach about 268 Billion cubic meters (Bcm) and over 85% of this is estimated to come from the North and West African projects
- The production from the existing producing fields is in terminal decline and any trend reversal is expected only from the currently pre-FID (Final Investment Decision) fields
- Any delays in these projects, thus, will have an adverse impact on the continent's natural gas aspirations
- Africa's total LNG export infrastructure capacity expected to increase from the existing 80 MMtpa to about 110 MMtpa by 2030 and further to over 175 MMtpa by the end of the next decade
- Nigeria, Algeria, Mozambique, Senegal – Mauritania, Tanzania and Egypt are expected to drive this LNG export capacity in the long term
- Africa's LNG exports are expected to increase from 66 Bcm in 2023 (a 5% year-on-year increase from 2022) to 77 Bcm by 2030 and further to 100 Bcm by 2035
- Africa's own natural gas production, international natural gas imports and the annual domestic demand levels put the continent in a position to pump natural gas volumes of 105 Bcm in 2023, 170 Bcm in 2030, 275 Bcm in 2037 and a slightly lower 220 Bcm in 2040 to both domestic and international markets
- Africa's upcoming upstream projects have already seen large delays from the time the hydrocarbon discoveries were made to the estimated future FID
- Many crude oil discoveries that can stabilize the production and offset the terminal decline in output for a few years; and also, giant natural gas finds that can help Africa meet domestic demand, universal electricity access and LNG export aspirations have seen long delays due to various above-the-surface issues

- Over a half of the hydrocarbon output from Africa over the period 2025 – 2040 and about 60% of the remaining recoverable oil and gas reserves in Africa is estimated to come from these upcoming/delayed start-ups
- Governments are now realizing the impact of these delays and putting in the efforts to bring these projects online and also bring in more exploration investments, but more is required
- At the current conservatively estimated development timeline and scale, a mammoth US$795 billion of greenfield expenditure is required over the period 2023 – 2040 to bring these undeveloped discoveries online
- 2023 global renewables capacity (solar + wind + hydrogen electrolyzer) is 1,500 GW
- Asia, Europe and North America are expected to drive over 90% of this capacity, with Africa contributing a negligible 1% of the annual capacity
- As hydrogen capacity in Africa picks up, 2035 Africa output is expected to increase to 7% of the global capacity
- Africa's current announced renewables capacity stands at 134 GW of wind capacity, 120 GW of solar capacity and 112 GW of hydrogen capacity
- Egypt, Morocco, Mauritania and South Africa are the major countries with current announced capacity
- Over 75% of the current announced capacity is in concept stage
- Africa's renewables capacity output is expected to increase from about 27.4 GW in 2023 to over 280 GW in 2035
- CWP Global (in partnership with Bechtel in a few projects) is the main operator with close to 25% of the current announced capacity in Africa
- Africa holds large natural gas and renewables potential, but over 60% of the natural gas potential and over 75% of the current announced renewables capacity is in a similar "pre-FEED" state
- Africa's COP27 commitments aim at phase down of coal power, natural gas as transition fuel and establishment of the Africa Carbon Markets Initiative (ACMI)
- Universal electricity access and power generation based on renewables is also on the agenda
- Africa continent estimated to stand fifth globally in upstream emissions and Africa's emissions expected to be driven majorly due to gas flaring
- High greenfield spending required to bring the large upstream potential online but the economic viability of the level of investment close to a 2˚C scenario
- At the current estimates, Africa needs fossil fuels as base case scenario suggests a third of the power generated in 2030 and over a quarter of this in 2040 is expected to come from gas-to-power
- Even in a 1.5˚C scenario, estimates suggest close to a fifth of the power generated in 2030 and about 8% of this in 2040 will be from gas-to-power projects
- South Africa is a classic example of an African nation that can benefit from the COP27 commitments around phase down of coal and usage of natural gas potential for power generation

1 AFRICA OIL SHORT-TERM SUPPLY OUTLOOK

1.1 Global and African 2023 liquids supply

Africa 2023 liquids supply is estimated at almost 7 MMbbls/d. This reflects a marginal year-on-year growth from 6.875 MMbbls/d and 6.7 MMbbls/d in 2021 and 2022 respectively, and close to 430,000 barrels per day (bpd) from 2020 lows of about 6.55 MMbbls/d. While this growth from the pandemic hit lows is a positive sign, it should be noted that 2023 expected output is lower by 1 MMbbls/d than the highs of 2015 where output was almost 8 MMbbls/d. This steep drop from 2015 is majorly due to output drop from declining fields in Nigeria, Angola, Equatorial Guinea, Egypt and South Sudan. Cumulative drop from these five countries is around 1.735 MMbbls/d and the overall production drop, from all the countries where output has declined, is 1.89 MMbbls/d. This drop is partially offset by production increase from mainly Libya, Congo and Ghana – accounting to a cumulative output increase of 880,000 bpd.

Nigeria, Libya, Algeria, Angola and Egypt are expected to be the top five liquids producers for the year with a combined output of about 5.76 MMbbls/d, more than 80% of the continent's overall annual output.

Nigeria – Nigerian crude production looks on course to rebound to over 1.3 MMbbls/d in 2023, as government efforts to tackle persistent oil theft and pipeline vandalism bear fruit. The major West African producer's crude oil output was 1.18 MMbbls/d last year, far below the 1.5 MMbbls/d seen in 2020, as theft and vandalism led to force majeures on key blends. Nigerian crude output averaged 1.3 MMbbls/d in 2021 despite numerous impediments, including accidental pipeline damage, OPEC+ quotas and other unplanned outages, even topping 1.4 MMbbls/d at the beginning of that year. The outbreak of war between Russia and Ukraine in February 2022 presented an opportunity for Nigeria – as with other major producer nations – to reap the benefits of high oil prices, but the country continued to be impaired by oil theft and pipeline damage. In an effort to curb theft and vandalism, the federal government announced a new approach in collaboration with host communities to protect critical pipeline systems, with a pipeline surveillance contract awarded to protect oil assets. The Nigerian Navy was also employed to track vessels illegally carrying crude oil, while Nigerian National Petroleum Corporation (NNPC) also deployed various other methods to monitor and report oil theft in the country. All these initiatives reaped benefits as Nigeria surpassed 1 MMbbls/d of crude production in October 2022, closing the year close to 1.2 MMbbls/d.

Nigeria's National Upstream Petro-

2023 global liquids (crude + condensates) month-on-month outlook expected to stay flat and stable with annual average at 83.4 million barrels per day (MMbbls/d)

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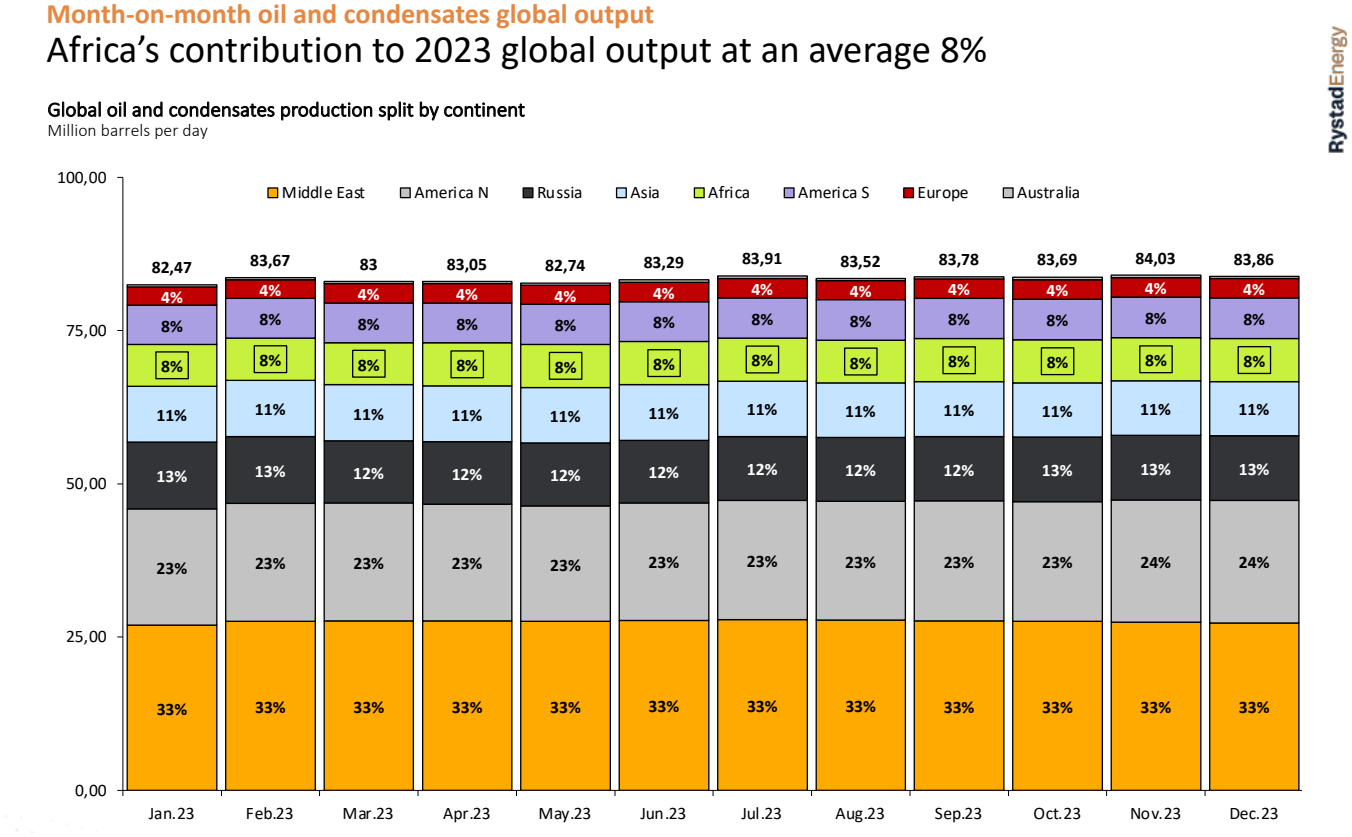
Regulatory cuts in the form of OPEC sanctions are expected to result in outages in Algeria's crude oil output throughout the year

1.2 Top liquids producers of Africa in 2023

leum Regulatory Commission (NUPRC), the country's upstream regulator, in December last year launched the Mini Bid Round 2022 in the hope of boosting investments and exploration activity. The Petroleum Industry Act (PIA) of 2021, with its improved legal and regulatory frameworks, also seeks to encourage new investors and investments into the next phase of exploration. Seven offshore blocks covering a total area of approximately 6,700 square kilometers and situated in water depths of between 1,150 meters and 3,100 meters are on offer as part of Nigeria's fresh attempt at developing offshore assets. The blocks are closer to the producing fields of Aje, Erha and Erha North and the undeveloped fields of Ogo and Bosi. With President-elect Bola Tinubu of the ruling All Progressives Congress (APC) party emerging victorious, the government's strategy to restore output levels can be ex-

Month-on-month oil and condensates global output

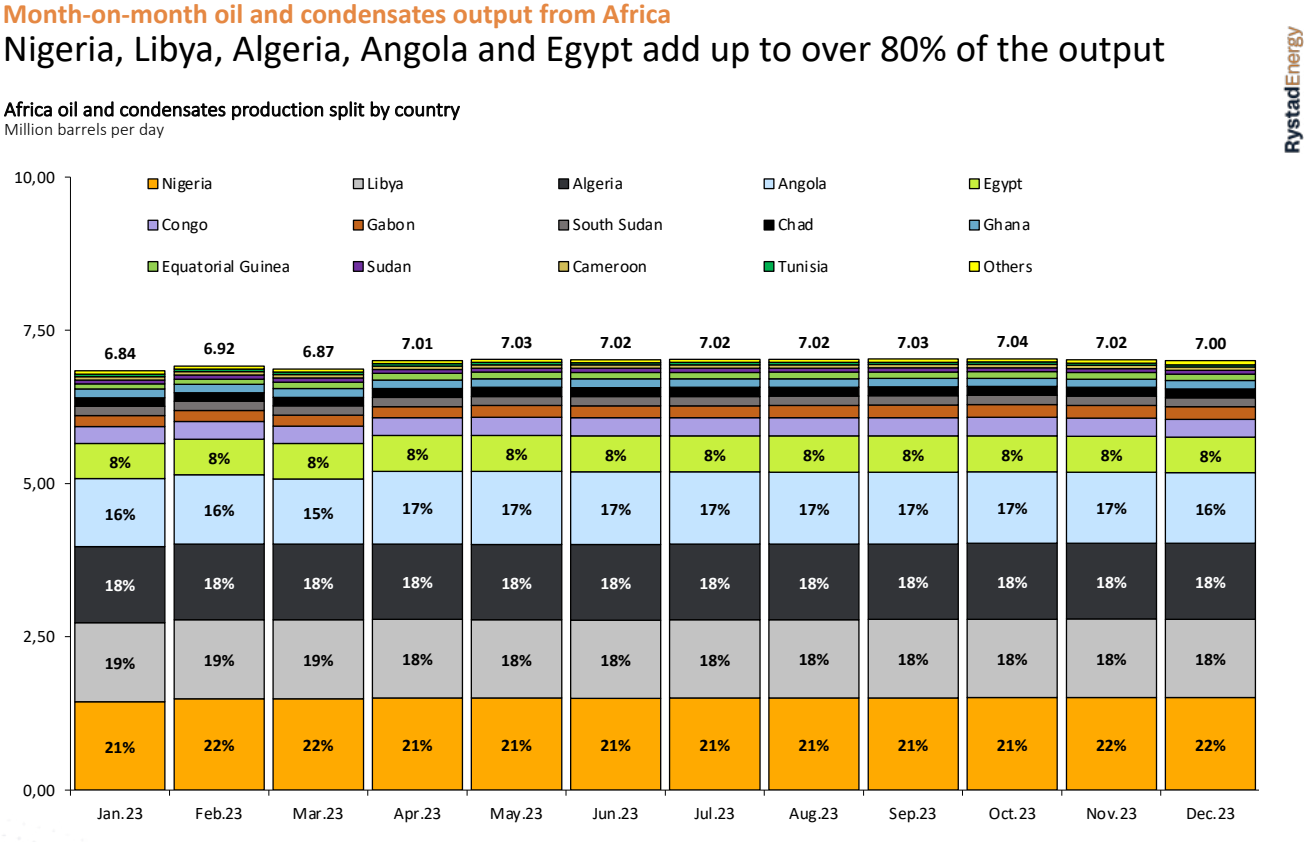
Africa's contribution to 2023 global output at an average 8%



Source: Rystad Energy OilMarketCube

Month-on-month oil and condensates output from Africa

Nigeria, Libya, Algeria, Angola and Egypt add up to over 80% of the output



Source: Rystad Energy OilMarketCube

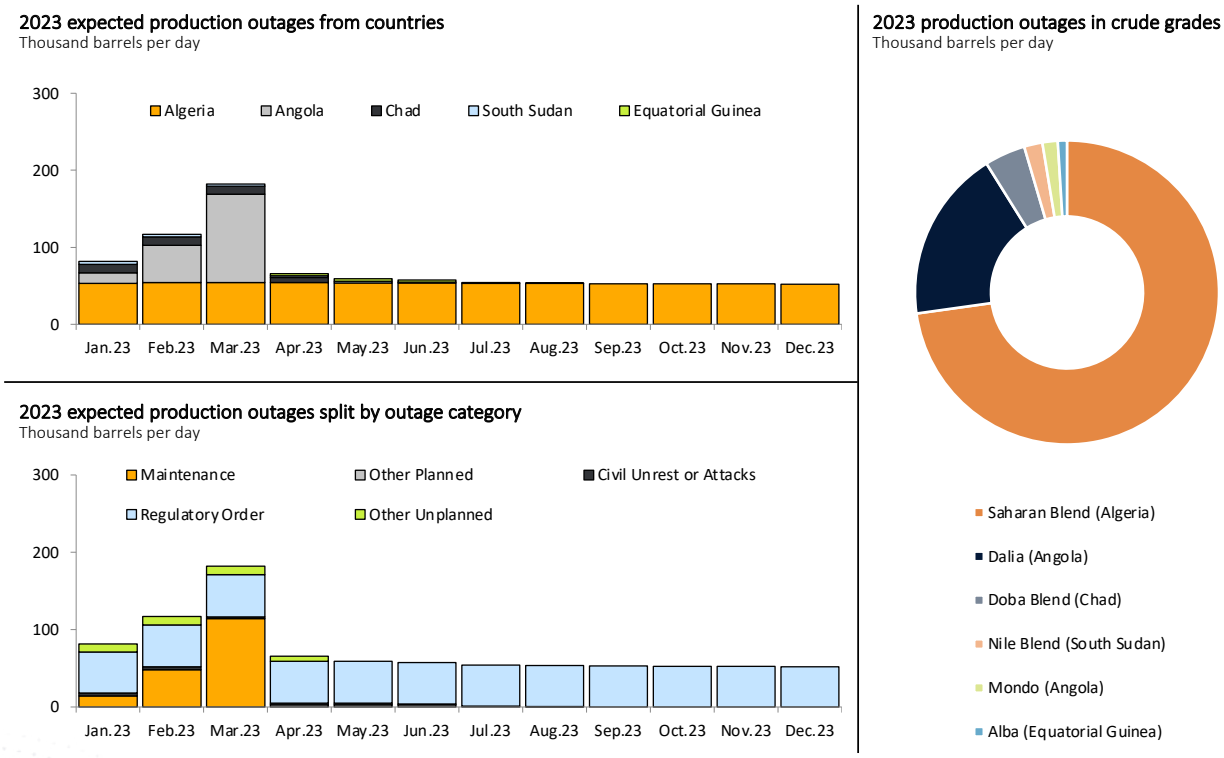
pected to remain in place, leading to 1.3 million bpd this year if no sudden outages manifest. There is also potential for upside if some blends that are still underproducing can be restored to pre-Covid-19 output levels.

