



Africa Energy Review 2021

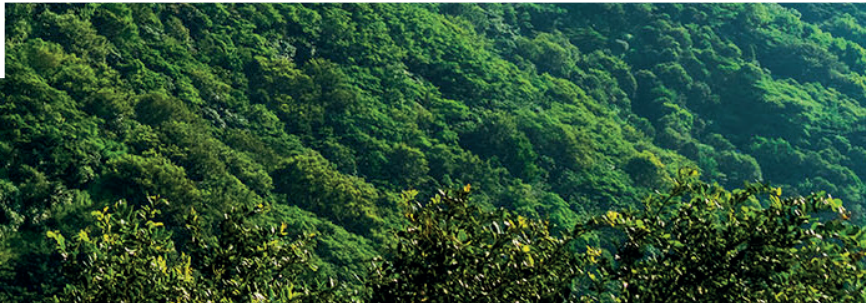
The global race to net zero by 2050 is accelerating. Will Africa realise a just transition or become a stranded asset?

November 2021

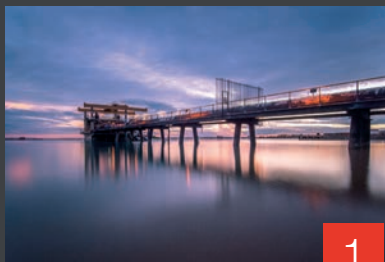
www.pwc.co.za/energyreview



pwc



Contents



1

Acronyms used in this report



2

1. Introduction



4

2. Energy snapshot



12

3. Africa's reality and the challenges of a net-zero transition



14

4. Economic benefits and opportunity costs of the energy transition



21

5. The role of Africa's emissions footprint in a just transition



23

6. The future structure of the energy sector



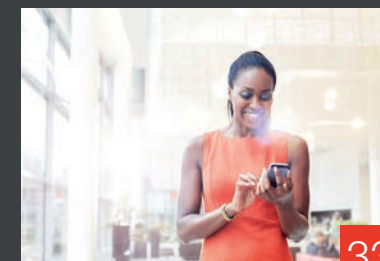
28

7. Driving a measured transition



32

8. Conclusion



33

Contacts



34

Contributors



Acronyms used in this report

bbbl	Barrels
Bbo	Billion barrels of oil
bbbl/d	Barrels per day
bcm	Billion cubic metres
bn	Billion
bt	Billion tons
CIM	Construction, manufacturing and installation
CO2	Carbon dioxide
COP26	2021 United Nations Climate Change Conference
CSP	Concentrating solar power
EJ	Exajoule
EU	European Union
FTE	Full-time equivalent
GDP	Gross domestic product

GHG	Greenhouse gas
GW	Gigawatt
IRENA	International Renewable Energy Agency
kt	Kiloton
kW	Kilowatt
kWh	Kilowatt-hour
LNG	Liquefied natural gas
m	Million
m	Thousand
mm	Million
mdbl	Thousand barrels
mdbl/d	Thousand barrels per day
mdbl	Million barrels
mdbl/d	Million barrels per day
Mt	Megatonne

mt	Million tons
MW	Megawatt
mWh	Megawatt hour
O&M	Operations and maintenance
PEM	Polymer electrolyte membrane
PPP	Public-private partnership
PV	Photovoltaic
SDGs	Sustainable Development Goals
tcf	Trillion cubic feet
tn	Trillion
TTF	Title Transfer Facility
TW	Terawatt
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development



1. Introduction

It has been estimated that achieving global net zero by 2050 will cost as much as \$130tn, making it the single biggest global growth opportunity. For those who can't transition, it will however be a significant disrupter, with the risk of major stranded assets across the globe. A critical question yet to be answered is whether Africa will benefit from an equitable share in this global investment and growth or, lacking the economic strength, will continue to fall further behind global standards as outlined in the Sustainable Development Goals (SDGs).

It is well documented that Africa still has significant untapped fossil fuel reserves, which could provide much-needed foreign direct investment and export revenue. Despite the clear and necessary long-term decline in demand for fossil fuels, shorter-term demand and prices remain buoyant, providing strong commercial justification for their exploitation and a necessity to smoothen the transition. Fossil fuel projects are, however, increasingly challenging and more expensive to finance given the acceleration of global net-zero policy and related disclosure for investors.

Developed economies around the world have for decades enjoyed the benefit of both cheap domestic energy as well as export revenues from fossil fuels. This associated export revenue is an obvious economic benefit of fossil fuels over domestic renewable energy.

According to Our World in Data, Africa accounts for only 3% of cumulative global CO₂ emissions.¹ Africa is, however, being swept along in the global energy transition and increasingly coming under the same net-zero policy pressure as developed economies such as the EU, which has contributed 33% of global CO₂ emissions. While the importance of global decarbonisation and a sustainable planet is foremost, the journey to achieve net zero is clearly highlighting the risk of further entrenching economic winners and losers.

Africa is home to 17% of the world's population, but it accounts for only 4% of global power supply investment. It is estimated that only 58% of the continent's population have access to electricity and two-thirds of Africa's existing grids are considered unreliable. Excluding South Africa, nearly one billion people across 48 countries in sub-Saharan Africa share roughly the same generation capacity of Germany providing for 83 million people.

Such challenges will further escalate as Africa's population is set to exceed 2bn by 2040. In order for Africa to achieve its SDGs relating to energy, its generation capacity will need to be doubled by 2030 and multiplied fivefold by 2050. If unmet, this energy demand-supply gap will be detrimental to Africa's standard of living and will greatly hinder economic growth.

Many African economies remain heavily reliant on fossil fuel revenue for their national budgets and have experienced considerable negative fiscal and economic impacts since the global COVID-19 pandemic broke out. This caused reductions in physical demand for energy products as well as price volatility. The fiscal position of these countries was already weak prior to the pandemic and since then has further deteriorated. GDP in oil-exporting countries in particular is estimated to have contracted by 2.6% in 2020. The recovery in 2021 is projected at 2.6%, and a strong rebound in the oil price (increasing by 70% in the first ten months of 2021) may still show a stronger recovery than expected. However, this recovery still places many countries below the pre-COVID-19 base position and with the risk of further waves of the pandemic to consider.

Since the COVID-19 pandemic began in early 2020, governments around the world have instituted fiscal stimulus packages in response to the crisis. In Africa, these stimulus packages have however resulted in increased public sector debt levels, debt service payments, and overall increased fiscal strain.

Notwithstanding the significant innovation and related cost reduction being realised from renewable energy technologies, the required capital investment for sustainable energy supply in Africa must cover the generation, much-needed sector reform as well as grid and utility strengthening. This is often unaffordable to poorer economies, which is evident in the slow pace of electricity growth in Africa relative to developed countries.

A conservative estimate done by PwC of the cost to achieve net zero for Africa by 2050 is \$2.8tn. Such investment levels are increasingly unaffordable for many African economies and increased reliance on international finance will be needed if progress is to be made towards sustainable access to affordable energy for all Africans.

Increasing policy pressure from developed economies to accelerate the net-zero journey is undoubtedly impacting Africa and the loss of export revenue opportunities from fossil fuel commodities further reduces long-term budgeting capacity. Global policy pressures manifest in many ways, from withdrawal of financial support for fossil fuel related projects, mandatory emissions related disclosures, and emissions reduction pressure. Markets are also changing through the addition of various forms of carbon related taxes, both direct and indirect, which have the potential to exclude African countries from global supply chains due to their inability to price competitively.

Within this context, we consider Africa's current energy landscape and outline potential scenarios for Africa's fossil fuel vs renewable energy development. The direction that is followed in this global transition will have profound implications for African economies, populations and the environment. As we explore these scenarios, we provide insight on the following:

- What is the potential for Africa's fossil fuels and related export revenues in the context of the global journey to net zero?
- As the world's lowest contributor to global emissions and as one of the poorest continents in the world, what role will foreign investment in renewables play to ensure a balance between achieving global net zero as well as a just transition for Africa?

¹ "CO₂ Emissions." Our World in Data. Accessed 20 October 2021. <https://ourworldindata.org/co2-emissions#co2-emissions-by-region>.



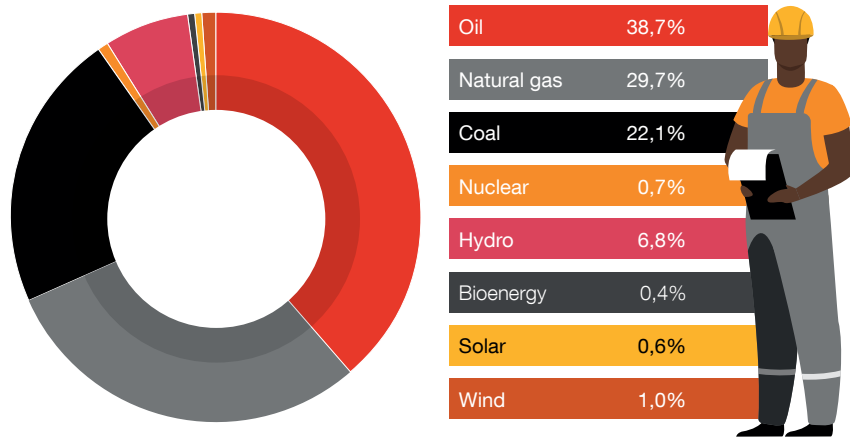
2. Energy snapshot

Africa's current energy mix

While Africa's energy sector is vital to the continent's economic prospects, it has not been able to achieve the reliable domestic energy supply that its people and businesses require. Energy demand in Africa has been increasing at an annual rate of around 3%, the highest among all continents, but energy supply continues to lag significantly.

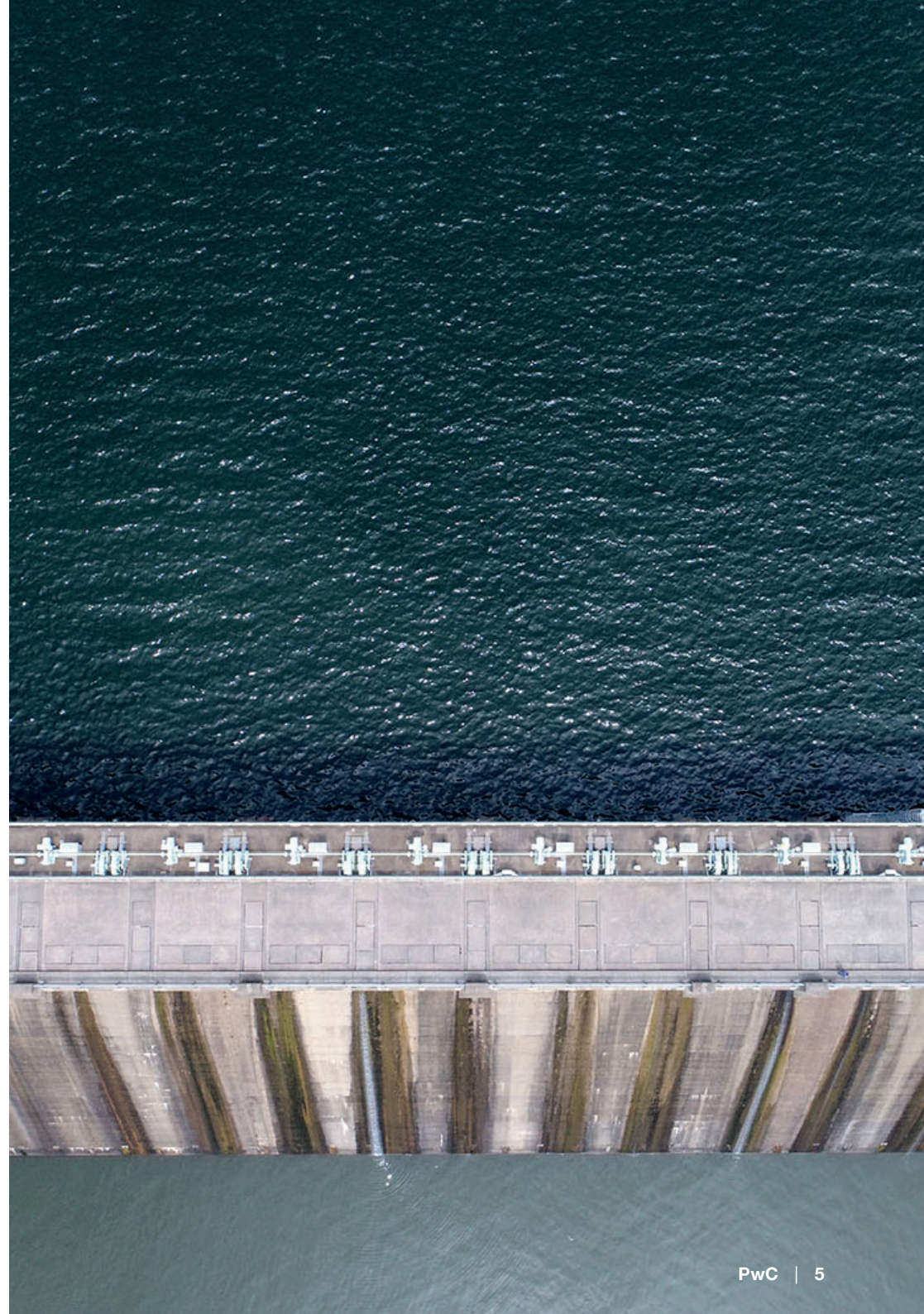
Africa's energy mix has been relatively constant for the last 30 years and despite successful renewable energy projects, the overall scale of renewables in Africa remains very small. Africa's current energy generation mix is dominated by fossil fuel generation with hydropower making the only meaningful renewable energy contribution. There has been a more recent shift within the renewable energy mix to accelerate solar and wind technologies, but they remain small at 1.6%.

Figure 1. Africa's current energy generation mix



Source: BP Energy Outlook 2020

On a country-by-country basis, however, continued exploitation of existing fossil fuel reserves, along with recent natural gas discoveries, could tempt some countries to disregard the benefits of a more diversified energy generation mix and remain entrenched in fossil fuels.



Fossil fuels snapshot

Oil



- Oil proven reserves saw a slight drop of **0.1%** from 2020, amounting to **125.1 Bbo**. Africa's oil proven reserves remain at **7.2 %** of the world's proven reserves.
- Production significantly decreased by **19%** to **6.8 mmbbl/d** from the prior year. This accounts for **7.8%** of global production.
- Consumption saw a decrease of **14%** to **3.5 mmbbl/d** from the prior year. Refinery throughput saw a decline of **11%** from the previous year, amounting to **1,826 mbbbl/d**.
- Exports remained at **7.2 mmbbl/d** in 2018 and 2019, but due to COVID-19, saw a drop to **5.7 mmbbl/d** in 2020.

Gas



- Gas proven reserves in 2021 amount to **455 tcf**.
- Gas production experienced a slight decline of **5%**, which amounted to **231 bcm**, compared to the previous year. Gas production saw a slight decline compared to oil production.
- Gas consumption saw a slight decline of **1.5%** relative to the previous year, amounting to **153 bcm**.
- Gas exports saw a decline of **6%** to **26.1 bcm** compared to the previous year.

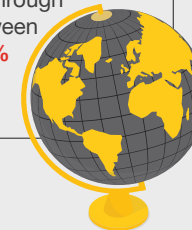
Coal



- Africa's proven coal reserves remained at **14.8 bt**.
- Coal production saw a decline of **5.5%** to **6.47 EJ** compared to the previous year.
- Coal consumption saw a decline of **5%** to **4.1 EJ**.

Oil and gas discoveries

- Oil proven reserves saw a slight drop of **0.1%** from 2020, amounting to **125.1 Bbo**. Africa's oil proven reserves remain at **7.2 %** of the world's proven reserves.
- The largest discovery in Africa between 2020 and 2021 is Total's **574 mmbbl** Luiperd discovery in South Africa, while Ghana's Eban discovery is second with **180 mmbbl** and Angola follows with **56 mmbbl**.
- About **343 mmbbl** of total discovered volumes between 2020 and 2021 are gas, while liquid volumes are estimated at **551 mmbbl**.
- Discoveries announced from 2020 through to August 2021 are evenly split between onshore and offshore. However, **60%** of Africa's top discoveries were made onshore.

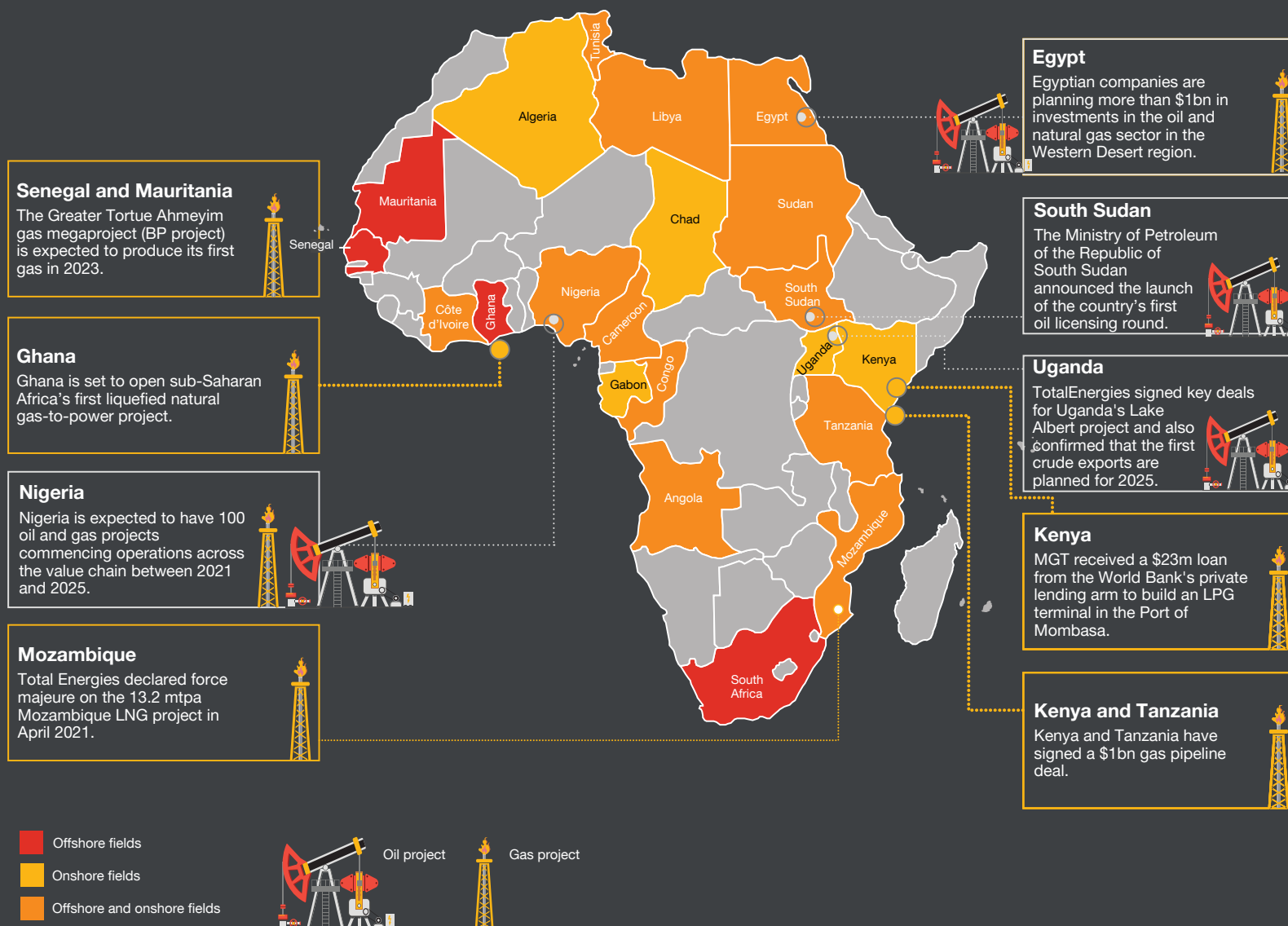


Current developments: New, stalled and cancelled projects

A large number of oil and gas projects in Africa are expected to start operations from 2021 to 2025. Upstream and midstream sectors are expected to witness the highest number of project starts, mostly linked to projects recently stalled or cancelled due to COVID-19. This trend is more evident in the gas sector.

Projects that were suspended in 2020, but have resumed in 2021 include:

- TotalEnergies' Zinia Phase II in Angola came on stream in May 2021. It is expected to reach production of 40,000 bbl/d by mid-2022.
- Aker Energy aims to approve a revised plan for developing the Pecan oilfield off Ghana by the end of 2021.
- The partners of the Lake Albert development project in Uganda concluded the final agreements required to launch the Tilenga project in April 2021.



Source: PwC analysis

Global investor pressure driven by increasingly stringent energy policies and regulation is resulting in rapid exiting of and disinvestment in portfolios, especially in coal. Yet, despite increasing pressure to exit fossil fuels, investors still see the potential of natural gas in the transition to cleaner energy sources, as it has scale to satisfy growing global demand and fuel switching from coal.

Liquefied natural gas (LNG) projects have remained resilient through the pandemic with a large number of projects advancing. They include the East Africa LNG projects whose substantial gas finds are likely to encourage greater investment in future.

Significant delays to LNG projects in Mozambique appear inevitable, but with a new regional effort to ensure security and stability, it is expected that the main projects will resume. Despite the setbacks, Mozambique is still expected to become a major player within the LNG industry post 2025 and the country's resources are likely to trigger more investments.

Rig count activity is returning upstream in Africa. From a low of 51 active rigs in January 2021, there were 75 rigs in operation by August 2021. The rise was led by Nigeria and Angola, but with growth also seen in Cameroon, Gabon, Ghana and Kenya.

Despite companies commencing exploration and development projects, planned capital expenditure in 2020–2021 has fallen from \$90bn pre-COVID-19 to \$60bn. Oil and gas producers as well as governments are being challenged by the lower investment appetite to fund oil and gas projects. They will thus need to show clear evidence of diversification and emissions reduction strategies as well as strong commercial business cases in order to attract competitive finance.

Renewable energy snapshot

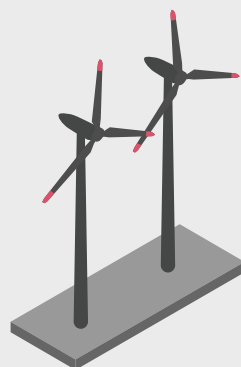
Adoption of renewable energy

Countries such as Egypt, Ethiopia, Kenya, Morocco and South Africa are leading the increase in renewable energy supply on the continent, while some of Africa's smaller countries including Cabo Verde, Djibouti, Rwanda and Eswatini have set ambitious renewable energy targets. Renewable energy is on a gradual rise across the continent with an annual growth rate of 21% between 2010 and 2020 and current total renewable capacity of more than 58 GW (of which hydropower contributes 63%).

Africa's renewable generation and capacity

Generation

Wind energy generation increased by **14%** and solar energy generation increased by **13%**, while total renewable energy generation increased by **11%** in 2020 compared to the previous year.