Libya – Libya's civil war had an adverse impact on the country's hydrocarbon output historically. 2020 saw the lowest of lows with crude oil production diminishing to about 370,000 bpd. However, 2021 saw a reversal with output surpassing the 1 MMbbls/d mark and reaching annual average of 1.12 MMbbls/d. 2022, yet again, proved something of a rollercoaster ride for the country and its staple oil sector, following a relatively stable 2021. With presidential and parliamentary elections originally scheduled for December 2021 but pushed to June 2022 and then delayed indefinitely, and given the continued existence of two parallel governments, the political atmosphere in the country soured in 2022, resulting in production shutins, violence and human casualties. The situation in Libya has remained strained due to the lack of any true decision-making body, with this instability linked to sudden eruptions of violence that have led to increased volatility, straining the nation's economy. While a common perception at that point was that the country would continue to struggle with production and the protests would turn more violent, resulting in more lost volumes, in July 2022, Libya's output surprisingly rebounded, protests ended, and the force majeure was lifted. The country staged a remarkable recovery, and within the space of three weeks, Libya was able to surpass its rated capacity of 1.2 MMbbls/d, since when production has remained relatively stable, with no major disruptions. As a result, 2023 crude oil output from Libya is expected at an average 1.2 MMbbls/d.

Algeria – Algeria, like the rest of the world, was hit by the pandemic and 2020 – 2021 crude oil output was at a sub-1 MMbbls/d mark at 930,000 bpd and 940,000 bpd, respectively. Better performance from the existing fields and newer start-ups combined with revision in OPEC regulations resulted in 2022 crude oil output reaching close to 1.07 MMbbls/d. However, OPEC+ cuts announced in October 2022, set to be effective from November 2022

Month-on-month oil and condensates production outages

Expected outages in Algeria throughout 2023 due to OPEC cuts



Source: Rystad Energy OilMarketCube

to December 2023 have resulted in monthly production outages throughout 2023. This, in turn, hindered any possibility of further output growth in 2023 and expected crude oil production from the country is expected at 1.06 MMbbls/d, similar to 2022 levels.

Angola – With depleting reservoirs and declining production from the Floating Production Storage and Offloading (FPSO) vessels deployed on the deepwater fields, Angola's liquids out has been in a freefall since 2015. However, newer start-ups in the Kaombo North, Eastern & Western hubs on Block 15/06 and Pazflor developments, the Greater Plutonio Phase 2, CLOV Phase 2 and Dalia Phase 3 have resulted in stable output since 2021. The country's 2021 and 2022 liquids output was 1.13 MMbbls/d and 1.15 MMbbls/d respectively, and expected 2023 production is 1.15 MMbbls/d.

Egypt – Egypt's liquids output is largely supported by its joint venture (JV) operations. The national oil company (NOC), Egyptian General Petroleum Corporation (EGPC) operates oil production in the form different JVs like Khalda Petroleum Company, Belayim Petroleum (PETROBEL), Gulf of Suez Petroleum Company (GUPCO), AGIBA Petroleum Company, Badr El-Din Petroleum Company (BAPETCO) and so on, with International Oil Companies (IOCs) like Apache, Eni, BP, Shell (whose share in BAPETCO was later acquired by Cheiron Group and Capricorn Energy). Compared to the other top African producers, Egypt's oil output has been relatively stable for the years 2021 – 2022 and 2023 output is expected to be at about 460,000 bpd with condensates reaching an output of about 125,000 bpd. About three-quarters of the 2023 oil production and a third of the year's condensates production is expected to come from the onshore projects.

Majority of the remainder of the production comes from sub-Saharan African countries like Congo, Gabon, Chad, Ghana and Equatorial Guinea. Apart from non-sub-Saharan African Tunisia, whose output for the year 2023 is estimated close to 38,500 bpd, the rest of the 17% of Africa's 2023 oil and condensates production is expected to come from sub-Saharan Africa.

2 AFRICA NATURAL GAS AND LNG OUTLOOK

Africa natural gas output is majorly driven by the North and West African projects

2023 annual output is expected to reach about 268 Billion cubic meters (Bcm) and over 85% of this is estimated to come from the North and West African projects

The production from the existing producing fields is in terminal decline and any trend reversal is expected only from the currently pre-FID (Final Investment Decision) fields

Any delays in these projects, thus, will have an adverse impact on the continent's natural gas aspirations

Africa's total LNG export infrastructure capacity expected to increase from the existing 80 MMtpa to about 110 MMtpa by 2030 and further to over 175 MMtpa by the end of the next decade

Nigeria, Algeria, Mozambique, Senegal – Mauritania, Tanzania and Egypt are expected to drive this LNG export capacity in the long term

Africa's LNG exports are expected to increase from 66 Bcm in 2023 (a 5% year-on-year increase from 2022) to 77 Bcm by 2030 and further to 100 Bcm by 2035

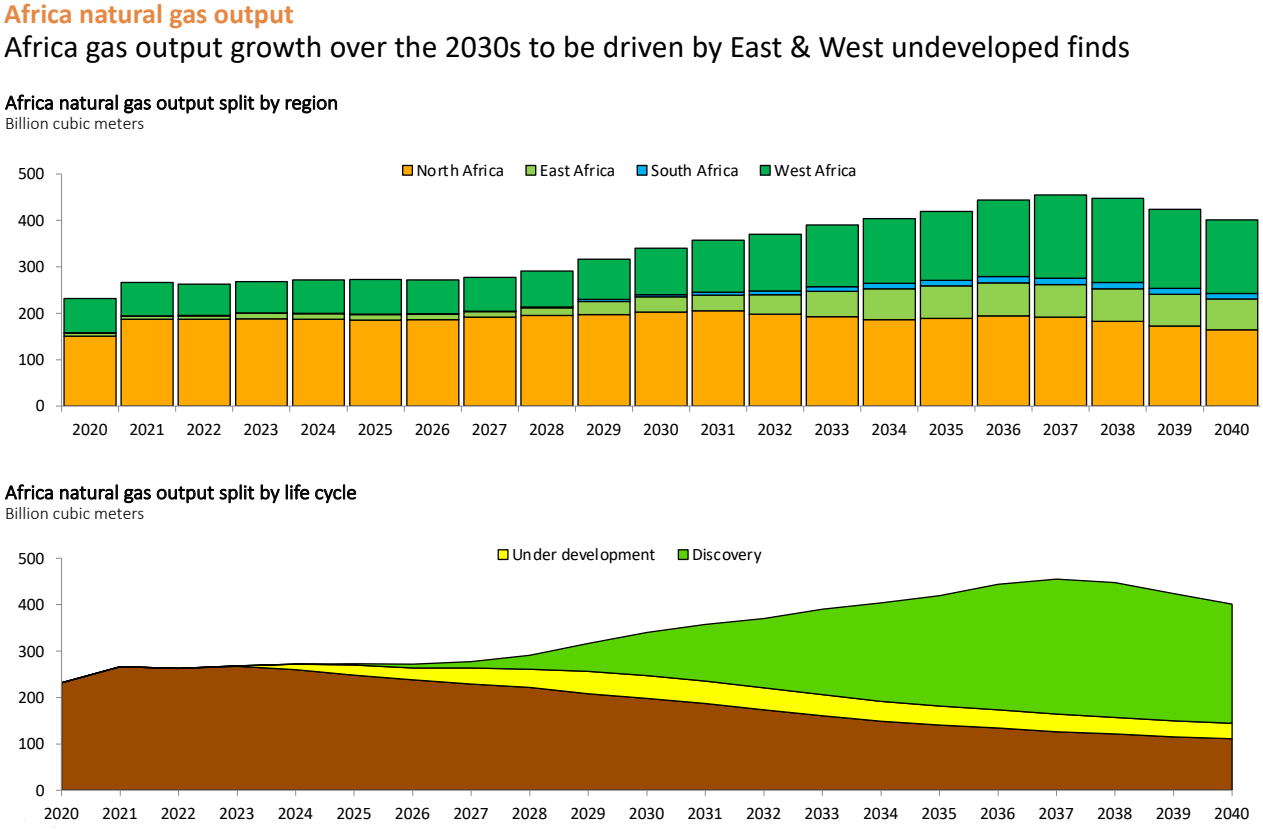
Africa's own natural gas production, international natural gas imports and the annual domestic demand levels put the continent in a position to pump natural gas volumes of 105 Bcm in 2023, 170 Bcm in 2030, 275 Bcm in 2037 and a slightly lower 220 Bcm in 2040 to both domestic and international markets

2.1 Africa natural gas supply, LNG infrastructure and LNG supply

Africa natural gas supply is majorly driven by the North and West African gas projects. This high ratio of production compared to the other regions is expected to remain throughout this decade and the next, considering the conservative development timelines and supply potentials of the mega projects of the Eastern African nations of Mozambique and Tanzania and the currently recovered relatively low potential of South Africa. 2023 Africa natural gas output is expected at close to 268 Bcm and cumulative share of North and West African projects is estimated at 95% of the overall volume. The share of these regions in 2025, 2030 and 2040 is estimated to be 95%, 90% and 80% respectively. North Africa takes the larger share of the two regions, but West is expected to catch up by the end of the next decade in the current conservative estimates of timelines and production trends. Major producers in North Africa include Algeria, Egypt & Libya, and these add up to almost all of the natural gas output from the region. The share of individual countries from West Africa is a different story – currently Nigeria, Angola and Equatorial Guinea add up to 85% of the overall output from the region. While the share of these three countries is expected to remain the same till 2025, it gradually decreases to 75% by 2030, 70% by 2035 and to about

Africa natural gas output

Africa gas output growth over the 2030s to be driven by East & West undeveloped finds



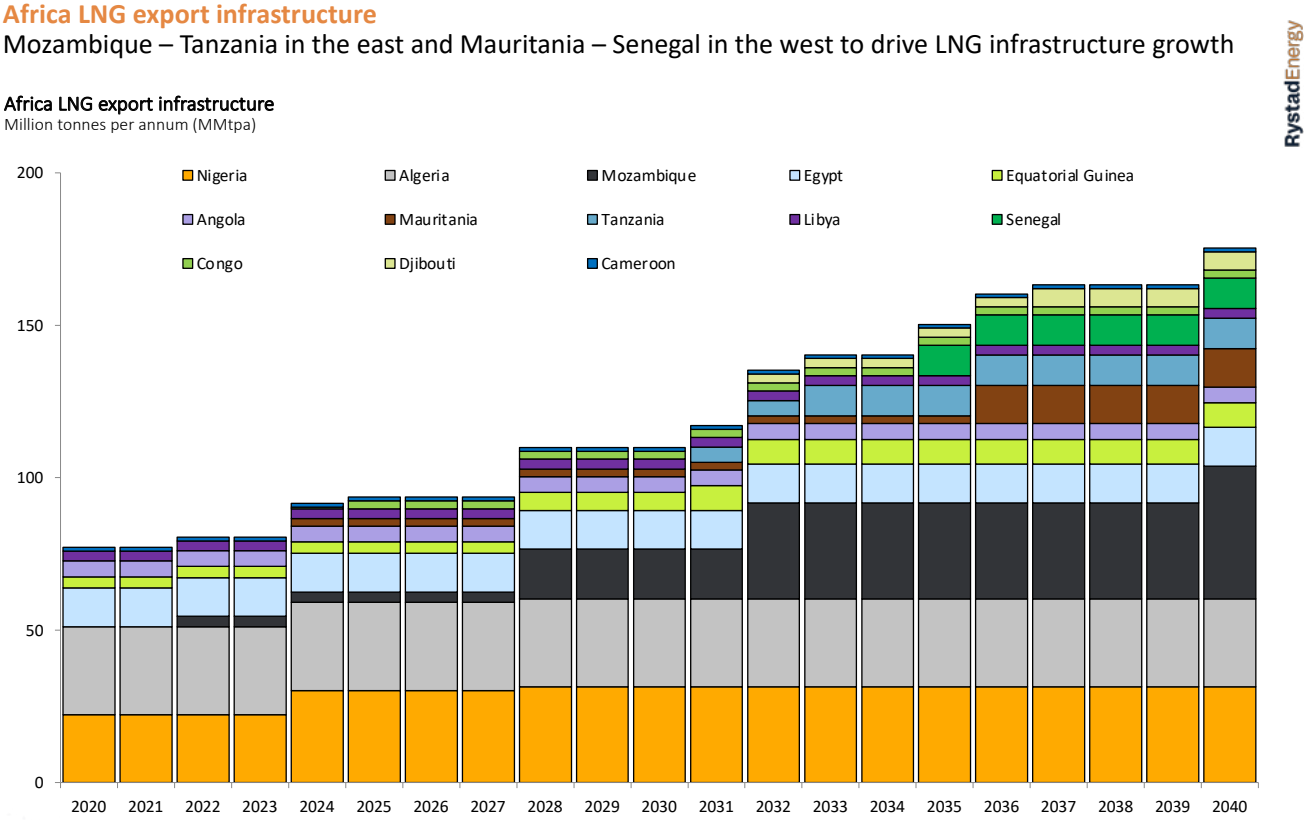
Source: Rystad Energy UCube

60% by 2040. While these countries' share is expected to decrease, natural gas output from Senegal – Mauritania is expected to increase as the BP – Kosmos projects of Greater Tortue Ahmeyim (GTA), Bir Allah, Yakaar – Teranga projects come online and ramp up. The share of these countries' cumulative natural gas output is 5%, 10%, 15% and 30% of the overall West Africa output from the years 2025, 2030, 2035 and 2040, respectively.

Natural gas production from Africa is expected to stay relatively flat till about 2027 at an average level of about 270 Bcm before the currently undeveloped volumes come online. Output from the currently producing fields is in terminal decline. Production from these fields is estimated to decline at an annual rate of about 5% from 2025 through to 2040. While the production from the currently post-FID under development fields is estimated to see an annual increase of about 15% from 2025 to 2030, output from these fields is also expected to decline going forward. The production growth expected to happen in the next decade is only from the currently pre-FID potential. This growth over the next decade is expected from projects in both currently nascent upstream economies like Mozambique, Tanzania, Mauritania, Senegal, South Africa and Ethiopia, as well as matured oil and gas economies like Nigeria, Libya and Algeria. At the current conservative forecast, the production from these projects is expected to double year-on-year from 2025 – 2029 and then see a gradual increase till about late 2030s. A little over 10% of the total natural gas production from Af-

Africa LNG export infrastructure

Mozambique – Tanzania in the east and Mauritania – Senegal in the west to drive LNG infrastructure growth



Source: Rystad Energy GasMarketCube

rica is from these currently pre-FID/ pre-FEED (Front End Engineering and Design) volumes and it increases to over a half of the total output. As such, these volumes are crucial to Africa's natural gas supplies and the continent's natural gas aspirations to be a major liquified natural gas (LNG) exporter to international markets.

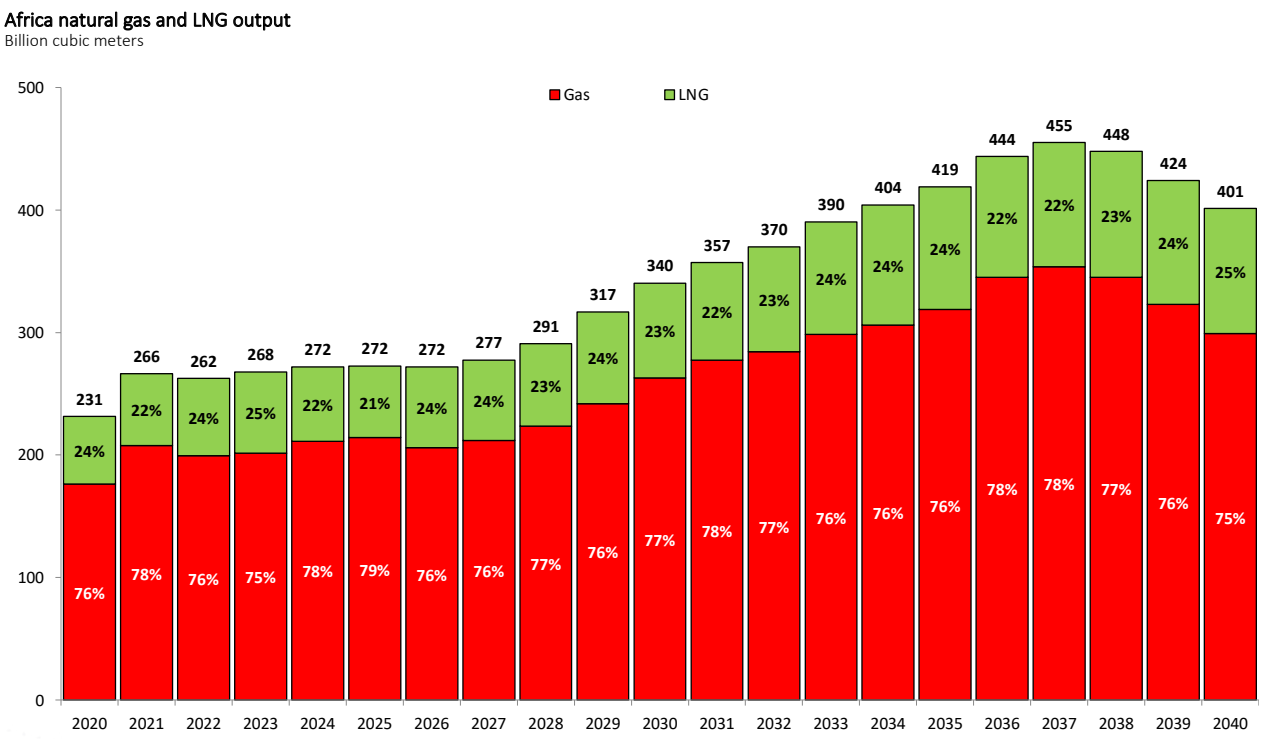
Africa LNG export infrastructure also is shaping in a similar way to the natural gas forecast. Between the bigger producers like Algeria, Nigeria and Egypt, Algeria and Egypt are expected to maintain their existing LNG infrastructure capacity of about 29 million tonnes per annum (MMtpa) and 12.7 MMtpa, respectively. Nigeria's plans involve increasing its LNG infrastructure capacity from the existing 22 MMtpa to 30 MMtpa via the Nigeria LNG (NLNG) Train 7 development and further marginally to just over 31 MMtpa via UTM Offshore's FLNG project.

In the period through to 2040, Mozambique is expected to see the highest increase in LNG export capacity, increasing from current capacity of 3.4 MMtpa to close to 16.3 MMtpa and further to 31.5 MMtpa and finally to about 43.5 MMtpa by the end of the next decade. This is conditional to situation in the country where operator TotalEnergies was recently reported to be resuming work soon after a force majeure was declared on the project in April 2021 after Islamist insurgents attacked Palma town close to the project construction site at Afungi. ExxonMobil partners in the Coral project were also recently reported that they would take a call soon on whether a second floating liquefied natural gas vessel (FLNG) vessel would be deployed. This decision is also subject to the US major's decision on it onshore US$24 billion Rovuma LNG scheme as disturbances in the Cabo Delgado province due to Islamist insurgency since 2017, are now reported to be subsiding.

Senegal – Mauritania on the Western side of Africa and Tanzania on the Eastern side are countries expected

Africa gas and LNG output

Africa average LNG output a quarter of the total over this and the next decade



Source: Rystad Energy UCube

to ramp up their FLNG export capacities. While BP – Kosmos owned LNG projects in the waters off Senegal and Mauritania are expected to lead to an increase in the cumulative capacity of both the countries from the 2.5 MMtpa capacity, that is expected to kick off next year, to an overall 22.5 MMtpa capacity by the second half of the next decade. In Tanzania, the Energy Ministry recently announced that partners on the deepwater blocks 1, 2 and 4 – Shell, Equinor, ExxonMobil, Pavilion Energy and Medco Energi and the government have completed discussions on the contractual terms of a critical host government agreement (HGA), taking another step towards the US$30 billion LNG project with a 10 MMtpa capacity. Other projects like Marine XII FLNG in Congo, Angola's Soyo LNG taking feedgas from the Quiluma – Maboqueiro and Sanha lean gas complexes, and Equatorial Guinea's Punta Europa LNG plant are a few other key projects maintaining or increasing Africa's LNG export infrastructure capacity.

Africa has been a historical LNG and gas-via-pipeline exporter, especially to Europe. Close to 65% of the overall LNG and pipeline exports from Africa in the period 2005 – 2022 have been to Europe. Historically a fifth of the overall natural gas produced in Africa has been catering to international markets via LNG exports. This volume share has seen a slight increase in the past 3 – 4 years where the overall LNG exports share has increased to a quarter of the total production. Taking into consideration the existing LNG export agreements, the export potential is expected to stay at a relatively flat share of 25% of the total natural gas produced. However, with the increase in natural gas production, the overall LNG exports are also expected to increase going forward. Overall natural gas output is expected to increase from 268 Bcm in 2023 to 272 Bcm in 2025. The output is further expected to increase to 340 Bcm in 2030 and further to about 420 Bcm. In lie with this, 2023, 2030 and 2035 expected LNG flows from Africa are 66 Bcm, 77 Bcm and 100 Bcm, respectively.

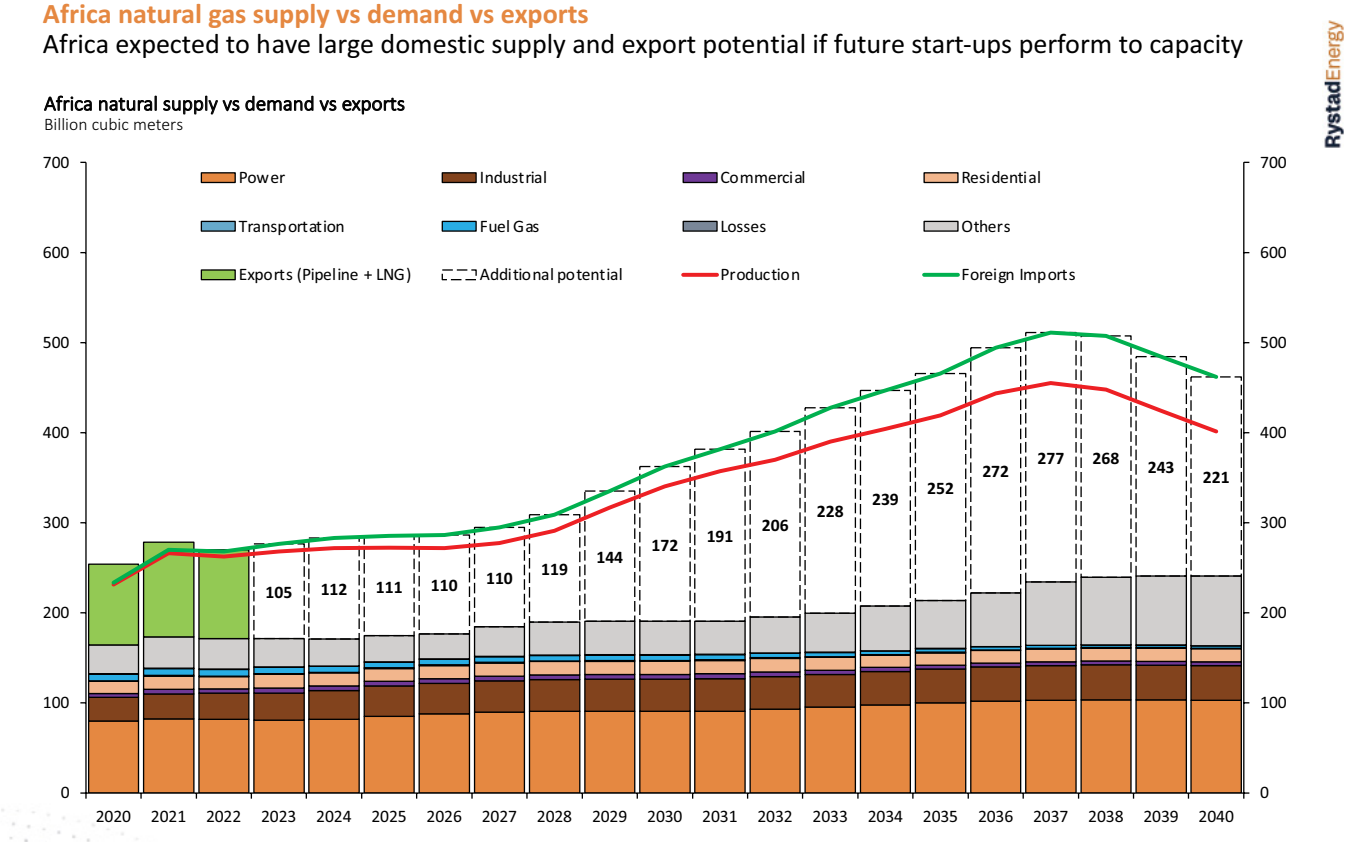
2.2 Africa gas demand and LNG exports vs additional potential

Africa natural gas production is on the rise, provided there are no project delays or revisions in current development plans, but so is the demand forecast. 2022 – 2023 production curve is relatively flat, and demand is also an annual 172 Bcm, a 65% share of the overall output. The share of demand is expected to remain flat at the 65% mark as demand grows in line with the output till about 2028. Post this, the production is expected to grow faster than the demand, reducing the overall share of demand to 60% in 2029 and further lower to 55% in 2030. Annual demand is expected to stay at around 55% of the total production throughout the next decade. Of the total demand, power generation's share is expected to be around 50% through the end of this decade and 45% on average through the next decade 2031 – 2040. Power generation, industrial usage and residential consumption form the key sectors of natural gas demand adding up to an average of 75% of the total demand through the period 2023 – 2030 and a slightly lower 70% of the total demand through the years 2031 – 2040. Taking into consideration Africa's natural gas imports, like Egypt importing gas from Israel, Africa's overall natural gas supply is expected to increase from 275 Bcm in 2023 to 285 Bcm in 2025, further to 360 Bcm in 2030 and 510 Bcm in 2037 before declining to 460 Bcm by 2040.

Taking out the forecasted domestic demand, these supply levels put Africa in a position to pump natural gas volumes of 105 Bcm in 2023, 170 Bcm in 2030, 275 Bcm in 2037 and a slightly lower 220 Bcm in 2040 that can be catered to both, domestic markets for an increased focus on gas-to-power output that can be in turn used to eliminate energy poverty and also international markets in the form of LNG cargos and pipeline exports that can generate revenues for the hydrocarbon dependant African economies.

Africa natural gas supply vs demand vs exports

Africa expected to have large domestic supply and export potential if future start-ups perform to capacity



Source: Rystad Energy UCube; Rystad Energy GasMarketCube

3 PROJECT DELAYS IN AFRICA AND IMPACT

Africa's upcoming upstream projects have already seen large delays from the time the hydrocarbon discoveries were made to the estimated future FID

Many crude oil discoveries that can stabilize the production and offset the terminal decline in output for a few years; and also, giant natural gas finds that can help Africa meet domestic demand, universal electricity access and LNG export aspirations have seen long delays due to various above-the-surface issues

Over a half of the hydrocarbon output from Africa over the period 2025 – 2040 and about 60% of the remaining recoverable oil and gas reserves in Africa is estimated to come from these upcoming/delayed start-ups

Governments are now realizing the impact of these delays and putting in the efforts to bring these projects online and also bring in more exploration investments, but more is required

At the current conservatively estimated development timeline and scale, a mammoth US$795 billion of greenfield expenditure is required over the period 2023 – 2040 to bring these undeveloped discoveries online

3.1 Future start-ups coming online after very long discovery to start-up periods

A condensed study on some the key producing projects and upcoming start-ups across Africa, suggests that while current producing fields saw a relatively lower discovery to start-up period suggesting a lower delay in terms bring the field on stream, the discovery to start-up period for the upcoming start-ups is sometimes double or even longer compared to the older producing fields. Many old gas discoveries in East Africa, which are expected to drive the natural gas and LNG growth from Africa, have already seen long delays from the time they were "found" to awaiting a final investment decision (FID) and kick off development.

Natural gas project delays across East Africa

Mozambique – Mozambique saw a wave of large gas discoveries in the early to mid-2010s and the total gas discovered was an estimated (conservative) 17 Bboe. Of these volumes, only about 700 Million barrels of oil equivalent (MMboe) Coral Sul field on Area 4 is currently pumping LNG volumes into international market via the 3.4 MMtpa Coral Sul floating liquefied natural gas (FLNG) vessel which saw the FID in mid-2017 and shipped off the first cargo in November 2022. Further development on Area 4 includes half a billion barrels of oil equivalent Coral North FLNG development expected to kick off in 2024 and come online in 2027; Area 4 LNG (Trains 1 & 2) with a capacity of 15.2 MMtpa with expected FID in late 2020s and start-up in early 2030s and finally the 12 MMtpa Area 4 LNG (Trains 3 & 4) expected to be FID'ed in mid-2030s and pump LNG exports by late-2030s.