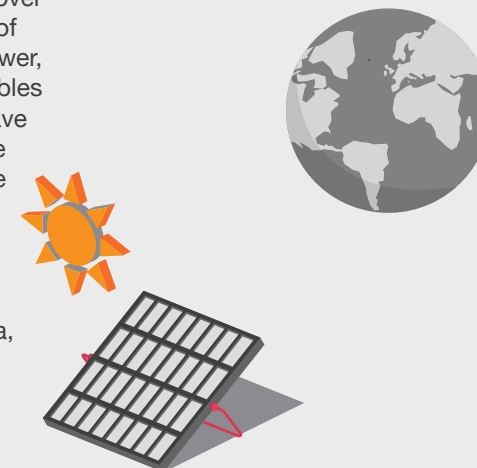


Capacity

Solar capacity increased by **13%**, wind capacity increased by **11%** and hydropower increased by more than **25%** in 2020 compared to 2019. Total installed renewable energy capacity in Africa has grown by over **24 GW** since 2013. While much of this total was related to hydropower, investment in non-hydro renewables like solar, wind and bioenergy have seen a significant uptake and are projected to surpass hydro in the next decade. The continent's capacity is expected to increase again by the end of 2021 with growth led by solar and wind projects in Egypt, Algeria, Tunisia, Morocco and Ethiopia.

Closing Africa's future energy demand gap

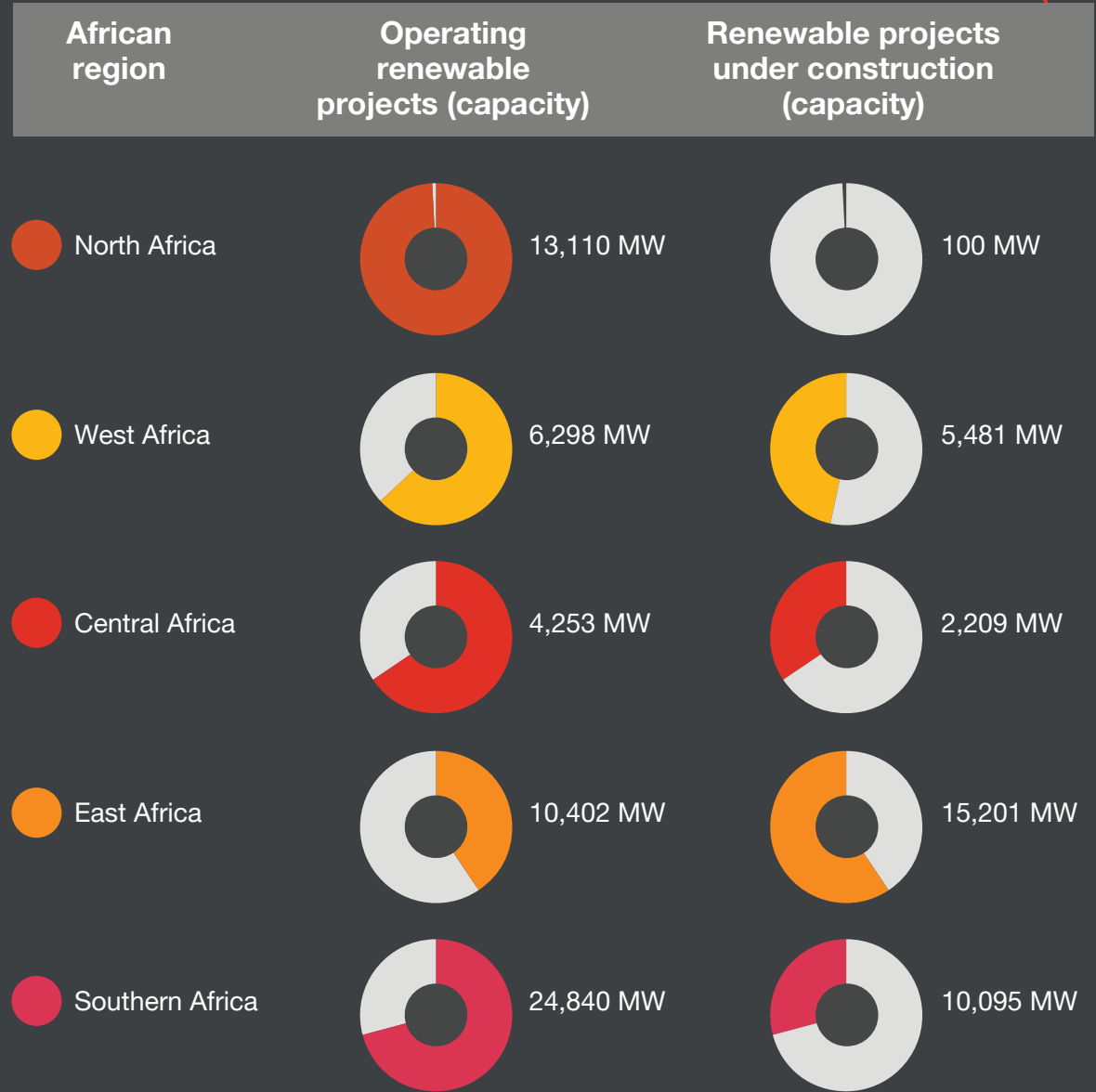
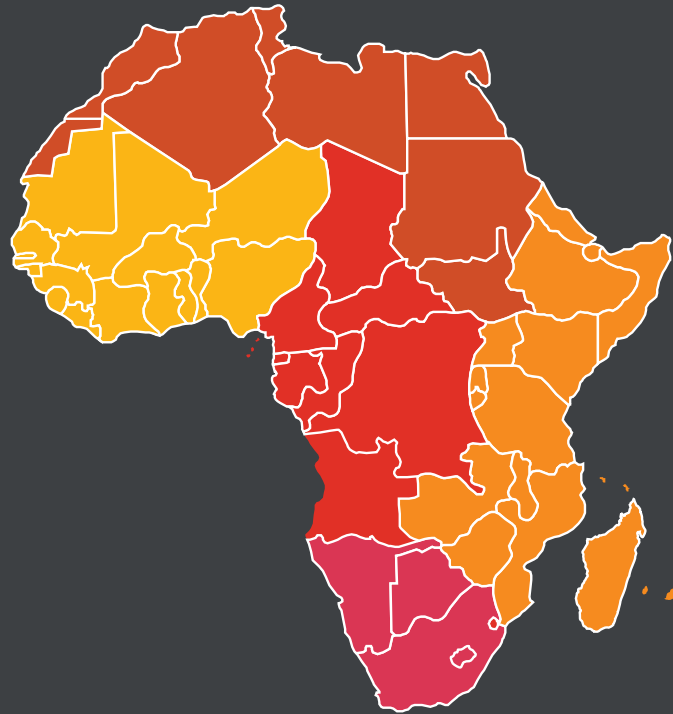
Forecasts to 2050 estimate **27.32 EJ** of additional renewable generation coming online, a significant increase from current generation of **1.79 EJ**.



Hydropower is the main provider of renewable electricity in Africa with over 37 GW of installed capacity. The continent has the highest untapped hydropower potential in the world, with an estimate of only 11% of its potential being utilised. Similarly, the technical potential of solar, bioenergy, wind and geothermal energy is also significant. Most African countries are increasing investment in solar and hydropower technologies and projects that are currently under construction are expected to add 33 GW of renewable energy capacity.

The following map displays renewable energy projects split by African region for current operating projects and projects under construction.

Renewable projects in Africa, 2021 (MW)



Source: ABIQ

Wind power

Africa's technical wind resource potential is more than 59 TW, however capacity from projects under construction and currently installed have only tapped into 0.01% of this potential. Currently installed wind capacity is 6,491 MW while 1,321 MW is under construction. Installed cost for onshore wind is the second lowest of renewable energy technologies, behind solar, at \$1,473/kW. South Africa has the greatest wind capacity, followed by Egypt, Senegal and Morocco.

Bioenergy

Africa has a vast variety of bioenergy feedstocks to meet Africa's burgeoning demand for modern energy services and thus most African countries are gradually adopting bioenergy technologies. More than 10% of the renewable energy supply in 2050 is expected to be some form of bioenergy. Installed bioenergy capacity is estimated at 1,709 MW while 151 MW is still under construction. Bioenergy installed cost is estimated at \$2,141/kW.

Solar power

Africa has substantial solar power potential. Solar energy can bring power to rural areas without expensive grid infrastructure with solar photovoltaic (PV) installation cost the lowest of all renewable technologies at \$995 per kW. Concentrating solar power (CSP) remains the most costly renewable energy form to install. Installed solar capacity is estimated at 9,604 MW while 7,158 MW is under construction. South Africa and Egypt currently have the largest solar capacity, followed by Algeria. BP projects that around 30% of Africa's energy production will be derived from solar by 2050².

² "Energy Outlook." BP. Accessed September 13 2021. <https://www.bp.com/en/global/corporate/energy-economics/energy-outlook.html>

Hydropower

Africa has abundant hydropower potential. With only 11% of its hydropower potential utilised, the continent has vast opportunities to develop new projects. Hydropower accounts for 17% of the electricity generated across Africa and remains one of the lowest-cost sources of electricity. Total installed cost for hydropower is favourable at \$1,704 per kW. Estimated hydropower capacity of 37,251 MW is currently installed while 20,403 MW is under construction. Hydropower in electricity generation exceeds 80% in countries such as Malawi, the Democratic Republic of Congo, Ethiopia, Mozambique, Uganda and Zambia.

Nuclear power

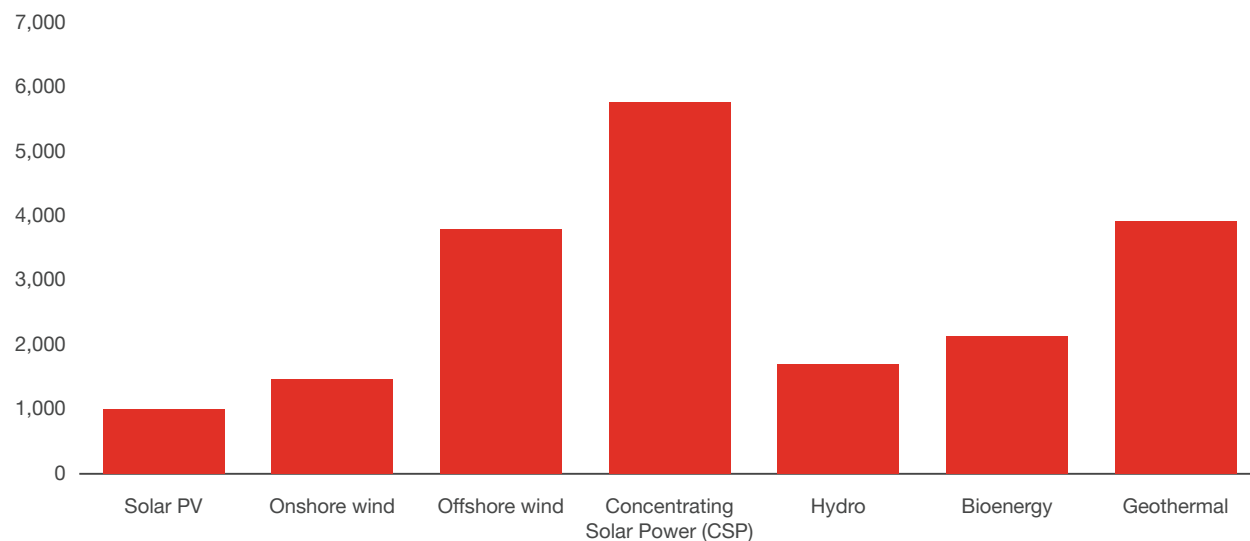
South Africa currently has the continent's only commercial nuclear power in Africa. The sole operating nuclear power project is generating 1,940 MW in South Africa, while 100 MW is under construction in South Sudan. Ghana, Kenya, Egypt, Morocco, Niger and Nigeria are considering adopting nuclear power and have engaged with the IAEA to assess their readiness to embark on a nuclear programme. Countries such as Algeria, Tunisia, Uganda and Zambia are also evaluating the feasibility of nuclear power.



Geothermal energy

Kenya is the largest geothermal energy producer in Africa, with its power production contributing approximately 40% of the country's electricity supply. East Africa is successfully harnessing its geothermal capabilities with installed geothermal capacity estimated at 824 MW in Ethiopia, while 3,953 MW is under construction in Ethiopia, Kenya and Uganda.

Figure 2. Total installed cost (\$/kW)



Source: IRENA, PwC analysis

The cost of electricity from renewable energy technologies has fallen dramatically in recent years, with solar PV and CSP experiencing the most rapid cost reduction in recent decades. According to the International Renewable Energy Agency (IRENA), more than half of the renewable capacity added between 2019 and 2020 achieved lower power costs than the cheapest new coal plants. Since 2010, solar PV power has seen a cost decline of 82%, followed by CSP of 47%, onshore wind of 39% and offshore wind of 29%.

These low-cost power generation technologies will increasingly offer competitive and sustainable electricity for Africa, as more contracted plants are commissioned. A growing bottleneck to such generation roll-out is however the market form, which is dominated by centrally controlled state utilities that are largely financially distressed and can't afford the related grid investment and system strengthening required to facilitate higher levels of variable energy associated with renewable energy.



3. Africa's reality and the challenges of a net-zero transition

Of Africa's 54 countries, 35 have undertaken some form of commitment towards net-zero emissions. Despite such public commitments, decisive actions and implementation remain inadequate and the pace of change is slow. With 17% of the world's population, Africa currently produces less than 5% of global emissions and only 3% of global cumulative emissions.

As such, carbon-cutting goals have limited relevance and present challenging affordability constraints, with most African nations focused more on providing improvement in living conditions, greater access to electricity, jobs and economic growth.

To achieve its SDGs in relation to energy, Africa needs to double its generation capacity by 2030 and grow it fivefold by 2050. To achieve net zero by 2050, Africa would need to invest an estimated \$2.8tn in a clean energy mix and reduce its current annual CO₂ emissions of 1.62m kilotons of CO₂e.

Investment in low-carbon energy systems in Africa lags global pace, but despite global climate finance commitments from developed economies aimed at \$100bn per annum, the allocation to Africa falls significantly short of what the continent requires to meet global targets. COVID-19 has further seen governments reprioritising budgets towards funding emergency health services and economic stimulus, and away from funding the expansion and improvement of electricity generation and infrastructure.

An additional financing challenge lies in the cost of finance and perceived investment risk. For African countries these remain significantly higher than for developed economies, despite the vast improvements in stability and governance. Africa still suffers from the perception that it is high risk, even though project finance defaults on the continent are the lowest globally.³

³ "The Road to COP26." Absa Africa. Accessed 27 September 2021. <https://www.absa.africa/absafrica/our-stories/our-voices/2021/the-road-to-cop-26/>.

The fiscal constraints being experienced across Africa create a challenge for the continent to move with pace on its net-zero journey. Private partnerships, public-private partnerships (PPPs) and blended finance are becoming increasingly important and will have to be mobilised along with strong public sector governance and innovative financing instruments to overcome these challenges.

Although governments have a moral obligation to all citizens and future generations to address climate change, Africa must carefully consider the economic cost of a transition away from fossil fuels and lost revenue against the timing of new growth opportunities associated with renewables, long-term stability and economic growth.

As a continent where more than a third of nations depend on fossil fuel commodities for state revenue, foreign currency reserves and local economic activity, too radical a shift from this sector may accentuate even greater fiscal strain in Africa. Conversely, too slow a transition may leave Africa isolated from global markets, and potentially 'stranded' in relation to the global net-zero journey.





4. Economic benefits and opportunity costs of the energy transition

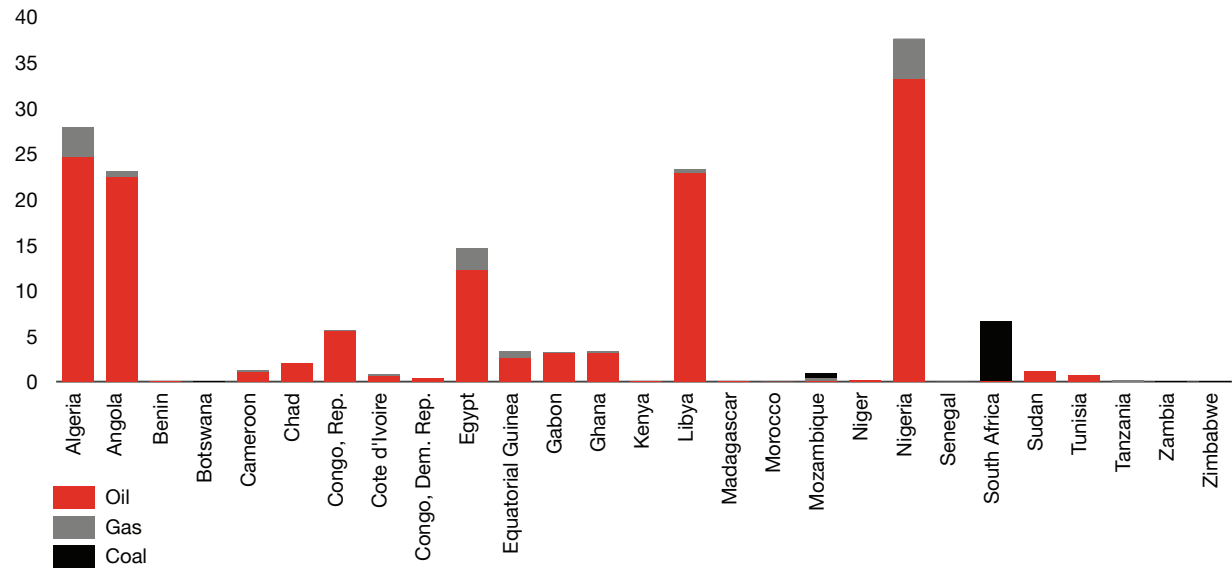
Fossil fuel derived economic benefits

Fossil fuel generated export revenue – direct economic benefit

Oil and gas resources play a pivotal role in the growth, development and economic stability of Africa. Africa's proven fossil fuel reserves are estimated at more than \$15.2tn based on current market value. In sub-Saharan Africa alone, nearly 50% of export value is derived from fossil fuels with an estimated annual contribution to GDP from Africa's current oil, coal and gas production of approximately \$156.2bn.



Figure 3. Africa: Fossil fuel revenue, 2019 (\$bn)



Source: World Bank, PwC analysis

The global energy transition is, however, putting this crucial income source for the continent at risk. While demand for coal will decline the quickest, there will be a slower global decline in demand for oil while gas is expected to see continued growth until the mid 2030s before peak demand is reached. This will specifically impact Africa's fossil-fuel exporting economies as they try to diversify their economies and income sources.

To achieve the 1.5°C global warming target under the Paris Agreement, studies suggest that a third of current oil reserves, half the current natural gas reserves and nearly 90% of current coal reserves must remain in the ground. Applying this to Africa would leave a potential \$6.7tn of fossil fuels stranded on the continent.

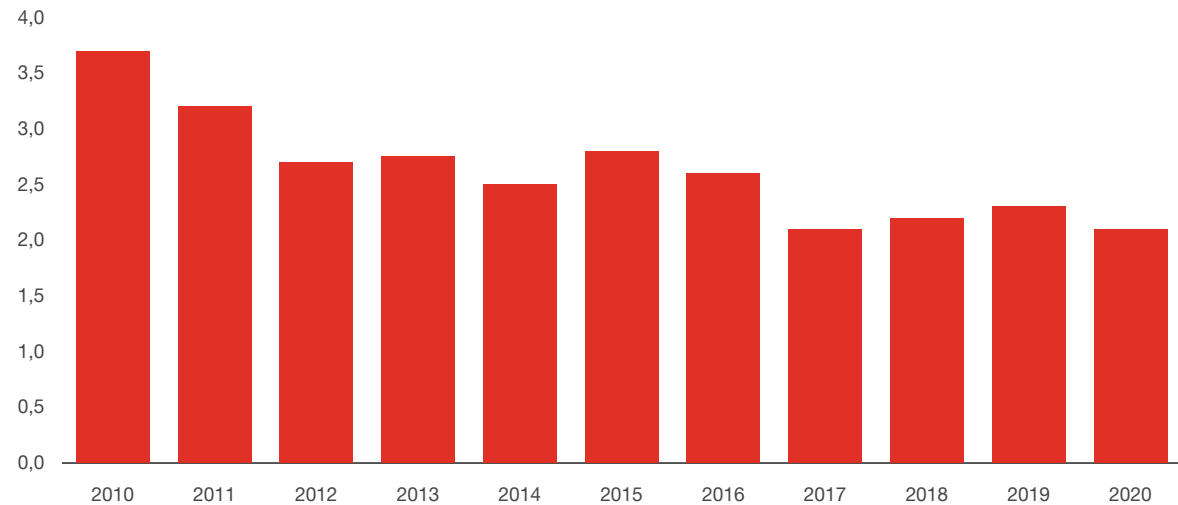
Fossil fuel industry's job creation — direct and indirect economic benefit

The fossil fuel sector provides a wide array of jobs with employment in the energy sector across Africa estimated at 2.1m.

Figure 4 illustrates the number of directly engaged workers employed in the energy sector. The historic numbers show a peak of around 3.7m jobs in 2010 when multiple new projects were under construction across Africa. It then drops to a low of around 2.1m jobs at present. This 43% decline is primarily the result of multiple large construction projects being completed, construction sites being demobilised and projects being stalled or cancelled during this time.

The operational phases of large oil and gas projects require significantly fewer staff due to the capital intensity of the sector. Further consideration needs to be given to the development of renewable energy, which is more labour intensive due to the lower capital intensity associated with an energy model that utilises free energy feedstock.

Figure 4. Africa energy employment (million jobs)



Source: BLS, UCube, AEC Outlook

Renewable energy derived economic benefits

Renewable energy has the potential to create improved job multiples and greater access to affordable electricity for Africa's population. Although a nascent market, the rapid development of green hydrogen could also provide attractive energy export revenues, especially for Morocco, Namibia and South Africa, which are all well positioned to be low-cost global suppliers of green hydrogen.

Africa could benefit from renewable energy-related exports in the medium term

As of 2021, more than 30 countries have published a hydrogen roadmap, which highlight more than 200 hydrogen projects, with governments committing over \$70bn in public funding to support the development of green hydrogen. Africa has an abundance of solar and wind energy potential as well as the largest reserves of platinum group metals, including platinum and iridium, which are critical in the manufacture of PEM electrolyzers and fuel cells.

The European Union, most notably Germany, is playing a leading role through its H2 Global programme. KfW, the German development bank, launched a \$235m concessional financing initiative in June 2021 seeking to catalyse the development of a green hydrogen economy in South Africa. Sasol, the world's largest producer of coal-to-liquids fuel, based in South Africa, has launched the Hydrogen Valley in partnership with international technology providers and developers. In addition to playing a critical role in decarbonising hard-to-abate industrial sectors such as steel and cement, green hydrogen opens the door to downstream exports as a zero-carbon fuel, including marine bunkering, green ammonia and green methanol. Green hydrogen is however still in its infancy, has a significant cost premium over fossil fuel incumbents

and will require significant technology innovation and scaling of production before price parity with fossil fuels is achieved. A second area of opportunity for Africa when considering the renewable energy market is rare earth metals mining. Africa is endowed with many of the metals required for battery production, including vanadium, manganese, nickel, cobalt and lithium. The market for these metals is expected to see rapid growth in the coming years and will be driven by increased demand for electric vehicles, smartphones and off-grid energy storage. In South Africa alone, the pipeline of near-term battery energy storage projects is expected to grow by \$3.6bn over the next three years.