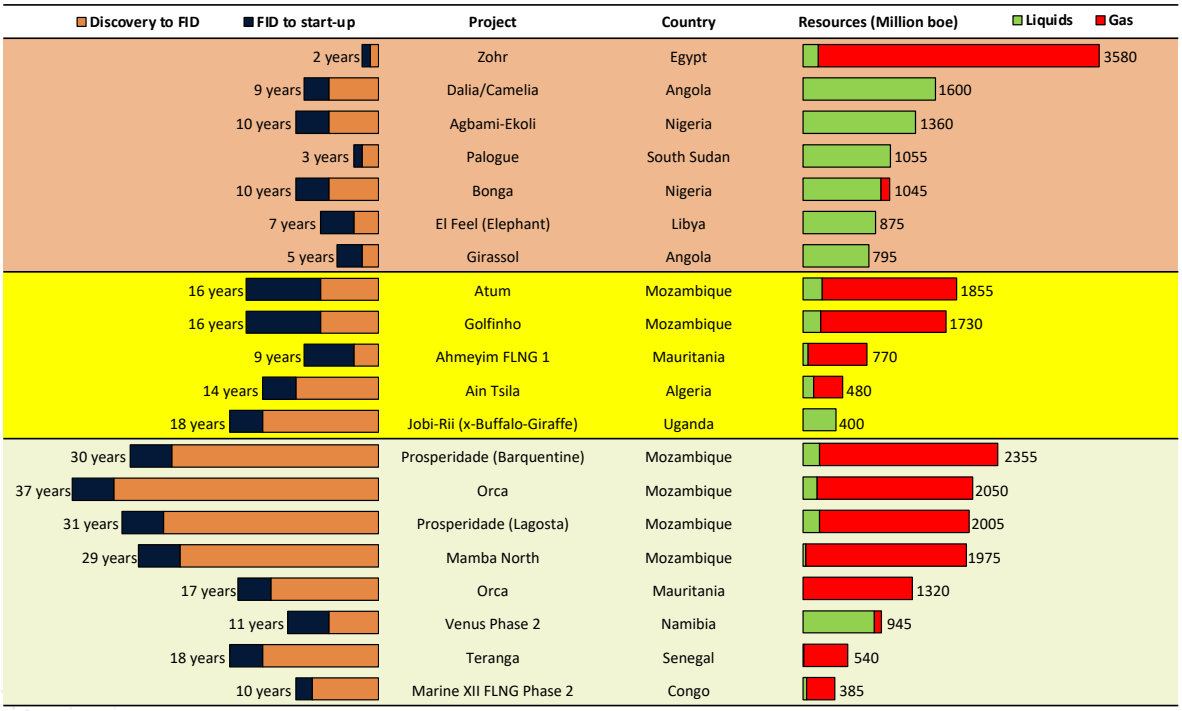
Area 1 also saw some progress in line with Area 4's Coral Sul development but hit brakes due to Islamic insurgency in the onshore development area. The Area 1 LNG (Trains 1 & 2) with a capacity of 12.88 MMtpa using feedgas from Atum and Golfinho fields with a cumulative gas volume of almost 3.2 Bboe saw the FID happen in 2019, but the start-up is now delayed to late-2020s due to the operator TotalEnergies imposing a force majeure on the $20 billion project as the security situation in the northeast region of Cabo Delgado worsened. Further development on Area 1 involves development of trains 3 & 4 with an expected FID in early to mid-2030s and start-up by late 2030s. Area 1 reportedly holds approximately 75 trillion cubic feet (Tcf) of recoverable gas. Development of further potential in the area can spill over to a much later timeline.

Mozambique also has the Eni – ExxonMobil – TotalEnergies partnered Joint development LNG project, expected to use feedgas from the 2010 – 2012 discoveries of Mamba North, Prosperidade (Lagosta & Windjammer) with an estimated gas potential of almost 4.5 Bboe. This is another delayed giant natural gas development expected to come online earliest by the end of the next decade.

Tanzania – Tanzania also saw a wave of natural gas discoveries in the early to mid-2010s, like its neighbour Mozambique. The overall discovered recoverable natural gas

Upstream project delays in Africa

Many post-FID and pre-FID projects seeing a large discovery to estimated start-up duration



Source: Rystad Energy UCube

volumes is a conservatively estimated 4.3 Bboe. These volumes were discovered in Block 1 and Block 4 both operated by Shell Plc and Block 2 operated by Equinor. These volumes have still not seen or even gotten close to a possible FID soon. However, both the operators and Tanzania's government recently concluded discussions and the contractual terms of a critical host government agreement (HGA) that will underpin the project are now being drawn up. Tanzania's Minister of Energy January Makamba said this was a major breakthrough on plans to build a US$30 billion LNG project aiming to pipe gas from these blocks to a 10 MMtpa LNG plant at Lindi. Last year, Tanzania's President Sumia Hassan suggested that if an HGA could be signed by the end of 2022, then the Tanzania LNG would see a possible FID by 2025. This would mean first cargoes from the project latest by early-2030s. It remains to be seen whether this agreement would result in actionable contracts and accelerated development of these stranded gas reserves

Ethiopia – The natural gas volumes discovered in Ethiopia in the 1970s – 1980s, amounting to over 1.5 Bboe at a conservative level, are yet to see an FID happen and these gas finds are expected to come online only in the next decade, that too in phases spread over early to late 2030s.

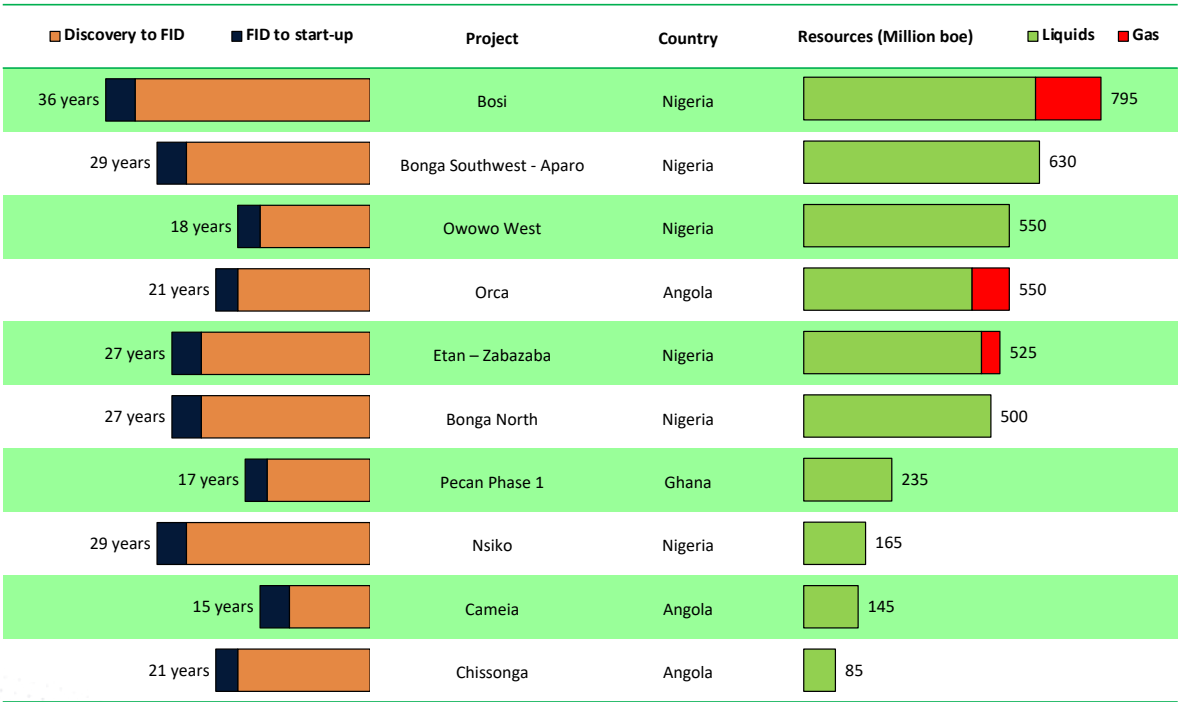
Crude oil project delays in West Africa

While the above narrative may suggest it is just the gas finds that are long delayed with a possible reasoning that historically operators having preferred development of oil finds over gas discoveries due to their impact on economics and/or regional disturbances and so on, the story is no different for many large oil finds in the western side of the continent. Lack of fiscal reforms, like in the case of Nigeria and Angola; delayed fiscal reforms like the more-than-a-decade-in-the-making Petroleum Industry Act (PIA) of Nigeria; market fluctuations due to demand – supply imbalances, crude price crashes due to these market fluctuations or the more recent pandemic and war situations or the currently ongoing energy transition and upstream cost cutting strategies have resulted in pushing out many large crude oil finds' development timelines. Shell Plc brought the Bonga Southwest – Aparo (BSWA) project contracts on to the table many times, before going back to the drawing board. The Etan – Zabazaba project offshore Nigeria spent years in delay due to an ongoing legal process which has now been resolved. Many such deepwater mega finds, with the capacity to reverse the declining production trend in their respective countries, are currently in long delayed FID state.

Namibia saw the giant offshore Venus, Graff and Jonker discoveries in the past fifteen months. Post these finds, the country has been seeing increased interest in exploration in its waters. Operator Shell, which made the Graff, La Rona and Jonker finds, announced that it plans to drill as many as 10 new exploration and appraisal wells on its prolific petroleum exploration licence (PEL) 39. Many other companies have expressed and/or already entered blocks in the region with plans to soon drill more exploration wells in hopes to mimic Shell and TotalEnergies' success. While this is great news for Namibia, the admin-

Upstream project delays in Africa

Many key West African crude oil projects also seeing large delays



Source: Rystad Energy UCube

istration will also be hoping that these discoveries add value to the economy in an accelerated timeline without any project delays. Africa, especially deepwater, has had a history of being brought on to the chopping block ahead of any other regions globally, by operators when the oil market turbulences happened. The recent case of Angola going through a period of no offshore drilling, something that years of internal struggle could not do, during the market crash led by the pandemic is an example. It is to be noted that Angola had, shortly before this, announced fiscal incentives to operators working on blocks in deep waters. This suggests something more is required alongside tax incentives for deepwater development to be more encouraged by the respective governments. A fiscal stability clause can be one way of doing this. A fiscal stability clause is a clause to provide the operators with reasonable assurance that changes in law or regulations will not adversely affect their expected economic return. Such stability oriented fiscal policies can support crisis mitigation when needed and act as a catalyst for increased interest in oil and gas exploration and development offshore Namibia in the Walvis and Namibe basins, alongside the already proven and prolific Orange basin. The fact that no such stability clauses for economic rebalancing and/or equalization are currently defined in Namibia's current tax royalty agreements can lead to delays in development of the giant discoveries that were made in the country.

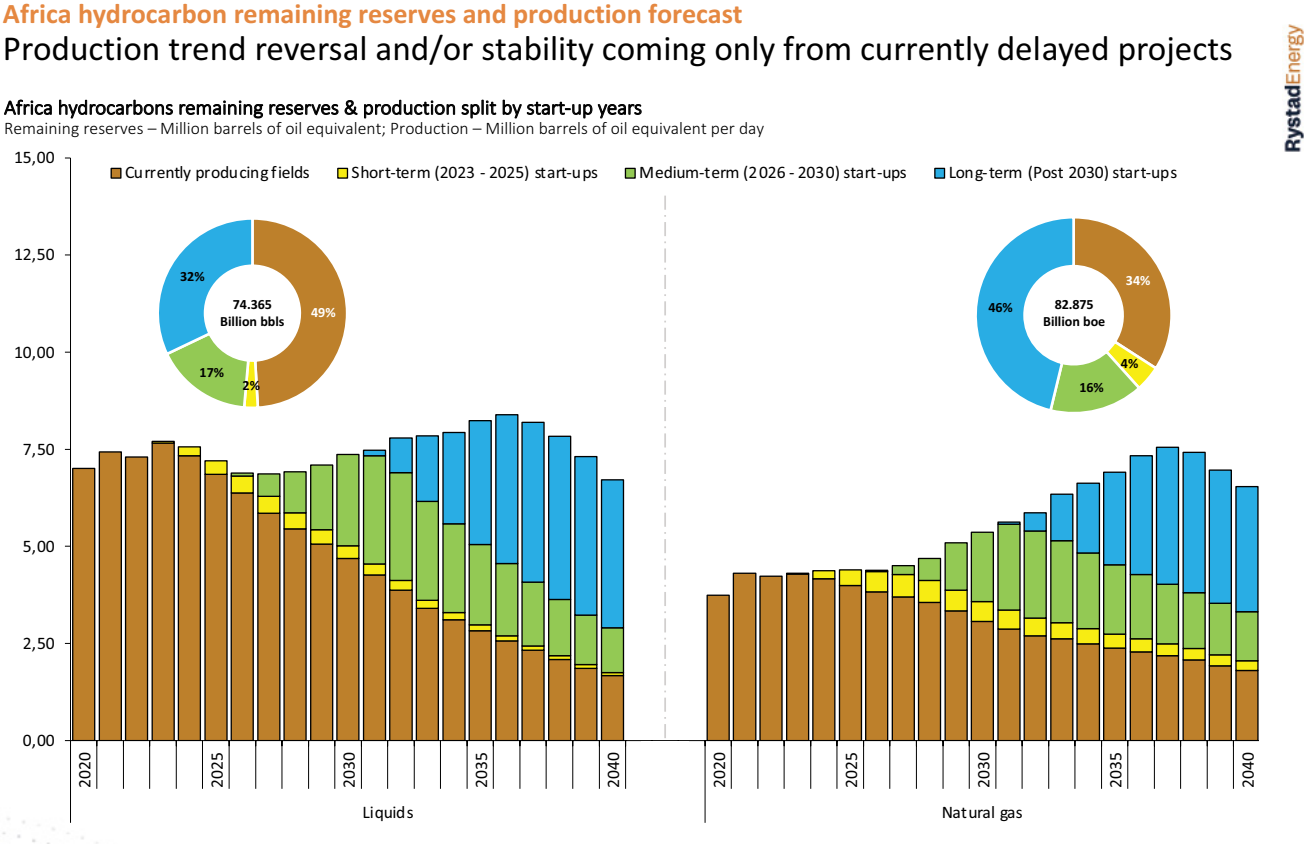
While project delays have impact on their individual country economies, certain regional schemes can also be adversely impacted. For example, in March 2022, Equatorial Guinea and Nigeria signed a memorandum of understanding (MoU) that could see gas from Nigeria fed to the Punta Europa LNG complex in Equatorial Guinea, that is currently fed by gas from the Alba and Alen-Aseng fields operated by Marathon Oil and Chevron, respectively. This deal, if ratified, could help monetise currently untapped offshore associated gas from Nigeria, while replacing declining output from Equatorial Guinean fields. This MoU was the latest of many deals signed by the Equatorial Guinean government over recent years to try to develop Bioko Island as a mega-gas hub in the region. It is to be noted such cross-border gas import arrangements were signed previously but never got implemented. In such environment, it becomes imperative that Equatorial Guinea is able to smoothly bring its own undeveloped gas reserves to start-up without any delays. The delays associated with the Fortuna FLNG on Block 27, formerly Block R, should be looked to cut down. The block is yet to see an operator finalised although it was reported in 2022 that Golar LNG and New Fortress Energy had teamed up to provide a deep-water floating liquefied natural gas (FLNG) unit for use on the Fortuna gas discovery in Block 27. As of early 2023, discussions were said to be ongoing between the administration and potential operators, and it was reported that a production sharing contract (PSC) was ready to be signed. The country should look to quickly finalising the required agreements and limit any delays to the project to progress towards becoming an important player in energy markets in a world transitioning to a lower carbon footprint.

3.2 Currently delayed future start-ups – key to Africa's production increase

These currently delayed projects and/or future start-ups have a large impact on the production forecast for Africa. The currently producing fields – both liquids and gas – are in terminal decline due to depleting reservoirs. Any infill drilling or redevelopment program on these fields, which will involve water depth corresponding brownfield spending, might result in a short-term stabilization of the decline in production but does not seem like it can offset the steep decline. Liquids output from these fields is estimated at about 7.66 MMbbls/d in 2023, 6.85 MMbbls/d in 2025 and 4.7 MMbbls/d in 2030. The average annual production decline rate is an 8% through 2025 – 2030 and a higher 10% through the years 2031 – 2040. 2040 production from these declining fields is a much lower 1.67 MMbbls/d. Any further delays or worse shelving of these future start-ups can be catastrophic to Africa's hydrocarbon output. While the short-term (2023 – 2025) start-ups are expected to have a little impact on the forecast, the medium-term (2026 – 2030) and long-term (2030+) start-ups are expected to drive a revival in Africa's liquids output in the period through 2040. The medium-term start-ups are expected to drive an output of about 1 MMbbls/d in 2028, increasing further to as high as 2.8 MMbbls/d by 2031 – 2032 before gradually declining to 1.15 MMbbls/d by 2040. The long-term start-ups which kick off post 2030 are expected to ramp up quickly to about 1 MMbbls/d by 2032, gradually increase to over 4.2 MMbbls/d by 2038 and decline down to 3.8 MMbbls/d by 2040. The overall impact of these delayed start-ups is still short lived as the total liquids output from Africa is expected to ramp up to about 8.4 MMbbls/d in 2036 from 2023 estimated production of 7.7 MMbbls/d and 2030 flows of 7.37 MMbbls/d, but soon starts declining to an estimated 6.7 MMbbls/d by 2040. The overall remaining recoverable liquids reserves in Africa, as of January 1st, 2023, are estimated at about 74.5 Bbbls and a half of this is from the currently producing

Africa hydrocarbon remaining reserves and production forecast

Production trend reversal and/or stability coming only from currently delayed projects



Source: Rystad Energy UCube

fields. A third of this volume is from the fields delayed to post-2030 as per the current estimated timeline and almost a fifth is from the medium-term start-ups. As such, Africa not only needs these existing discoveries to not see any further delays, but also additional exploration and development to stabilise at production levels higher than 2023 in the future.

The situation of natural gas production forecast is no different from the liquids forecast. The decline in producing fields although terminal, however, is not as steep as the liquids producing fields. 2023 output of 4.29 Million barrels of equivalent per day (MMboe/d) actually is marginally higher than the 2022 output of 4.23 MMboe/d. From 2023 through to 2040, the average annual decline in production from the producing fields is 5% year-on-year (YoY). The short-term start-ups are estimated to account for 10% of the total output by 2025. The share from the currently producing fields is expected to drop to 50% by 2031 and further to about a quarter of the total output by 2040. Also, the long-term start-ups are estimated to add up to a third of the total output by 2035 and half of the total output by 2037 – 2038, and this share is only expected to increase going forward. Of the remaining reserves of close to 83 Bboe, only a third is from the currently producing fields and almost a half comes from the long-term start-ups. While the newer start-ups are expected to offset the decline from the producing fields and take the overall output on a ramp up till about 2037, the total output declines going forward. Any increase in domestic demand, universal electricity access via gas-to-power or LNG export aspirations post this period of ramp up will require newer gas volumes required to be injected into the flows via additional exploration.

Governments do realize the project delays and the issues caused – both economic for the countries dependant on hydrocarbon exports and domestic for countries looking for alternate sources other than coal and firewood for power generation and residential purposes (like cooking). Past few years have seen fruition of these efforts with Nigeria finally passing the long-delayed Petroleum Industry Act (PIA) and this has resulted in critical new production sharing contracts (PSCs) signed with supermajors. In August 2022, Nigeria executed new terms and conditions for six prolific offshore licences – Oil Mining Lease (OML) 125 operated by Eni, OMLs 128 and 132 operated by Chevron, OMLs 130 and 138 operated by TotalEnergies and OML 133 operated by ExxonMobil. It is no secret that these operators have shown disinterest thus far in further investments in these blocks due to legal and fiscal uncertainties and older PSCs due to expire. The renegotiated PSCs were in line with the provisions of the PIA. These renewed PSCs enable improved long-term relationships with contractors and help eliminate any contractual ambiguities — especially in relation to gas. National Petroleum Investment Management Services (NAPIMS), which monitors PSC investments, said that the renewed PSCs will unlock more than 10 Bbbls of oil and generate an estimated revenue of over US$500 billion to the government and its PSC partners. Nigeria, earlier this year, launched a licensing round covering seven frontier deep-water and ultra-deepwater blocks – Petroleum Prospecting Licences (PPLs) 300, 301, 302, 303, 304, 305 and 306 as part of ongoing efforts to boost largely stalled exploration activities.

Angola also passed the Marginal Field incentives allowing tax incentives on deep water field development that can encourage the operators to accelerate the development of these discoveries. And more recently, Agência Nacional de Petróleo, Gás e Biocombustíveis (ANPG) or Angola's National Oil, Gas and Biofuel's Agency signed a memorandum of understanding (MoU) covering revised fiscal and contractual terms for the Risk sharing agreements (RSAs) covering deep-water blocks 30, 44 and 45 with the block partners ExxonMobil and Angolan state-owned partner Sonangol P&P. This has led to ExxonMobil recently announcing that it is set to spend US$200 million to drill an exploration well by the end of 2024 in the untouched frontier Namibe basin. Other regions also are stepping up in terms of attracting investments from international oil companies (IOCs).

On the other hand, there are also situations that need to be better addressed by the respective administrations. Nigeria's previous marginal field licensing round, despite talk about being a streamlined and open process, instead became a lengthy test of patience, with its transparency also questioned. For the mini-round launched in January 2023 also, the schedule beyond submission of pre-qualification documents to be submitted by the end of January, is unclear, with bid round documentation not outlining when awards are due to take place. Another case example is the long running gas price discussions between the South African administration and TotalEnergies, for the usage of Block 11B/12B gas for domestic purposes, leading to the French major now considering LNG scheme for export markets. These kind of issues can prove to be a hindrance and prove that more is required from the administrations in terms of both attracting investments in the upstream industry as well as reaping benefits from the hydrocarbon developments.

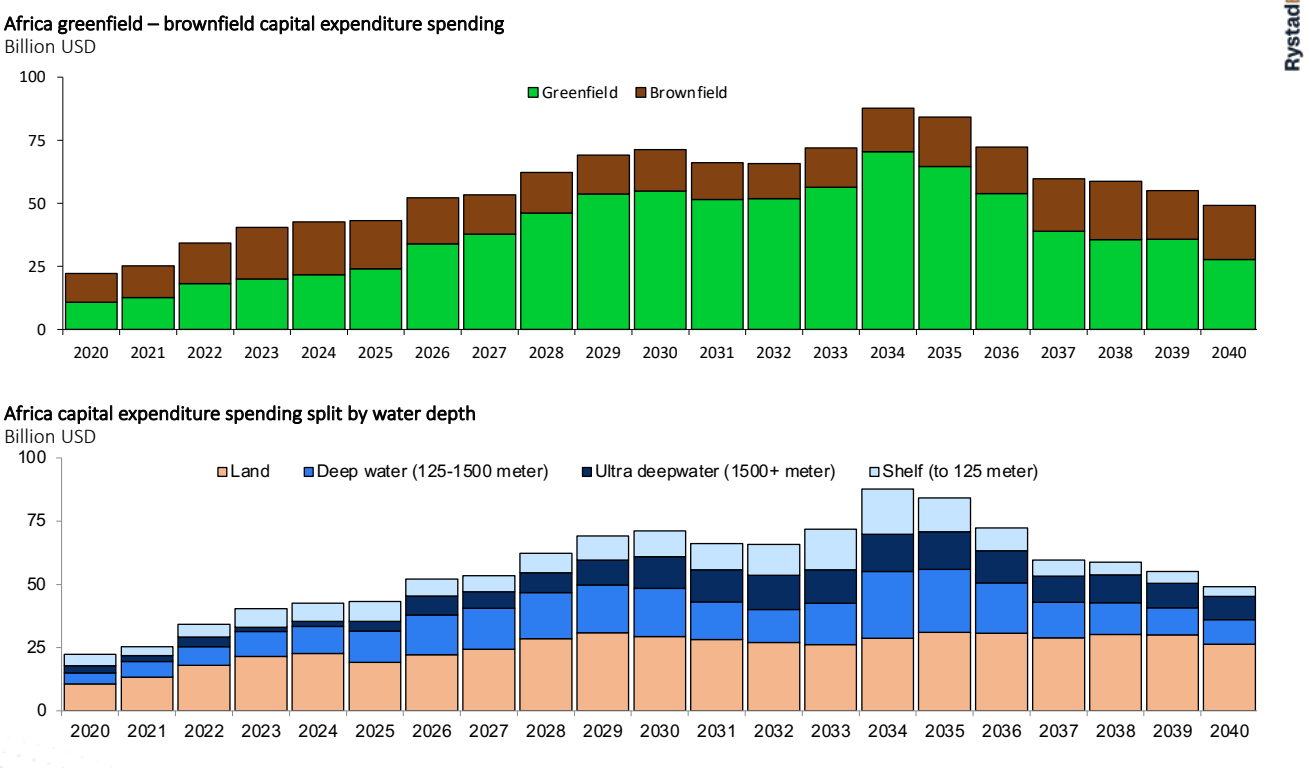
3.3 Plenty of potential but equally large investments needed to develop the volumes

The development of the large undeveloped recoverable reserve potential requires an equally high greenfield investments. The spending levels are also seeing an increase YoY, with 2022 greenfield expenditure at US$18 billion and 2023 estimated greenfield spending at US$20 billion – a 10% YoY increase. 2025 greenfield spending is estimated at about US$24 billion, a 20% increase over 2023 spending. At the current conservative recoverable reserves, development timeline and per-barrel spending estimates, the estimated (required) overall greenfield spending over the years 2023 – 2030 is US$290 billion and it further increases to close to US$485 billion over the next decade. Close to 50% of the 2023 greenfield spending is expected to be spent on offshore projects and 30% of the total spending is expected to be spent on deep water projects. As most of the large undeveloped oil and gas finds currently are in deep waters off Africa, majority of the greenfield spending going forward is also expected to be on deep water projects. 2025 offshore greenfield spending and deep-water greenfield spending is expected to increase to 65% and 45% respectively of the total spending of US$24 billion. This is expected to increase to 67% and over 50% of the total spending of about US$55 billion in 2030; and further to over 70% and about 55% respectively from the total spending of about US$64.5 billion in 2035. Of the total estimated greenfield spending of about US$775 over the period 2023 – 2040, US$500 billion or about 65% is expected to be spent on offshore projects and US$375 billion or close to 48% is estimated to be spent on deep water projects.

These deep-water investments include some high-profile projects like the Greater Tortue Ahmeyim (GTA) – Yakaar – Teranga – Bir Allah – Orca offshore Senegal – Mauritania; Pecan offshore Ghana; Bosi, Bonga North, BSWA, Etan – Zabazaba offshore Nigeria; Cameia – Golfinho and Chissonga offshore Angola; offshore feedgas fields for Area 1 and Area 4 LNG schemes in Mozambique; Blocks 1,2 and 4 offshore gas fields off Tanzania; Brulpadda – Luiperd gas fields offshore South Africa and the most recent Venus – Graff oil discoveries offshore Namibia to name a few. The magnitude of reserves and the cost intensive nature of offshore deep-water projects are the key drivers behind this large spending forecast. Considering the impact of these projects on Africa's production forecast, the importance of securing the funding for the development should be on the forefront for the governments as well as the operators.

Africa capital expenditure spending

Close to US$775 billion greenfield spending required over 2023 – 2040



Source: Rystad Energy UCube

4 AFRICA RENEWABLES OUTLOOK

2023 global renewables capacity (solar + wind + hydrogen electrolyzer) is 1,500 GW

Asia, Europe and North America are expected to drive over 90% of this capacity, with Africa contributing a negligible 1% of the annual capacity

As hydrogen capacity in Africa picks up, 2035 Africa output is expected to increase to 7% of the global capacity

Africa's current announced renewables capacity stands at 134 GW of wind capacity, 120 GW of solar capacity and 112 GW of hydrogen capacity

Egypt, Morocco, Mauritania and South Africa are the major countries with current announced capacity

Over 75% of the current announced capacity is in concept stage

Africa's renewables capacity output is expected to increase from about 27.4 GW in 2023 to over 280 GW in 2035

CWP Global (in partnership with Bechtel in a few projects) is the main operator with close to 25% of the current announced capacity in Africa

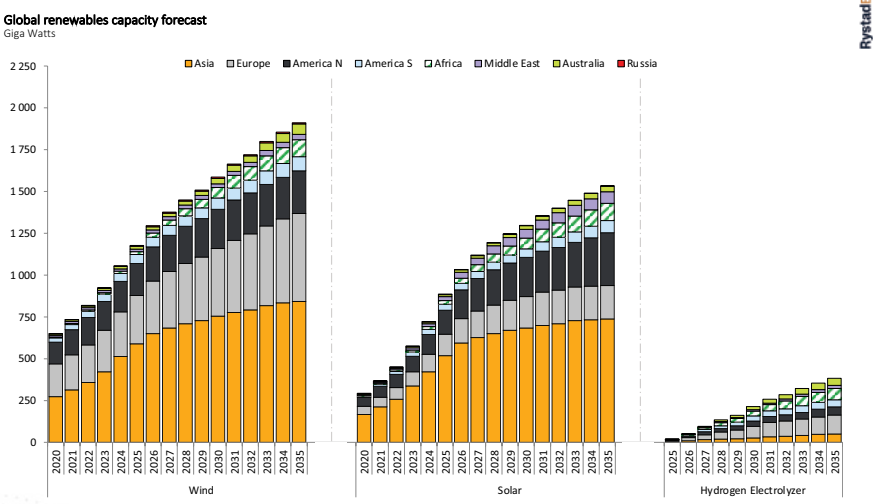
4.1 Global renewables capacity driven by Asia, Europe and the States

2023 global renewables capacity (solar + wind + hydrogen electrolyzer) is estimated to reach about 1,500 gigawatt (GW) largely driven by the growth in Asia, Europe and the United States where the 2023 renewables capacity is about 760 GW, 330 GW and 265 GW, respectively. This cumulative capacity adds up to over 90% of the global 2023 capacity. These three regions are expected to drive majority of the capacity going further till 2035. While the global capacity is estimated to grow to about 2,075 GW, 3,085 GW and 3,815 GW by 2025, 2030 and 2035 respectively, these three regions are expected to cumulatively contribute 90%, 85% and over 80% of the total capacity during the same years 2025, 2030 and 2035, respectively. Africa's capacity also is expected to see a gradual through the period 2020 to 2035 but is marginal compared to major drivers and global cumulative capacity volumes. Africa 2023 capacity is expected to reach 21.5 GW and increase to close to 30 GW by 2025. This capacity is expected to grow further to about 75 GW by 2030 and over 135 GW by 2035. This corresponds to 1%, 2%, 5% and 7% of the global capacities for the years 2023, 2025, 2030 and 2035, respectively.

2023 global wind and solar capacity is estimated to reach about 925 GW and 575 GW, respectively. Global wind capacity is expected to increase to 1,580 GW by 2030 and further to over 1,900 GW by 2035. And solar capacity is expected to increase to 1,295 GW by 2030 and further to over 1,530 GW by 2035. Compared to this, Africa's 2023 solar PV and onshore wind capacity is about 12 GW and 9.3 GW respectively, and 2025 capacities are expected to show increases to 21.5GW and 17.5GW of solar PV and onshore wind capacity, respectively. These low-capacity volumes reflect Africa's exposure to renewables compared to the giant contributors like Asia, Europe and North America which are expected to see a relatively massive capacity and growth.