These opportunities could provide a logical transition for workers previously employed by the fossil fuels industry such as coal mining, or manufacturing industries that rely heavily on fossil fuels. They could also bring some relief in the form of new export revenues for Africa. While many positive benefits can be achieved through this focus, the infrastructure and technology required for Africa to pivot to such renewable industry led exports demands substantial financial investment. Africa needs to act now to capitalise on these new growing sectors and capture relevant market share or the opportunity will be lost.



Renewable energy adoption has the potential to boost employment

The green energy sector has been shown globally to have a far greater employment multiplier than that of fossil fuels. The fossil fuel industry creates 2.7 jobs per US\$1m invested, whereas the clean energy sector (renewable energy and energy efficiency) creates between 7.5 and 15 jobs per US\$1m invested.⁴

This employment creation is also not limited to direct employment and of particular relevance to Africa is the potential boost in non-energy jobs through broader economic activity in rural communities where improved energy access through mini-grids and off-grid solutions will impact economic productivity.⁵

⁴ International Finance Corporation. "A Green Reboot for Emerging Markets". Accessed 19 October 2021. https://www.ifc.org/wps/wcm/connect/26f79a1b-c191-494b-b2d9-c891e138bb37/IFC_GreenReport_FINAL_web_1-14-21.pdf?MOD=AJPERES&CVID=ns1JVvR

⁵ "Renewable Energy Jobs in Sub-Saharan Africa and Asia 2019." Power For All. Accessed 29 October 2020. <https://www.powerforall.org/resources/reports/powering-jobs-census-2019-energy-access-workforce>

The table below shows a breakdown of potential job gains per renewable energy technology per MW. This is given in terms of short-term construction, manufacturing and installation (CIM) FTE and medium-to-long term operations and maintenance (O&M) FTE to meet Africa's forecast renewable energy demand in 2030.

Potential job gains per renewable energy technology per MW in Africa by 2030 (FTE jobs/MW)

		Construction, installation and manufacturing	Operations and maintenance	Potential CIM jobs in Africa (Short term)	Potential O&M jobs in Africa (Medium to long term)
Renewable technology	Solar PV	34	3	3,799,913	335,286
	Wind	7	0.4	284,076	16,233
	Hydro	7.5	0.04	571,950	3,050
	Bioenergy	7.7	1	131,128	17,030
Total				4,787,067	371,599

Source: IRENA, SAPVIA 2021, PwC analysis

The area with the highest job multiplier potential is solar PV with hydropower, which is currently the most common form of renewable energy in Africa, showing much lower job multipliers. This is, however, consistent with the capital-intensive upstream model discussed under fossil fuels.

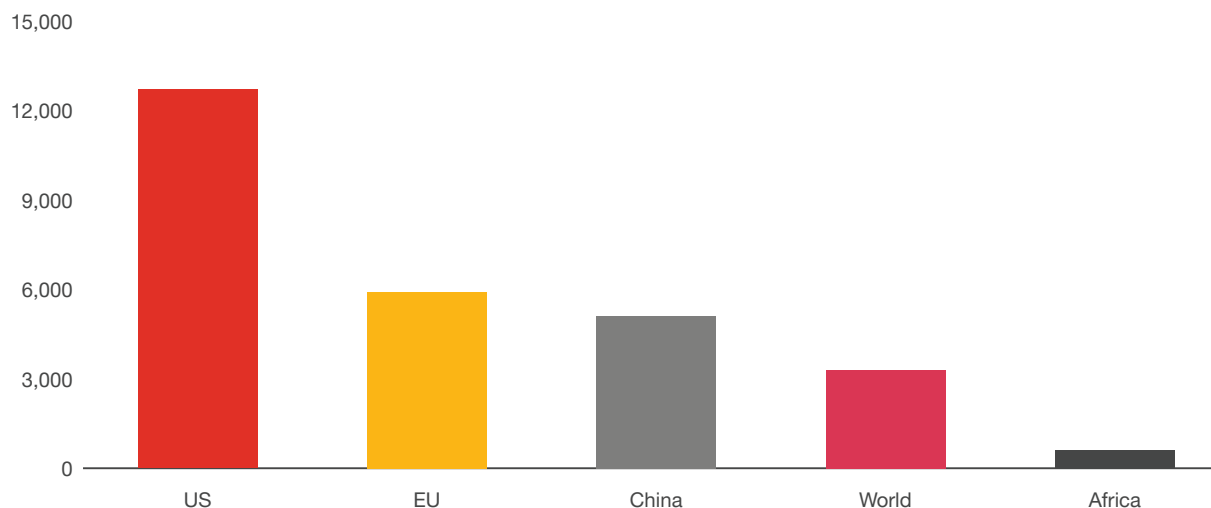
Overall, the energy transition in Africa has the potential to result in total renewable energy employment of around 5m jobs by 2030, which is a substantial increase from the estimate of 324,000 currently employed⁶. With the solar PV workforce making up 80% of renewable sector job creation, it suggests that a holistic government plan is required to understand and manage the transition where new skills and opportunities do not equate to old ones.

⁶ IRENA. "Renewable Energy and Jobs – Annual Review 2020." Last modified 29 September 2020. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Sep/IRENA_RE_Jobs_2020.pdf.

Providing energy access as the backbone of the economy

The COVID-19 pandemic has seen disruption in planned government and international aid financing, as these budgets have been pivoted towards social services such as healthcare instead of scaling-up energy infrastructure. Those already connected have seen basic electricity services becoming less affordable and in some circumstances less reliable. Figure 5 shows that Africa’s energy consumption per person is a fraction of that in the US, EU and China as well as the world average. This has detrimental impacts on economic productivity as well as on people’s well-being.

Figure 5. Average annual per capita electricity consumption, 2020 (kWh)



Source: World Bank, 2020

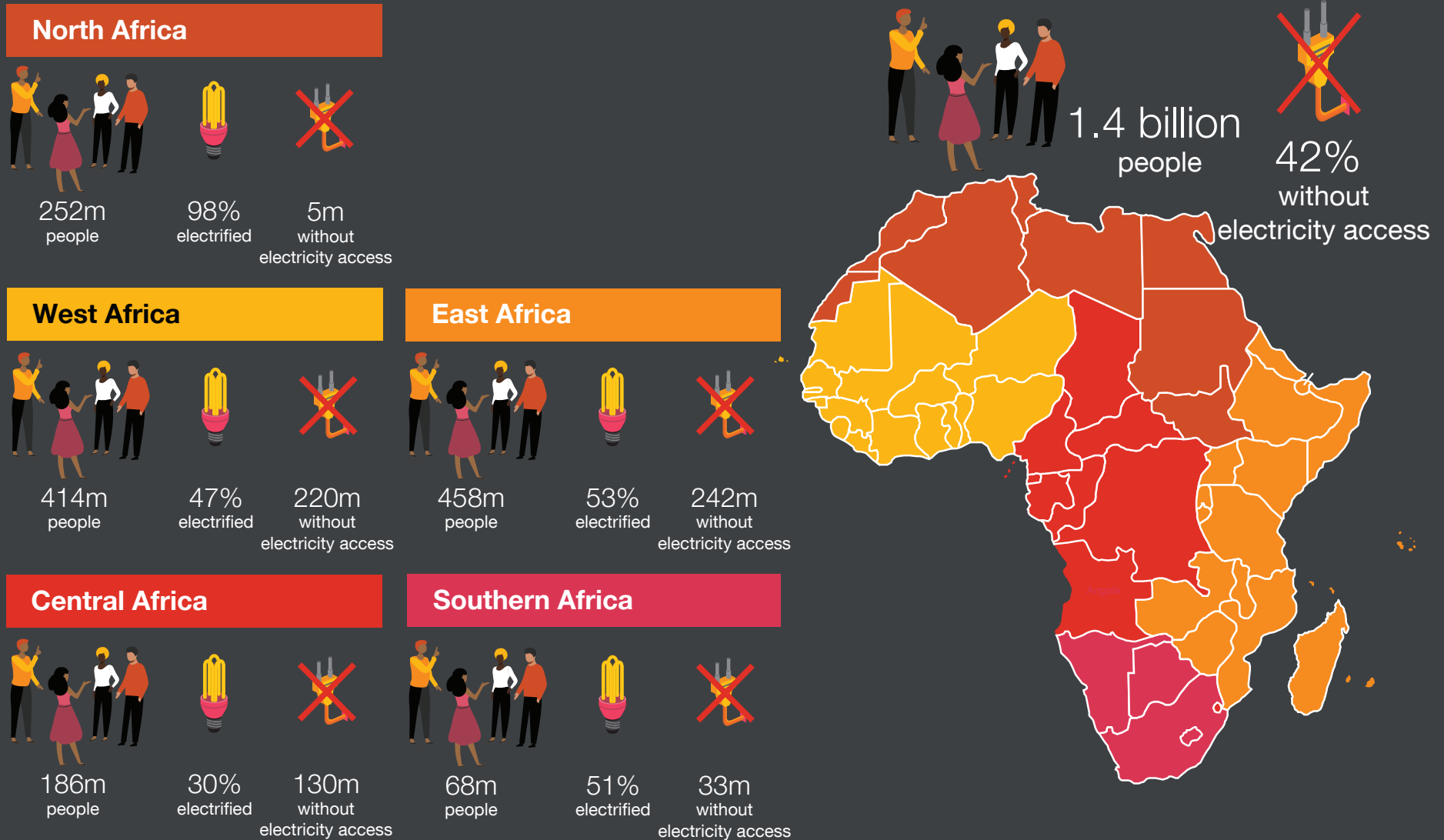
With many African countries experiencing recurrent electricity outages and load-shedding as the norm, such sector bottlenecks and power shortages are estimated to cost Africa about 2–4% of GDP annually.

This issue does not only impact business and economic growth, it also has severe impacts on the quality of life of Africans as well as carbon emissions per mWh of energy produced on the continent. Approximately 730m Africans rely on traditional uses of biomass and unsustainable cooking energy, causing an estimated 600 mt of carbon to be emitted per annum.⁴ Two-thirds of African grids are considered unreliable. As a result of this, there are estimated to be more than 7m non-utility backup diesel generators on the continent, producing carbon emissions equivalent to 120 coal-fired power stations. In addition to the emissions cost, the need for such generators also necessitates \$13bn of otherwise needless spending on fossil fuel inputs.⁷

⁷ “Unlocking Climate Finance to Accelerate Energy Access in Africa.” Shell Foundation. Last modified 22 April 2021. <https://shellfoundation.org/app/uploads/2021/04/Unlocking-Climate-Finance-for-SDG7-Report-For-RF-web-04-21-2021.pdf>.

The figure below shows the severity of energy scarcity across the various African regions, with only North Africa reaching an acceptable electricity access rate. Providing reliable and wide-reaching access to electricity should therefore be a top priority for Africa.