Global vs Africa operating renewables capacity forecast

Africa renewables capacity marginal compared to giants Asia, Europe and the US



4.2 Majority announced renewables capacity in concept stage and in North Africa

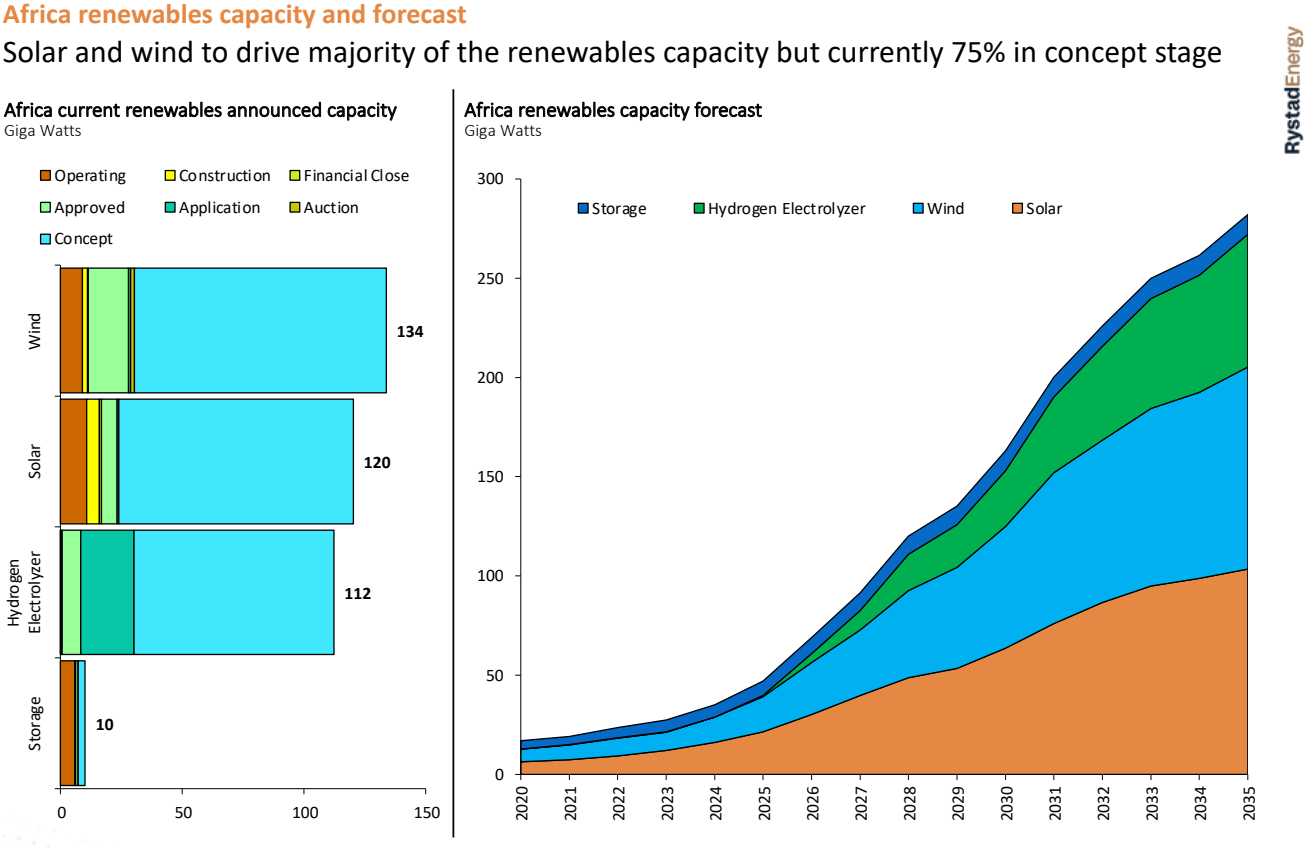
Total announced capacity of renewables in Africa is currently just over 375 GW. More than three-fourths of this is currently in concept stage and a little over 5% is operating. This suggests a large potential with further upside as more operators and investors enter the continent with a clean energy and energy transition objective, but very little currently contributing to Africa's energy needs. This also suggests large infrastructure needs which demand equally high investments. The geographical split suggests more than half of the announced capacity is in North Africa and apart from Mauritania in the west and South Africa in the south, the exposure of the rest of sub-Saharan Africa to announced renewables capacity is relatively much lower. Apart from Mauritania and South Africa, announced wind capacity in Nigeria, all round capacity in Djibouti and promising hydrogen capacity growth in Namibia round off the main sub-Saharan African renewables investments.

The continent is expected to see a steep growth in renewables capacity from 2025. Solar and wind is expected to drive the capacity as well as the YoY growth going forward. Close to 80% of the 2023 capacity is driven by solar and wind; and this increases to about 85% by 2025. 2026 – 2030 average cumulative solar and wind capacity is expected to be close to 80% of the total capacity over the period. As hydrogen capacity picks up over the 2030s, the average cumulative solar and wind capacity is expected to be close to 75% of the total capacity over the period 2031 – 2035.

Africa's current total announced renewables capacity suggests that the wind capacity at close to 134 GW is the largest. Almost a half of this comes from Egypt, and Morocco and Mauritania add up to just over 30% of the total capacity. South Africa and Djibouti round off the top five countries with announced wind capacity

Africa renewables capacity and forecast

Solar and wind to drive majority of the renewables capacity but currently 75% in concept stage



Source: Rystad Energy RenewableCube

with a cumulative capacity of about 15.5 GW. These five countries add up to 90% of the total current wind capacity in Africa. Over 75% of the current wind capacity is still in concept phase and only about 7% is operating, in line with the overall announced renewables capacity.

Solar in Africa takes the second spot after wind with the current announced capacity at 120 GW. Solar announced capacity too, similar to wind capacity in Africa, is led by Egypt – 27.86 GW capacity, Morocco – 22.11 GW capacity and Mauritania – 13.315 GW capacity. These three countries add up to over 50% of the current announced solar capacity in Africa. Nigeria and South Africa with 11.1 GW and 9.97 GW capacity respectively round off the top five countries in Africa with respect to announced solar capacity. Close to 96.3 GW (~80% of the total) is in concept phase now and about 10.75 GW (~9% of the total capacity) is operating.

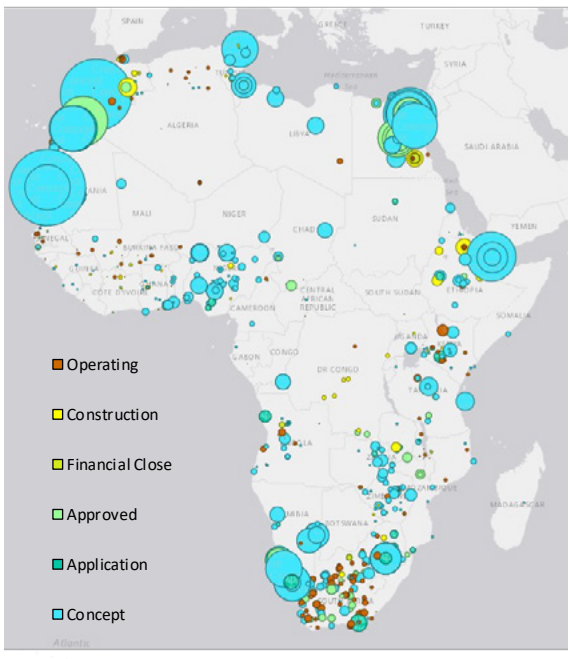
Africa's current total announced electrolyzer pipeline capacity is 112 GW, with about 40% of this tied to countries in North Africa. The continent's potential goes beyond the north, however, with Sub-Saharan Africa hosting numerous prospects for green hydrogen developments. This region has an announced electrolyzer pipeline of about 68 GW, with Mauritania claiming over 50% of this total, followed by South Africa and Namibia. Namibia's green hydrogen sector is poised for growth following recent export agreements with Germany and South Korea, while neighbour and regional powerhouse South Africa sits on about 90% of the world's reserves of platinum group metals, which are critical for the manufacture of polymer electrolyte membrane electrolyzers. With the recent unveiling of the European Union's Green Deal Industrial plan, which aims to promote renewable and hydrogen developments in Africa, the continent is primed for foreign clean energy [EO1] investments in the coming years.

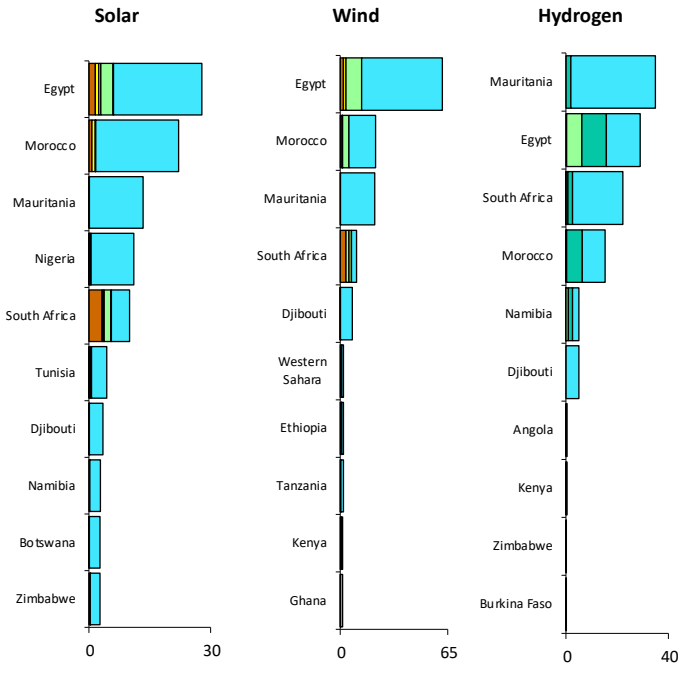
Africa renewables capacity

Egypt, Mauritania and Morocco leading the way in current announced capacity

RystadEnergy

Africa current renewables announced capacity
Giga Watts





Source: Rystad Energy RenewableCube

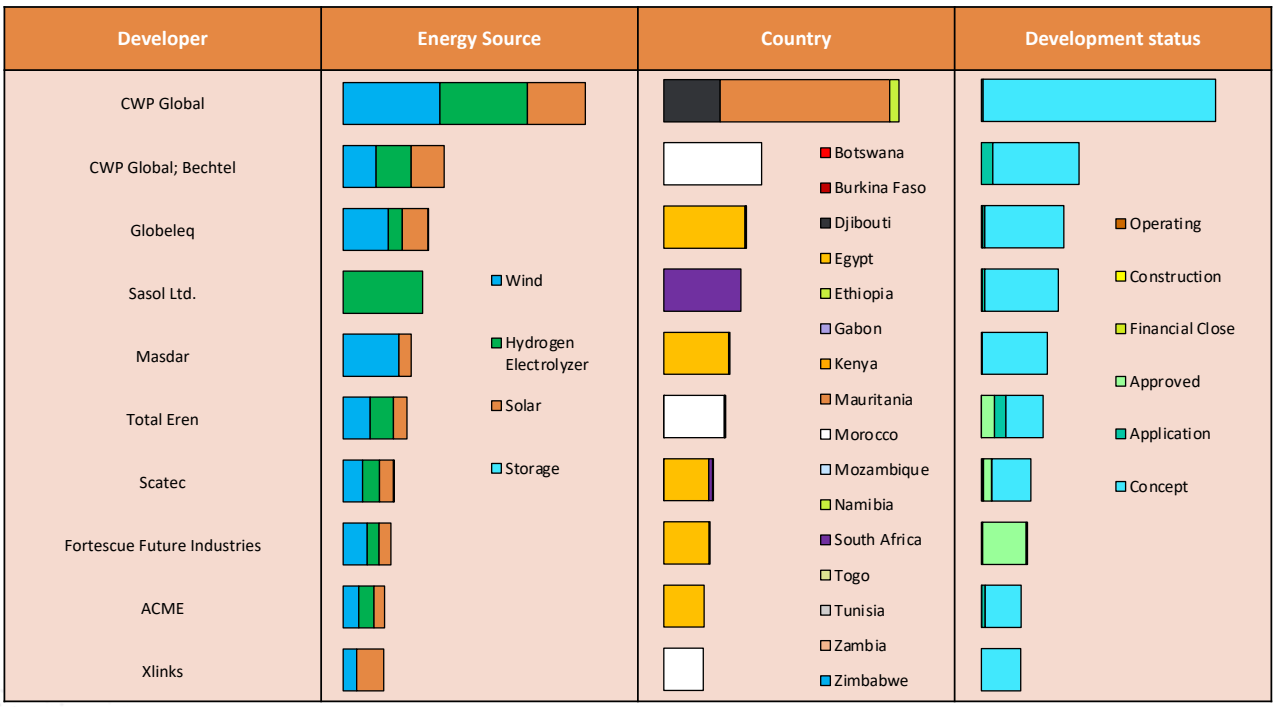
4.3 CWP Global – current leader in Africa's announced capacity

In terms of the developers, the top 10 groups of developers contribute to over 55% of the currently announced renewables capacity in Africa. Leading renewable energy developer CWP Global alone is said to be developing close to a fifth of Africa's announced wind capacity, close to 12% of the announced solar capacity, a fifth of the continent's hydrogen capacity adding up to about 17% of Africa's currently announced renewables capacity. With Bechtel's partnership, CWP Global as a developer, is developing Africa's 25% announced wind capacity, 20% announced solar capacity, 28% announced hydrogen capacity and an overall 24% announced renewables capacity. The US$40 billion Aman green hydrogen project is being developed by CWP Global and is the largest green hydrogen project in Africa. It will have a 15 GW electrolyzer capacity, powered by 30 GW of combined solar and wind. Geographical proximity to the Mauritanian deepwater port of Nouadhibou and the large European market for exports make the green hydrogen project on Mauritania potentially very lucrative. Morocco's Amun project, with an annual hydrogen capacity of 900,000 tonnes per annum (tpa), is also being developed by CWP Global along with North American EPC player Bechtel and is the largest in Morocco. CWP Global also signed an agreement with the government of Djibouti to develop a 10-GW renewable energy and green hydrogen hub, making the company the biggest renewable energy developer in the Africa. Together, CWP Global and Bechtel have announced a capacity of about 88.5 GW of which over 95% is still in concept phase and a mere 4% has received approval for development.

Africa renewables developers

CWP and Bechtel leading the way in current announced capacity

Current top 10 renewables developers in Africa and their respective announced capacity
Giga Watts (GW)



RystadEnergy

Source: Rystad Energy RenewableCube

5 AFRICA COP27 COMMITMENTS AND NATURAL GAS

Africa holds large natural gas and renewables potential, but over 60% of the natural gas potential and over 75% of the current announced renewables capacity is in a similar "pre-FEED" state

Africa's COP27 commitments aim at phase down of coal power, natural gas as transition fuel and establishment of the Africa Carbon Markets Initiative (ACMI)

Universal electricity access and power generation based on renewables is also on the agenda

Africa continent estimated to stand fifth globally in upstream emissions and Africa's emissions expected to be driven majorly due to gas flaring

High greenfield spending required to bring the large upstream potential online but the economic viability of the level of investment close to a 2°C scenario

At the current estimates, Africa needs fossil fuels as base case scenario suggests a third of the power generated in 2030 and over a quarter of this in 2040 is expected to come from gas-to-power

Even in a 1.5°C scenario, estimates suggest close to a fifth of the power generated in 2030 and about 8% of this in 2040 will be from gas-to-power projects

South Africa can benefit from the COP27 commitments around phase down of coal and usage of natural gas potential for power generation

5.1 Natural gas vs renewables potential in Africa

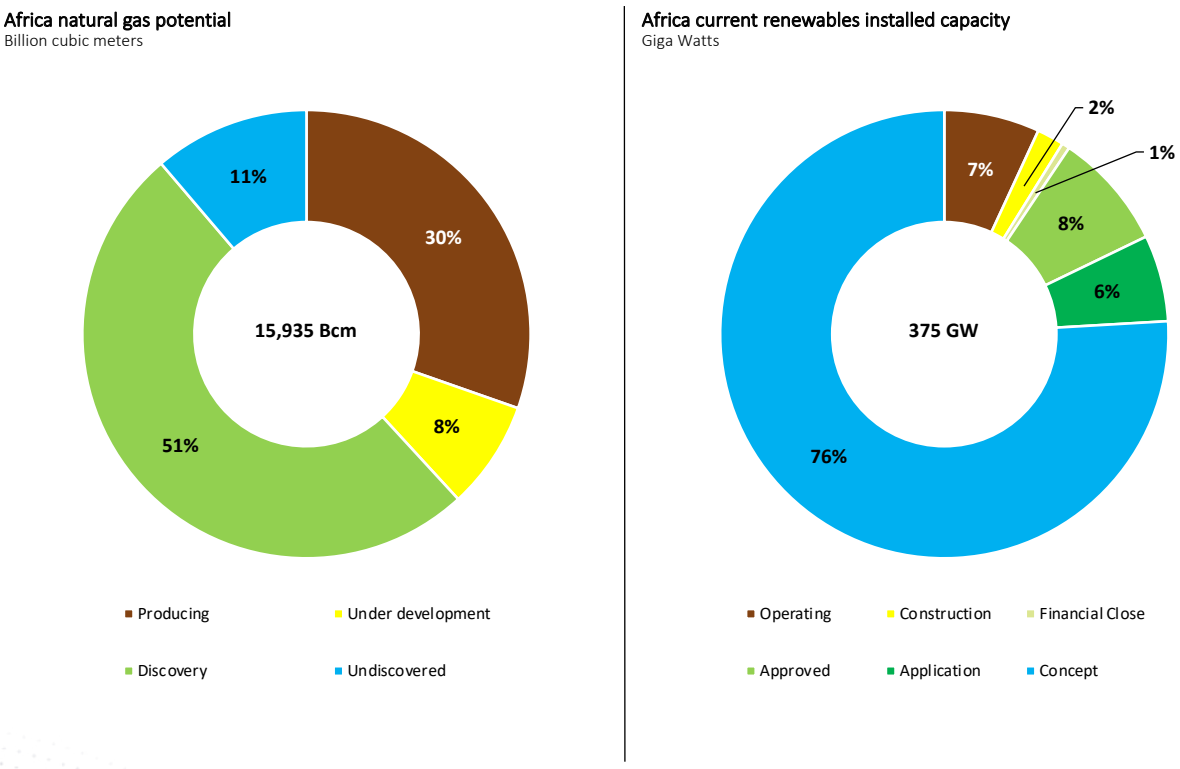
Conservative estimates suggest Africa's current natural gas potential is close to 16,000 Bcm. This includes an 11% "undiscovered" potential, but this can be higher based on the amount of unexplored and under-explored acreage both onshore and offshore Africa. An increase in this number will take the overall reserve potential much higher. The 51% "discovered" reserves are the "stranded" or currently undeveloped reserves in pre-FEED and in some cases pre-appraisal or pre-technical evaluation volumes that are being estimated as future FIDs. This is a large chunk of the overall potential and is in a phase where even a possible scheme of development is yet to be conceptualised and eventually finalised.