Electrification rates in different regions





5. The role of Africa's emissions footprint in a just transition

Africa's carbon emissions

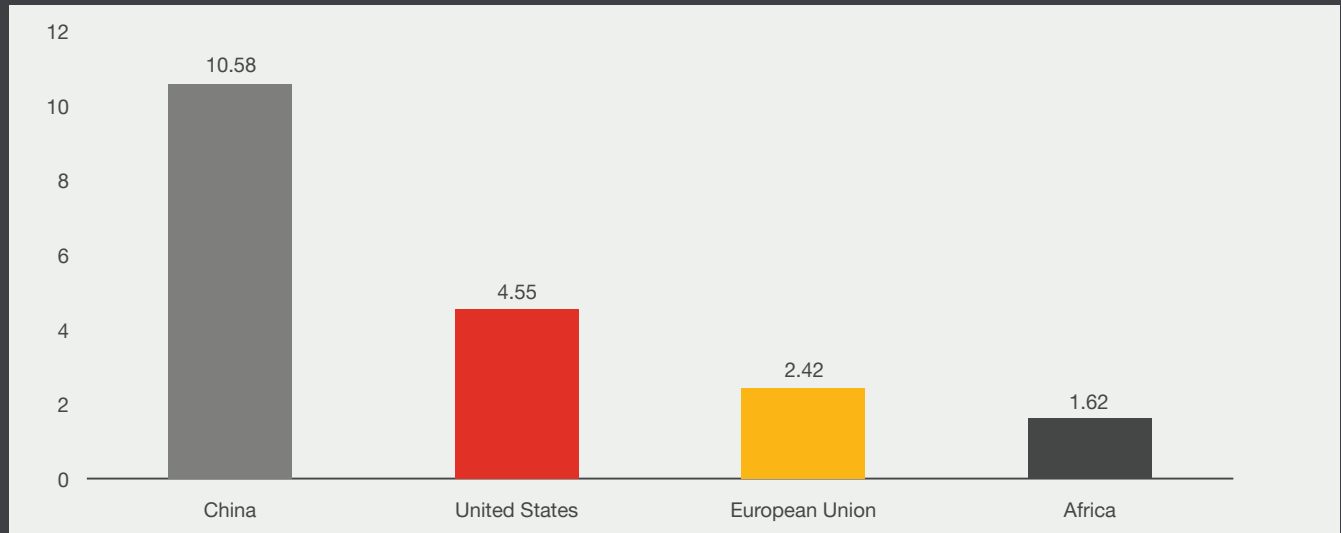
Africa accounts for only 3% of cumulative global CO₂ emissions and less than 5% of the world's annual CO₂ emissions. The United Nations Framework Convention on Climate Change (UNFCCC) highlights that Africa has made the smallest historical contribution to the greenhouse gases that are causing global warming and yet at the same time bears the brunt of the negative impacts of climate change.

Africa has a far smaller carbon footprint compared to others as shown in Figure 6. Africa emitted 1.62m kilotons of CO2 in 2020 against a global estimate of around 33m kilotons.

Excluding Africa's higher emitting nations namely South Africa, Egypt, Algeria, Nigeria and Libya other African nations contribute only 1.6% of total annual global emissions. Excluding South Africa, those from sub-Saharan Africa are the lowest emitters in the world.

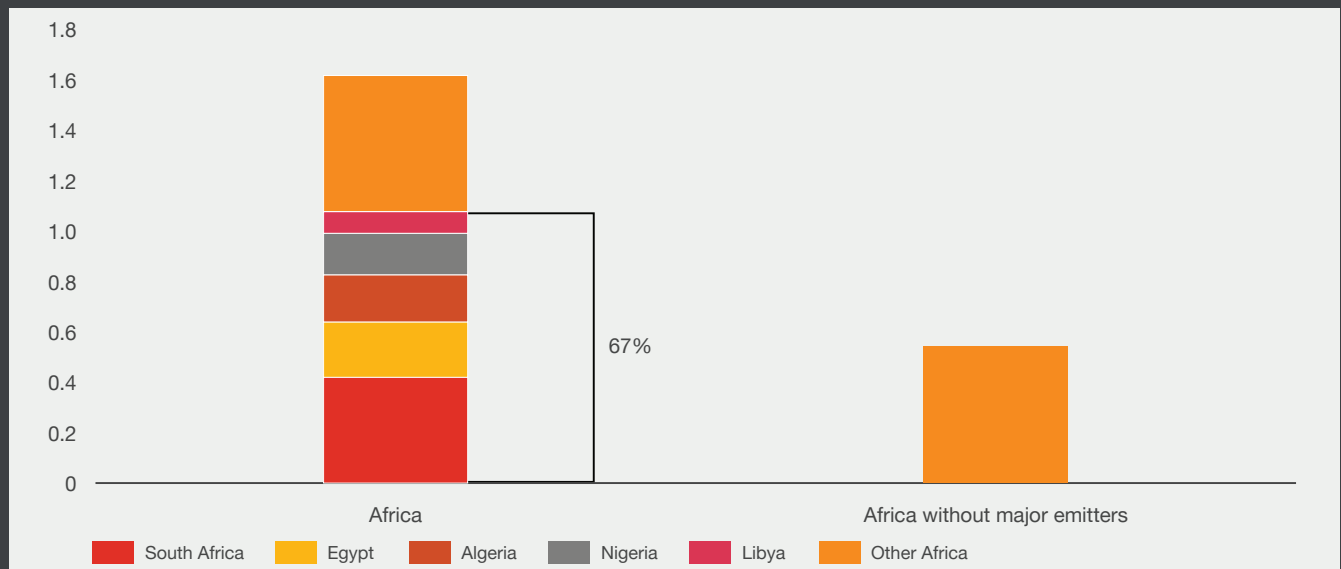
Considering that one of the key principles outlined by the United Nations Framework Convention on Climate Change (UNFCCC) is that parties should act 'on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities'. Simply put, the just transition to a sustainable development pathway will vary among different societies and economies and a one-size-fits-all approach cannot be adopted. On the basis that Africa contributes a minor fraction of global carbon emissions, applying the same degree of legislative and punitive measures to the continent as adopted by the developed world, would place the continent at a disadvantage.

Figure 6. CO2 emissions for selected countries and regions compared, 2020 (million kilotons)



Source: CAIT

Figure 7. Africa's CO2 emissions in 2020 (million kilotons)



Source: CAIT



6. The future structure of the energy sector

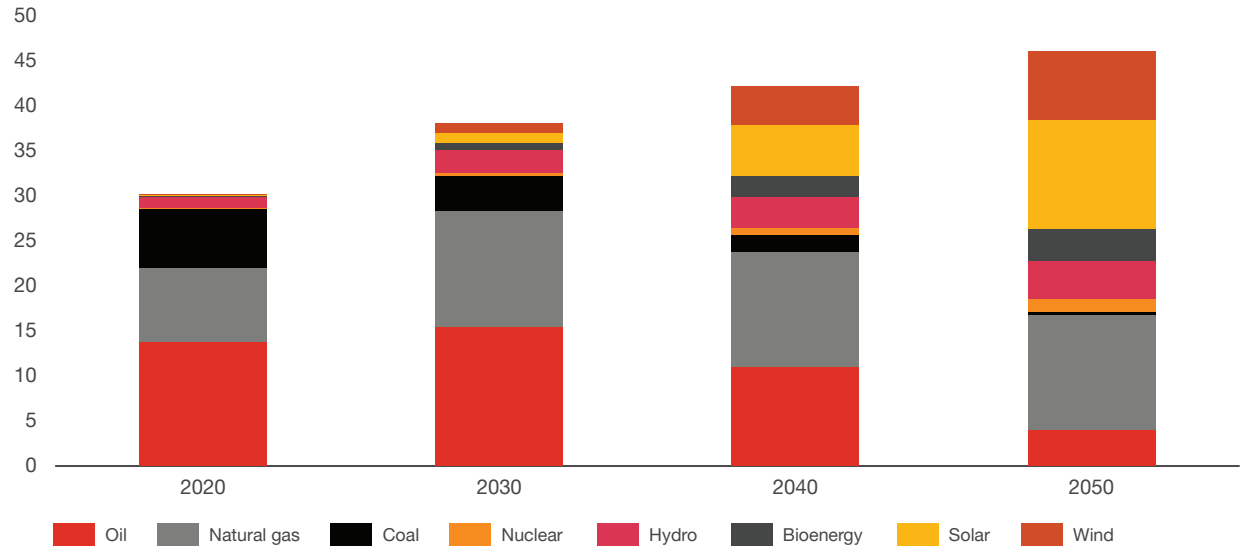
Momentum is growing for energy sectors around the world to decarbonise. As of June 2020, 120 countries, 823 cities and more than 1,000 companies, had committed to achieving net-zero carbon emissions and the structure of Africa's energy sector will need to evolve rapidly to keep pace with global trends.

Africa's energy generation mix to 2050

Africa's coal and oil energy production are expected to drop by around 96% and 71% respectively by 2050. This will be driven by declining demand for fossil fuels globally with leading international oil and gas companies already refocusing their portfolios to include higher renewables exposure.

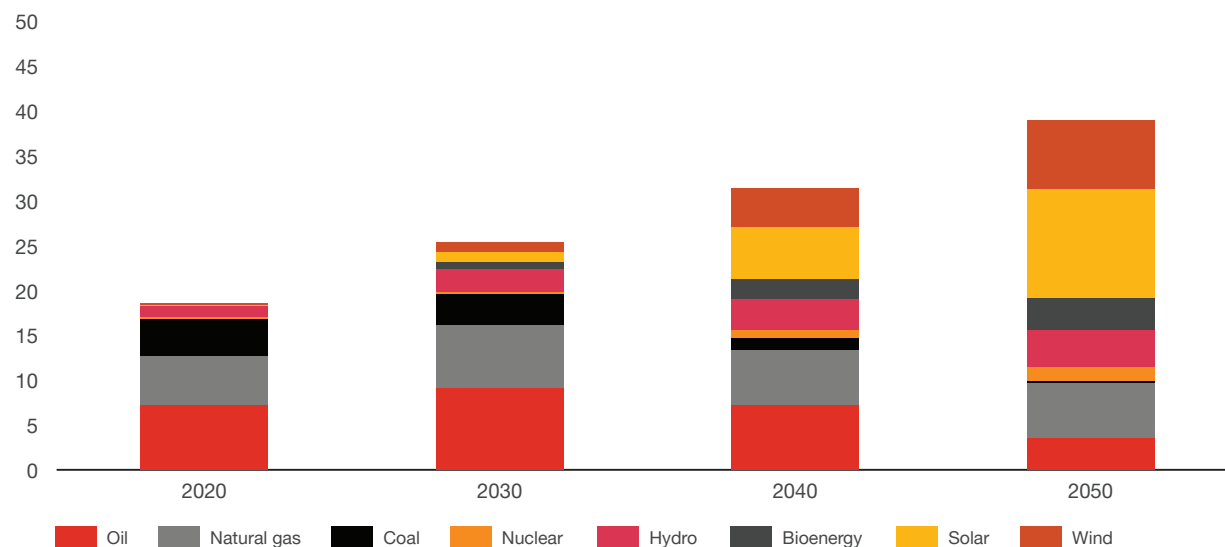
Renewable energy is expected to see large gains in Africa over the next three decades. Solar and wind generation capacity has grown at an annual rate of 50.2% and 25.3% respectively between 2010 and 2020. By 2050, energy production from solar and wind is expected to increase by as much as 110 times and 40 times respectively. This suggests that Africa's energy mix is already seeing tangible progress in moving toward lower emissions generation and will see exponential growth of renewables in future.

Figure 8. Africa's energy production towards net zero, 2020–2050 (EJ)



Source: BP Energy Outlook 2020

Figure 9. Africa's energy consumption towards net zero, 2020–2050 (EJ)



Source: BP Energy Outlook 2020

Natural gas is often described as a bridging fuel to renewable energy due to it being a cleaner fossil fuel alternative. Natural gas has also historically been a relatively cheap fuel, however, in the second half of 2021 there have been significant surges in price. Benchmark European gas prices at the Dutch TTF hub have increased more than 250% since January, while benchmark German and French power contracts have doubled.

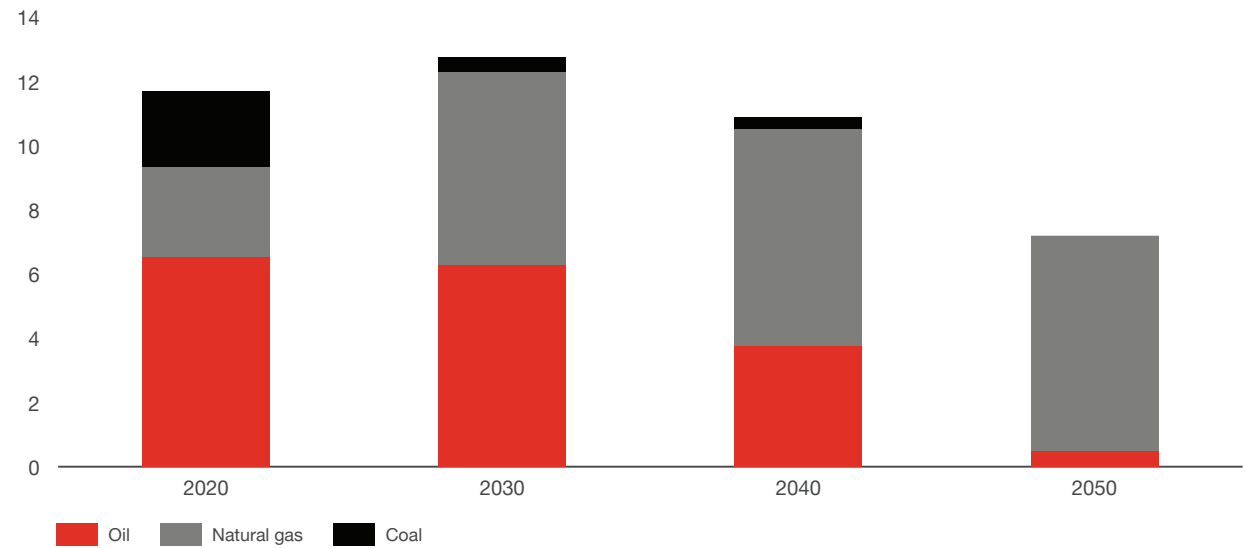
There have been numerous contributors to the current supply demand imbalance in addition to the slow erosion of inventories during the COVID-19-related lockdowns, which led to significant temporary decreases in demand. Other supply disruptions include lack of investment and infrastructure development during the pandemic, a prolonged northern-hemisphere winter; disruptions of imports piped from Russia and Norway; a fire at a processing plant in Siberia and an abnormally harsh winter in Russia that has depleted reserves.



Although natural gas will enjoy increasing demand and strong pricing in the medium term, Africa is not seen to be a significant supply-side player, with Russia, the US and Qatar seen as the major beneficiaries. As highlighted earlier, lack of finance and challenging geopolitics will constrain Africa's potential to participate in this growth.

Africa's gas reserves are therefore largely likely to remain untapped. In light of the intensification of foreign demand for natural gas, as well as the need for cleaner fuels domestically, African nations should aim to expedite the development of the necessary infrastructure to capitalise on their natural gas reserves.

Figure 10. Africa's energy exports, 2020–2050 (EJ)



Source: BP Energy Outlook 2020



Employment distribution within the future structure

Managing jobs and livelihoods as the structure of the energy sector evolves must be a fundamental part of all planning. Employment levels in the sector will depend greatly on the manner in which the energy transition takes place.

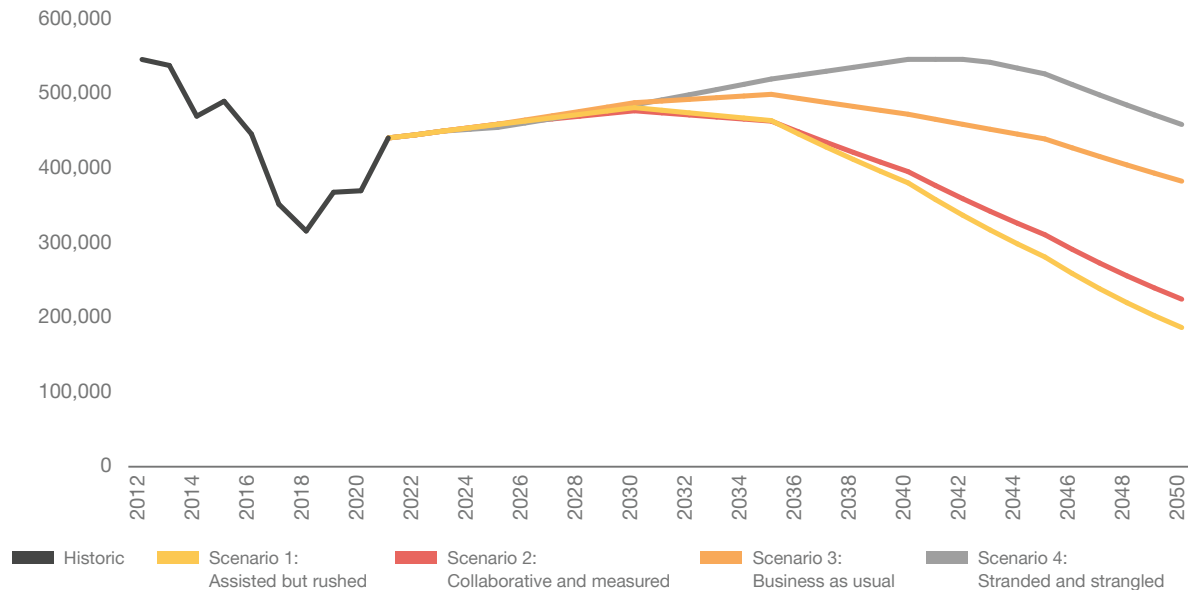
In the scenario where Africa is left to fund its own energy infrastructure from fossil fuel export revenue, jobs could increase up to 2040 and then begin to decline steadily thereafter. By 2050, upstream jobs in the sector will remain flat at around 450,000.

However, if Africa is pressured into rapidly transitioning to renewables and is assisted in this process through renewable energy funding, the transition of workers away from fossil fuel related jobs will be much faster, with a projected decline of 57% or 250,000 upstream jobs leaving the sector by 2050. The greatest unknown is when the decline in fossil fuels jobs will begin and how rapid it will be.

Figure 11 illustrates the potential decline of upstream fossil fuel jobs until 2050 in each of the four scenarios we discuss in the next section of this analysis.



Figure 11. Africa's upstream employees (FTEs)



Source: BLS, UCube, AEC Outlook, PwC analysis

Fortunately, this potential jobs exodus can be mitigated. As explored in the previous section, it is forecast that jobs can be created rapidly in the renewable energy sector and this suggests that there is the potential for an overall gain in employment from a renewable energy transition.

However, it must be noted that these jobs are skewed towards short-term employment opportunities. In tandem with this, the need to develop the specific skills and capabilities required by the renewable energy sector needs to be recognised. These may not overlap with the skills required for employment in the fossil fuel sector. Training and skills development takes time and targeted funding to achieve. In addition, a quick decline in the income fossil fuel exports bring into Africa could have the knock-on effect of creating or losing a wide range of indirect jobs and revenue streams. This is a secondary outflow that will need to be dealt with as fossil fuel exports decline.

In order to fill the financial gap that the phasing out of fossil fuel exports would bring, and to bolster the number of long-term jobs that renewable energy can create, there should be large investments in the skills and technology to manufacture renewable energy related products or infrastructure components locally for export. Promising industries that could do this are the hydrogen industry and the battery metals mining industry. As discussed earlier, Africa is well positioned to gain a competitive advantage in the production of green hydrogen as well as the export of a wide variety of battery metals. This development of new renewable-related industries in Africa would allow the reskilling of workers and the provision of new growth opportunities. It remains to be seen, however, whether such initiatives would be able to reskill and employ sufficient workers in stable, long-term jobs.



7. Driving a measured transition

The energy sector in Africa will experience substantial structural change over the coming decades. Financing this change at the pace required will be one of the most pressing issues that Africa and the world must address. PwC has defined four potential scenarios that could materialise as Africa progresses the energy transition. These are dependent on several factors including: the speed of global net-zero adoption; foreign funding available to Africa; and the level of Africa's economic growth, which will include fossil fuel export revenue.

A growing ‘fault line’ between the developed and developing world

Global energy transition is being led by developed economies and specifically the EU. European Climate Law legally obliges its nations to collectively decrease emissions by 55% from 1990 levels by 2030; and become a net-zero economic zone by 2050. Measures instituted such as regulated emissions disclosure; banning of carbon-intensive technologies; advanced taxation, Emissions Trading Systems and the Carbon Border Adjustment Mechanism are driving a change in behaviour within the EU, but also have wider ramifications for other markets and economies.

Through this acceleration towards net zero, an increasingly widening ‘fault line’ is developing between developed and developing countries. Developed economies are more fiscally robust, with greater access to financial backing to support their economies through these disruptions. Developed economies have the benefit of mature electrical grids with high levels of electrification as well as well-funded utilities that operate in stable, sustainable and robust regulatory environments where there is greater penetration of renewable energy across the grid.

In contrast, nations in Africa are fiscally constrained, with less defined regulatory frameworks in support of the energy transition, stricken utilities, large debt burdens and struggling economic growth. This is coupled with an increasing divide between finance available for developed vs developing economies, as demonstrated by annual investments across all parts of the energy sector in developing and emerging markets having fallen by around 20% since 2016.

The reality is that developed and developing economies do not have equal ability to finance and resource a journey to decarbonise. There is a need for a more coordinated, global just transition, to ensure that no country, or continent, is left stranded.

In line with a just transition for Africa, stronger recognition for economies with low cumulative emissions and lack of fiscal capacity to deliver an energy transition should be considered.

Funding the net-zero transition in Africa

According to PwC estimates, it would cost Africa around \$2.8tn to reach a net-zero energy mix by 2050. This would include annual costs of circa \$33bn between 2020 and 2030; \$111bn between 2030 and 2040; and \$142bn between 2040 and 2050. The Africa-EU Energy Partnership (AEEP) has estimated a similar price tag of \$40–100bn per annum for Africa to meet SDG7 (estimated Africa investment in 2019 was \$17bn by comparison) — ‘ensuring everyone has access to affordable, reliable, and modern energy services by the year 2030’.

Assistance from developed nations will be vital

While there has been increasing support from international donor agencies and multilateral banks, it is insufficient for Africa to keep pace with the global net-zero journey and required emissions reductions.

Currently, Power Africa, a partnership led by the US Government, has committed \$40bn, the single largest capital commitment to Africa. It aims to add at least 30,000 MW of new, cleaner electrical power capacity and 60m electrical connections across sub-Saharan Africa.⁸ This is to be achieved by unlocking substantial wind, solar, hydropower, natural gas and geothermal resources. While this commitment is commendable, Africa needs almost double this investment annually if net-zero targets are to be met by 2050.

⁸ “Power Africa Partners.” U.S. Agency for International Development. Last modified 17 August 2021. <https://www.usaid.gov/powerafrica/partners>.

According to the United Nations Economic Commission for Africa there are several key drivers for an accelerated Africa renewable energy investment case, namely:⁹

- African energy demand and affordability is rapidly increasing based on population growth, an expanding middle class, industrialisation, trade, urbanisation and climate change.
- It is widely recognised that there is an urgent need to address the African energy gap as outlined against SDG 7.
- Africa has a strong advantage in its abundance and quality of renewable resources. Recent independent power producer tenders on the continent have seen some of the cheapest tariffs in the world. A good example of this is the World Bank/IFC Scaling Solar project in Zambia, which saw tariffs of \$0.06/kWh for its 72 MW.