The current announced renewables capacity also is in a similar mix in terms of the status of development. Of the total capacity of 375 GW, only 7% is "operating" or is fully connected to the grid and generating electricity. A further 8% announced capacity is approved for development, 2% capacity is currently under construction and a marginal 1% has acquired the necessary financing and will soon hit the market to tender for contracts to build the project. A 6% of the capacity is in the process of obtaining the necessary permits and approvals from the administration. While this cumulative capacity of about 90 GW has at the least crossed the barrier of submitting the paperwork for approvals, a large chunk – 76% of the announced capacity is from the projects where paperwork for the necessary regulatory approvals is yet to be initiated. These projects are currently speculative and the eventual approvals as well as the timelines are highly speculative.

Africa natural gas vs installed renewables capacity

Majority of the gas potential undeveloped and majority of the renewables capacity in concept phase

RystadEnergy



Source: Rystad Energy UCube; Rystad Energy RenewableCube

5.2 Africa COP27 Africa commitments and impact

The 27th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP27) reaffirmed COP26 conclusions of "phase down of unabated coal power" and "phase out of inefficient fossil fuel subsidies", while natural gas received a more prominent role in energy transition and for tackling climate change, as "low-emission" energy won approval. The conference also saw the African policy makers pledge a climate initiative in the name of Africa Carbon Markets Initiative (ACMI) targeting 300 million carbon credits per year- equivalent to 300 million tonnes of CO2 reduction by 2030. The initiative is aimed at providing a potential source of financing to support energy transition in Africa. Another key takeaway for Africa was the launch of the Africa Just and Affordable Energy Transition Initiative (AJAETI).

The COP27 agenda included some of the most important global energy relate climate themes – reducing emissions to bring 1.5˚C within reach, reduce usage of coal, help prepare and deal with climate change, support developing countries with technical and financial aid, establishment of a global carbon market and finally, a new pooled fund arrangement for countries most affected by climate change. While these key themes were discussed at length and the new funding arrangement on loss and damage was hailed as a "historic moment". The representatives of African nations seemed to have a more balanced voice between energy requirements and climate change as opposed to the previous conference where the key narrative was that Africa was on the receiving end of the problem and it was the bigger

emitters that had the responsibility to cut down fossil fuel production. The AJAETI and ACMI initiatives clearly highlight this.

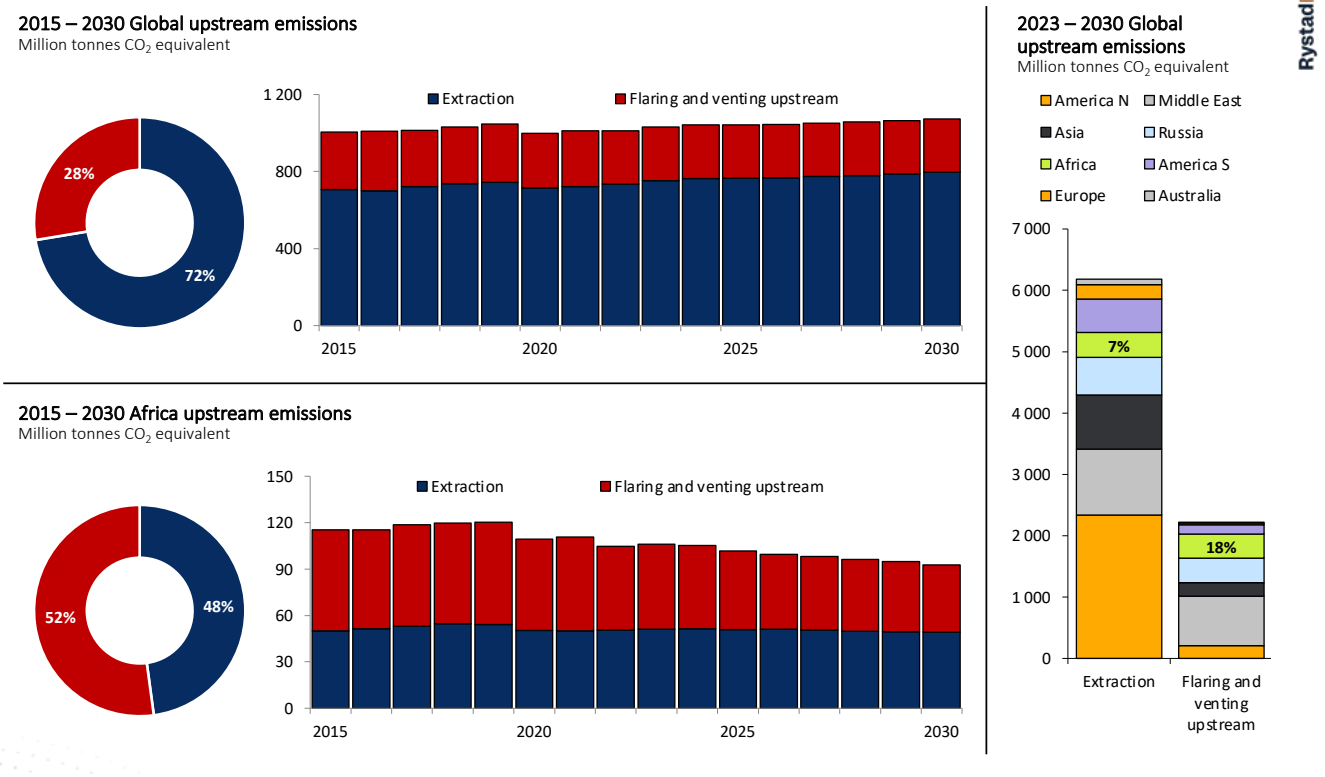
The AJAETI aims at three key targets, all focusing on power – increasing the share of electricity generation using renewable sources by 25% points by 2027, universal access by 2030 and finally, establishing a power sector completely based on renewable sources by 2063. The ACMI targets a voluntary carbon market where carbon credits are released per tonne of CO2 eliminated within a company's operations and these credits can be bought by other operators who need to offset unavoidable emissions. Existing and upcoming oil and gas producers like Nigeria, Gabon and Kenya were among the member nations joining this initiative. With the push for universal access, natural gas as pathway for energy transition and oil producers supporting the ACMI, Africa is clearly looking to address both – the energy issues within and the climate issues globally.

Where does Africa stand globally with respect to upstream emissions?

From 2023 through to the end of the decade, Africa's upstream emissions are estimated to reach a cumulative 795 million tonnes of CO2 equivalent. Globally, Africa is estimated to stand fifth after North America, the Middle East, Asia and Russia in terms of overall emissions over the period. Africa's upstream emissions are an estimated 9.5% of the global upstream emissions over the period 2023 – 2030 and about a half of Africa's upstream emissions during the period are estimated to be result of gas flaring. While the upstream extraction related emissions from Africa are a mere 7% of the global extraction emissions, the flaring and venting emissions from Africa over the period are estimated to be almost a fifth of the global levels. This suggests flaring results in majority upstream emissions in Africa and Africa is also one of the major flaring regions globally.

Global and Africa upstream CO_2 Emissions

Africa's upstream CO_2 emissions largely driven by natural gas flaring



Source: Rystad Energy UCube

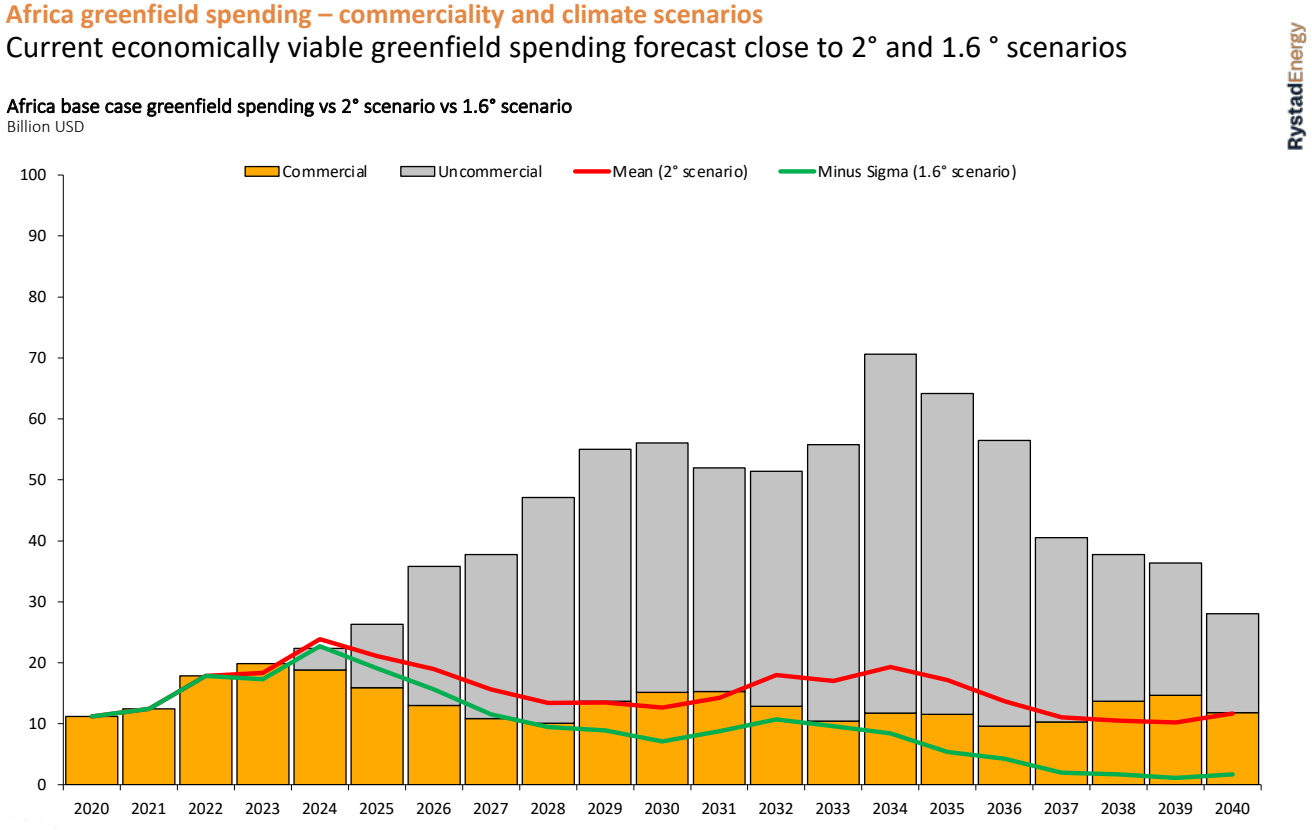
How is Africa's oil and gas landscape now?

As discussed previously, Africa's estimated oil and gas resource potential and production forecast going forward clearly suggests there is significant undeveloped potential and output is completely dependent on these undeveloped volumes as the producing reservoirs are now in terminal decline. At a conservative level, Africa is estimated to hold about 74.365 billion barrels (Bbbls) of recoverable liquids and 82.875 billion barrels of oil equivalent (Bboe) of recoverable natural gas resources. Only half of this liquids potential and a third of the natural gas potential is currently developed and is producing. 45% of the liquids and a much larger 60% of the natural gas potential is currently "stranded" in pre-FEED state. While natural gas production can see an increase if these stranded volumes are developed without any further delays than currently expected, liquids flows need accelerated development and more discovered volumes to see an increase as current volumes and timelines are expected to only stabilize the decline and maintain a flat production trend.

To maintain the above-mentioned production levels at the estimated conservative timeline, the scale of required investments is quite steep. The maintenance of a stabilized oil output and meeting the natural gas domestic and international supply aspirations will need an estimated greenfield spending of close to US$65 billion over the period 2023 – 2025. This is estimated to increase to a cumulative spending of about US$225 billion for the remain-

Africa greenfield spending – commerciality and climate scenarios

Current economically viable greenfield spending forecast close to 2° and 1.6 ° scenarios



Source: Rystad Energy UCube; Rystad E&P Energy Transition Risk Dashboard

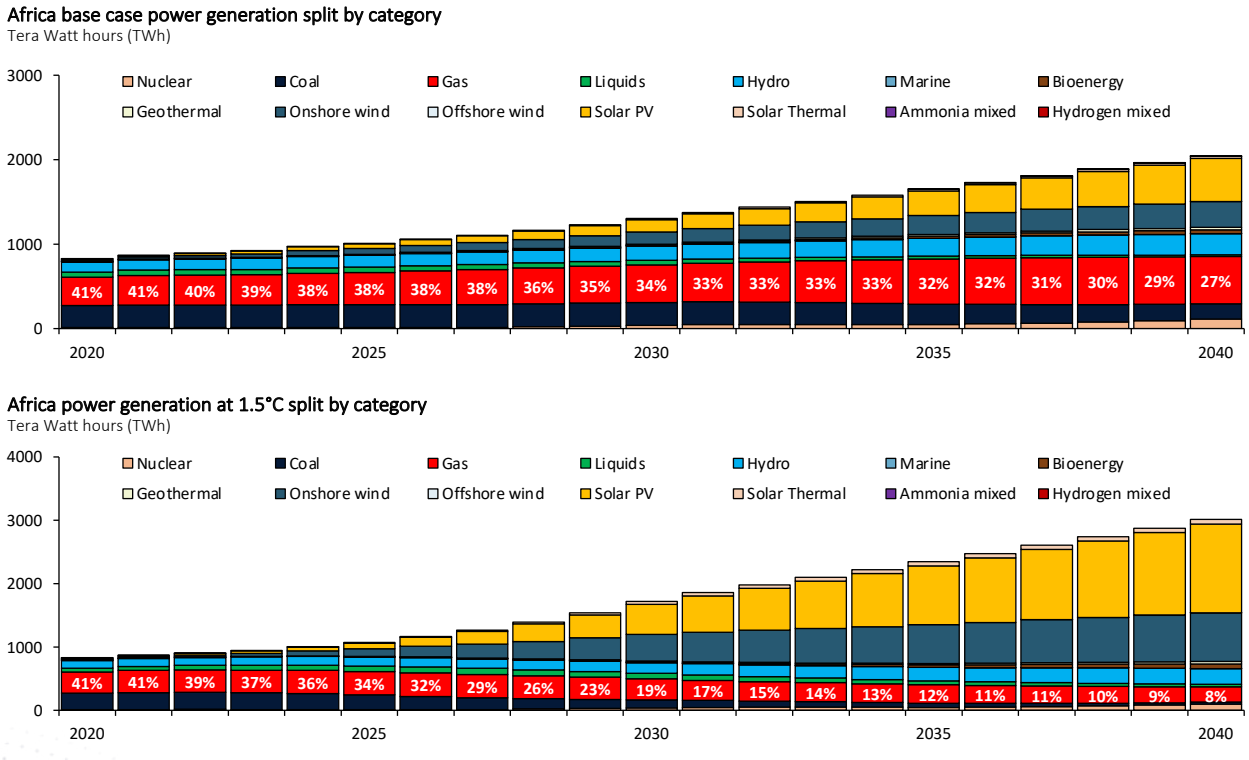
der of this decade, and over US$485 billion over the next decade 2031 – 2040. However, the current estimated economic viability or "commerciality" of this spending paints a different picture, and this "commercial" spending is closer to a 2˚C drop climate scenario. While the 1.6˚C scenario greenfield spending forecast is relatively in line with the 2˚C scenario levels, 2031 – 2040 greenfield spending can be expected to be diminished to about US$55 billion. This can mean a potential deathblow to Africa's oil and gas aspirations, economical future of a number of fossil-fuel exports dependent economies in the continent and, energy security and universal electricity access being aimed to achieve using natural gas as a transition fuel.