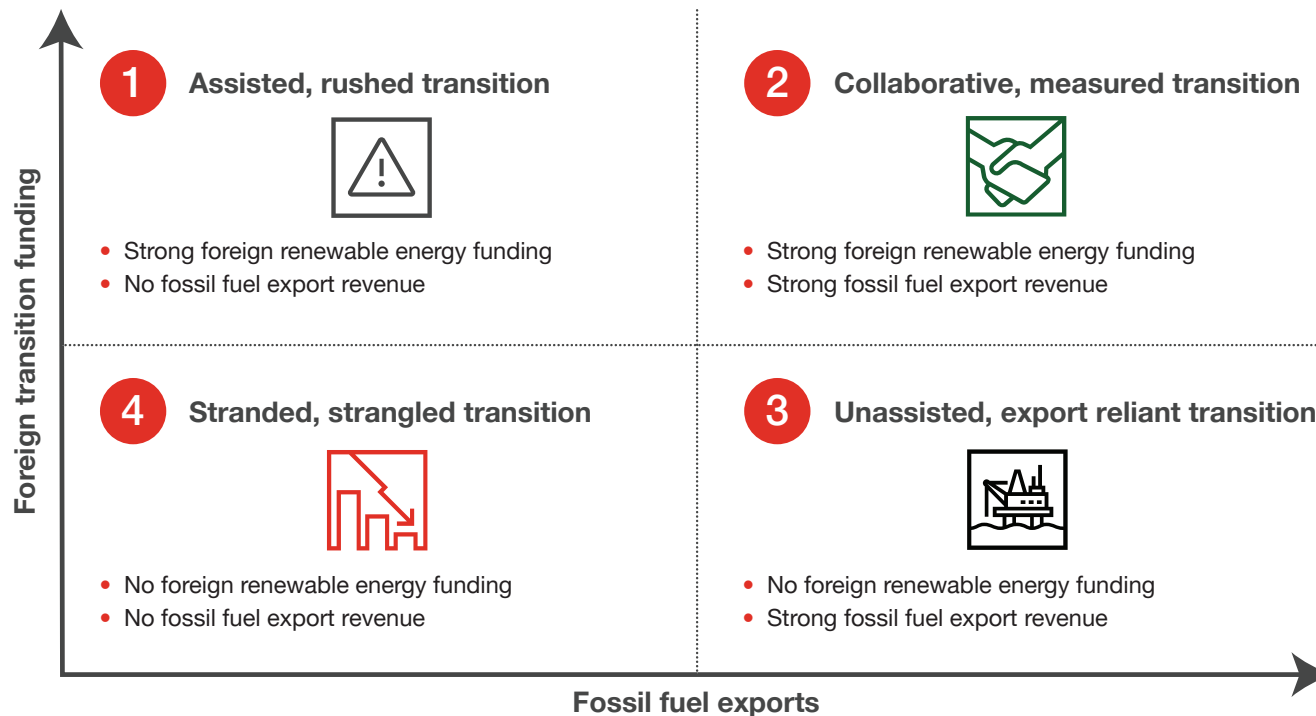
⁹ United Nations Economic Commission for Africa. “The “SDG7 Initiative for Africa: Accelerating clean energy investments for access and climate ambition in Africa.” Accessed September 13, 2021. https://archive.uneca.org/sites/default/files/PublicationFiles/technical_background_papers_-_sdg7_-_ndcs_-_en_-_e2000081.pdf.

What possible energy transition scenarios could be realised in Africa?

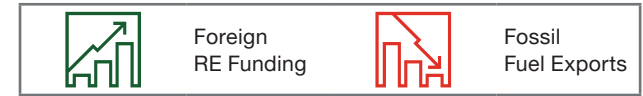
We have outlined four potential directions that the African energy transition could take over the coming decades and have developed these scenarios on the basis of two key factors, namely:

- The level of foreign renewable energy funding that Africa is able to attract for its transition.
- The level of fossil fuel revenue that Africa can still earn as its energy transition unfolds.

Four scenarios for energy transition in Africa



Scenario 1: Assisted but rushed



In scenario 1, foreign investors increase funding substantially to aid Africa’s energy transition. The funding has extremely positive effects in diversifying Africa’s energy mix and reducing the unreliability and scarcity of energy production across the continent.

Funding is coupled with stringent emissions reduction targets and bilateral climate agreements continue to become more prescriptive and punitive on nations that are not rapidly abandoning fossil fuels.

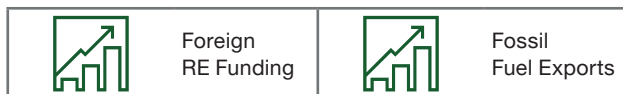
As a result, fossil fuel exports from developing nations carry a form of a punitive cost measure for the importer/developing nations thus accelerating decline in demand. In addition, developed world governments and companies make definitive statements to stop importing and funding fossil fuels globally.

The result of this scenario is that Africa will become a global climate change leader and substantially contribute to achieving the 1.5°C warming target. Support will be required to offset the accelerated loss of Africa’s fossil fuel export revenue. and loss of employment in the sector. Displaced workers will need to be reskilled or supported under a just transition.

African nations are unprepared for such a decline and will rely on large concessional funding and financial stimulus packages to accelerate the benefits of the renewable energy sector.

This could, however, create an environment of economic instability in Africa, rising debt-to-GDP levels and an unhealthy reliance on foreign funding. This would likely hinder the continent’s efforts to stimulate its economy and create a smooth and widely beneficial transition to net zero.

Scenario 2: Collaborative and measured



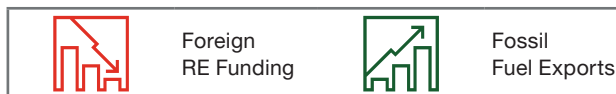
In scenario 2, international investors provide some increase in funding to Africa’s energy infrastructure. As in scenario 1, this helps to rapidly increase energy production and goes a long way toward alleviating Africa’s severe energy shortage. In contrast to scenario 1, the funding comes with fewer conditions on a rapid abandonment of its fossil fuel sector and takes a more medium-to-longer-term view on the transition.

Instead of a radical and more immediate transformation of Africa’s existing energy sector, Africa capitalises on what it currently has, while simultaneously growing its energy capacity through development of additional energy infrastructure that focuses on clean energy. At an international level, multilateral climate partnerships heed the advice of the UNFCCC, which advocates for the principle of common but differentiated responsibilities and capacities, thus allowing measured support for Africa investment in fossil fuels.

Although global energy production quickly moves away from fossil fuels to renewable energy in affluent, industrial nations, Africa follows a more measured approach, which does not threaten its economic stability. Since the world will likely still require some degree of fossil fuel exports in the medium term, Africa is allowed to meet this demand.

This scenario may be the most beneficial for Africa, but face a potential fatal flaw of incumbent fossil fuel providers who are unlikely to forgo market share in order to provide an equitable share to Africa.

Scenario 3: Business as usual

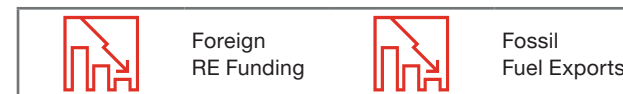


Scenario 3 is largely considered to be ‘business as usual’ where Africa must compete in the open market for finance and export market share. Foreign investment declines as investors look to de-risk and invest in ‘cleaner’ and faster-growing markets in the developed world. Africa’s carbon emissions are also not seen as a priority since they only make up around 5% of annual global emissions, but Africa lacks the fiscal ability to monetise proven reserves.

Africa’s fossil fuel and market exports may receive some tax leniency under jurisdictions such as carbon border taxes, but slowly become less competitive in the global market. There is an understanding that large fossil fuel producers in Africa will be able to capitalise on the twilight years of fossil fuels, but that they must progressively diversify their revenue streams and begin funding renewable energy portfolios and infrastructure.

Despite the fact that Africa continues to derive revenue from fossil fuel exports, this scenario leaves Africa in a potential death spiral in which declining revenue from fossil fuels constrains affordability to transition economies, which leads to less competitive economies and overall lower growth and increased fiscal pressure. Africa continues to lag the developed world on most development metrics, including SDG 7 targets for affordable energy. Africa’s energy transition will therefore likely be slow and stifled.

Scenario 4: Stranded and strangled



Scenario 4 is the worst outcome for Africa. Under this scenario international relations and investment become increasingly segmented, exacerbated by Africa not meeting the developed world’s emissions standards and/or deteriorating economic conditions. There is significant outflow of capital and Africa is left to tackle its energy shortage without foreign investment and just a small volume of donor funds.

Countries that have abundant coal and natural gas reserves will likely look to these in order to urgently increase energy production and domestic consumption, along with as much renewable energy as can be funded. However, while it attracts only 4% of global energy supply funding, transforming the African energy sector by 2050 will likely be unrealistic.

A few of the more resilient African economies may be able to navigate this transition and those that are fortunate to be endowed with minerals used in the production of renewable energy infrastructure may see some gain over this period. However, it’s likely that most countries will not have sufficient time or funds to transition away from fossil fuels in this scenario. Unemployment and economic instability are likely to increase significantly and economies reliant on fossil fuel are likely to experience substantial economic decline.





8. Conclusion

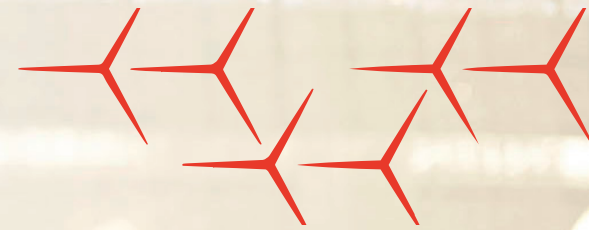
There is no doubt that the energy transition in Africa will be a complex journey and that there isn't a blueprint to solve Africa's challenges. However, the long-term outcome of the energy transition is inevitable and critical to the long-term sustainable future of our planet.

The pace and success of the transition will ultimately be determined at a global level and as such the concept of a just transition must go beyond identifying winners and losers and be positioned as a global challenge in which all nations must succeed.

Africa will have no choice but to adapt to this new world, but to avoid a growing 'fault line' between the developed and the developing world, greater focus on equitable policy, markets and investment is required.

Global climate change discussions at the COP26 conference promise to significantly raise these pressures and discussions with the hope that a combination of stronger foreign financial support, equitable policy and market allocations as well as firm commitment and planning from Africa will result in a favourable platform to support a sustainable Africa energy transition.

Contacts



Andries Rossouw

*Africa Energy, Utilities and
Resources Leader*
andries.rossouw@pwc.com



Wayne Jansen

*Energy, Utilities and Resources
Consulting Leader*
wayne.jansen@pwc.com



James Mackay

*Energy Strategy and
Infrastructure*
james.mackay@pwc.com



Pedro Omontuemhen

*Africa Oil and Gas
Leader*
pedro.omontuemhen@pwc.com



Jayne Mammatt

*Sustainability and
Climate Change*
jayne.mammatt@pwc.com



Contributors

- Andries Rossouw
- James Mackay
- Christie Viljoen
- Jeremy Dore
- Matthew Plumstead
- Pearl Maseko
- Stacey Buck
- Wessel van Wyk



At PwC, our purpose is to build trust in society and solve important problems. We're a network of firms in 156 countries with over 295,000 people who are committed to delivering quality in assurance, advisory and tax services. Find out more and tell us what matters to you by visiting us at www.pwc.com.

PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see www.pwc.com/structure for further details.

© 2021 PwC. All rights reserved (21-27449)