How is Africa's power mix expected to pan out?

Africa is currently heavily dependent on fossil fuels for power generation. About 75% of the power generated in Africa over 2022 – 2023 is estimated to be generated using oil, gas and coal. A cumulative 60% of the power generated in 2030 is expected to be from fossil fuels with oil and gas generating about 40%. Even 2040 forecast suggests close to 37% of the power generated will be using oil, gas and coal with coal still playing a 9% role and natural gas accounting for over a quarter of the power generation. As such, fossil fuels are expected to play a long-term role in Africa power generation. Power mix in the 1.5˚C scenario, the power mix also. 25% of the power generated in 2030 and 5% in 2045 is estimated to be from oil and gas. As such, oil and gas is expected to play a long-lasting role in Africa's power mix.

Africa power generation forecast in different scenarios

Natural gas to play a role in Africa's power generation even at 1.5°C scenario



Source: Rystad Energy Power Transition Scenarios Dashboard

5.3 South Africa can benefit by adhering to the COP27 commitments

Africa's COP27 commitments focus on phasing down of usage of coal for power generation, universal uninterrupted electricity access and natural gas as transitional fuel towards switching to renewables completely for power generation. These initiatives aim at cutting down emissions from the usage of fossil fuels especially coal, end energy poverty and utilise the large potential of African gas, for Africa, for firing the gas-to-power plants. As a case example, the current electricity situation in South Africa can be reviewed to understand how these commitments are very close to reality and how natural gas potential can be utilised to both minimise emissions and avoid power outages.

Most power stations in the country are owned and operated by Eskom. These plants account for about 95% of all the electricity produced in South Africa. Coal fired power plants account for bulk of this, with 2022 power mix suggesting coal was the energy source behind 80% of the power generated. Relatively more expensive Open Cycle Gas Turbines (OCGTs) like Ankerlig, Gourikwa, Dedisa and the likes, which use diesel as the primary resource; and renewable energy sources backed power stations also contribute to power generation, but the share is miniscule compared to coal-fired plants. Historically, South Africa could benefit from via access to cheap electricity but this eventually led to the issues plaguing the country now – ageing fleet of coal-fired stations consistently breaking down and/or needing extensive maintenance, additional expenditure on diesel to replenish outages caused by these breakdowns, high CO_2 emissions placing the southern African nation in the world's top 20 emitting countries and most importantly, introduction of load shedding to prevent total blackouts.

Africa power generation forecast in different scenarios

Natural gas to play a role in Africa's power generation even at 1.5°C scenario

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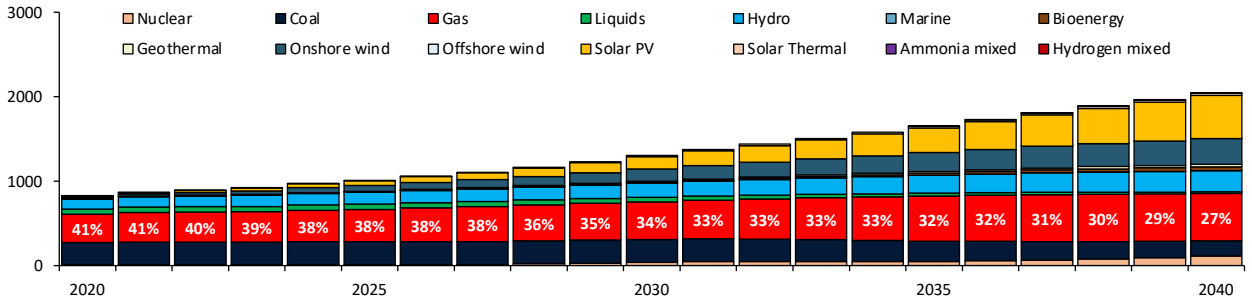
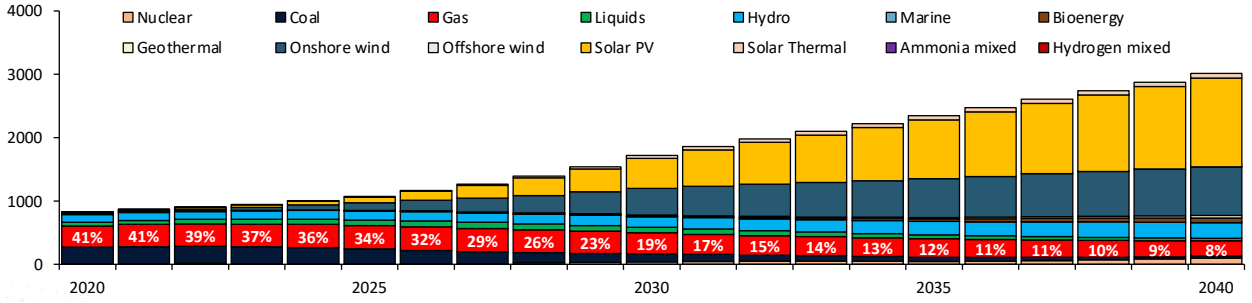
Africa base case power generation split by category

Tera Watt hours (TWh)



Africa power generation at 1.5°C split by category

Tera Watt hours (TWh)



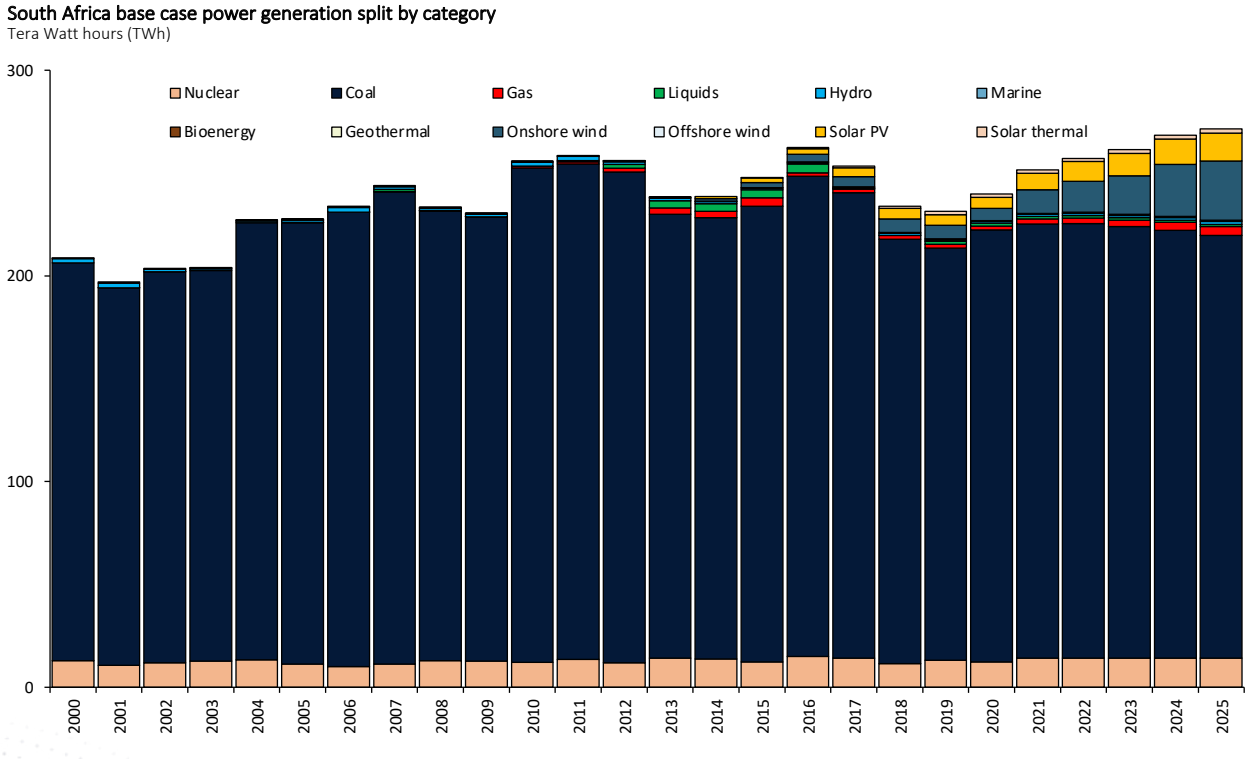
Source: Rystad Energy Power Transition Scenarios Dashboard

While these issues have had a larger impact on the wider economy of the country, the expenditure to maintain the aging power plants, to purchase diesel to keep up the power supply and other factors driving huge losses to the national entity Eskom have led to high electricity tariffs on the regular domestic electricity consumer. The period between 2000 – 2007 saw linear increase in average Eskom electricity tariffs. However, since the first load shedding was implemented in 2007, average Eskom electricity tariff has seen an exponential growth of 460% by 2020. 2020 average tariff was about 110 c/kWh and the same year saw Eskom win a major legal battle where Eskom is allowed to increase average electricity tariff to 128.24 c/kWh under court order, to allow the state player to manage its mountain of debt through increased revenues via increased tariff.

South Africa, in the recent years, has seen two large gas finds in its waters on TotalEnergies operated Block 11B/12B. The operator revealed in early February 2019 that the deep water Bruldpadda-1AX re-entry well, which was drilled on Block 11B/12B in the Outeniqua Basin, 175 kilometres off South Africa's southern coast, detected 57 meters of net gas-condensate pay in Lower Cretaceous reservoirs. Another significant gas-condensate discovery was made with the Luiperd wildcat well in October 2020. The Luiperd-1X well was drilled in approximately 1,800 meters of water to a total depth of about 3,400 meters encountered 73 meters of net gas-condensate pay, 16 meters more than the Brulpadda well. Both Brulpadda and Luiperd rank high on the list of Africa's largest discoveries in their respective year of discovery. Estimates put Brulpadda at 275 million barrels of oil equivalent (MMboe) and Luiperd at 340 MMboe, with 70% gas each in both discoveries.

South Africa historical power generation

Heavily dependent on coal, with 90% of 2020 – 2025 power generated using coal



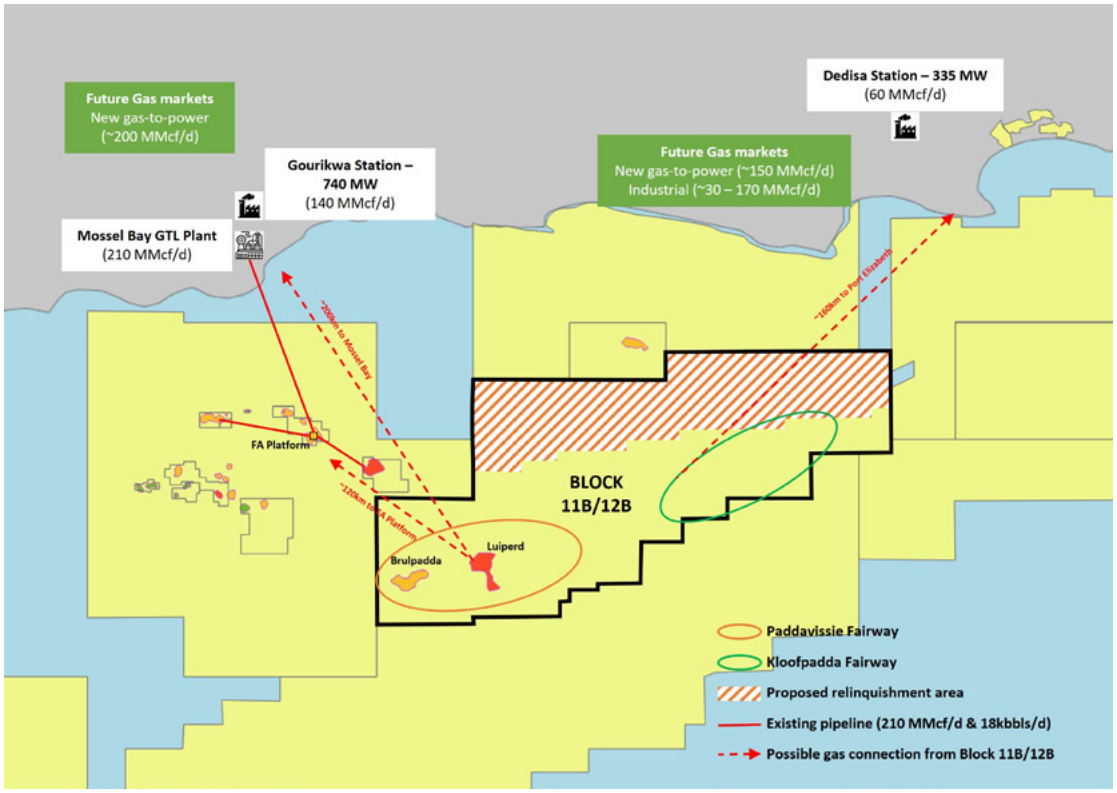
Source: Rystad Energy Power Transition Scenarios Dashboard

The large scale finds of Brulpadda and Luiperd, when developed, have an equally impressive natural gas and condensates production potential. Brulpadda alone has the potential to deliver a peak output of about 25,000 barrels per day (bpd) of condensates and 50,000 barrels of oil equivalent per day (boepd) of natural gas. Luiperd phases 1 and 2 put together have an estimated peak production capacity of about 30,000 bpd of liquids and 80,000 boepd of natural gas. Cumulatively, Brulpadda – Luiperd project peak output is an estimated to be 50,000 bpd of liquids and 125,000 boepd of natural gas. The individual fields are expected to come online through late 2020s or early 2030s. The average output from the project cumulatively is estimated to be around 35,000 bpd of liquids and about 100,000 boepd of natural gas. For a nation that is currently dependant on ageing and emission intensive coal-fired power plants for electricity generation and a continent that has pledged to utilise natural gas as a transition fuel towards 100% utility generation from renewables, Brulpadda and Luiperd can help South Africa negotiate through the power crisis that the country is going through if the gas is directed towards domestic markets and gas-to-power plants.

The gas from Brulpadda and Luiperd can also enable conversion of power plants like Gourikwa station with a capacity of 740 MW and Dedisa station with a capacity of 335 MW to run on baseload gas, and any further potential can cater to future gas-to-power requirements. As such, catering Block 11B/12B potential to the domestic market can result in not only meeting the country's energy needs but will also a significant boost to the economy. Phasing down usage of coal for power generation, and thereby cutting down on emissions; using natural gas as a transition fuel for generation of electricity before being able to switch to renewables completely; guaranteeing universal electricity access and avoiding power outages – this clearly is in line with Africa's COP27 commitments.

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

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



Source: Rystad Energy Corp; Rystad Energy Research and Analysis

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