RENEWABLE ENERGY PATHWAYS IN AFRICA

LANDSCAPE AND SCENARIOS TO 1.5°C

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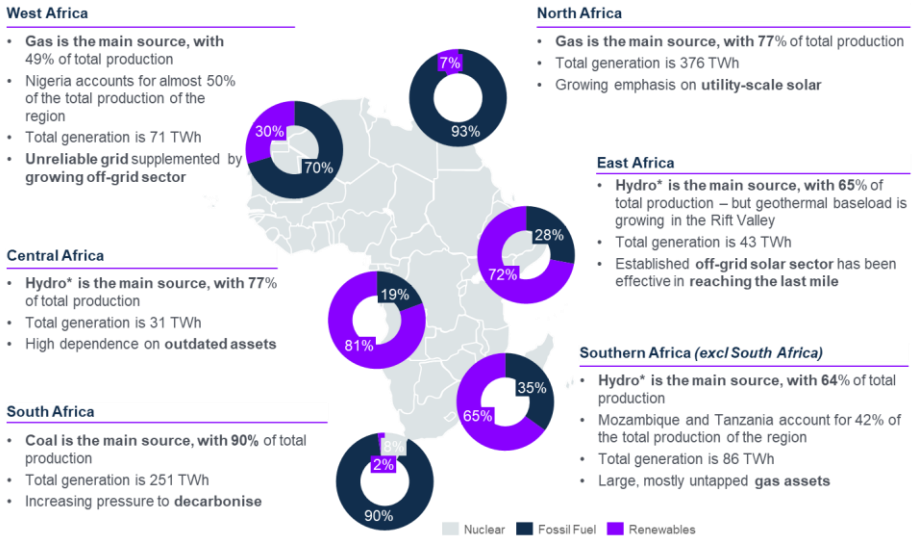
This report was created by Dalberg in partnership with the UN High Level Champions Team. We collated knowledge from across our work to present this concise view of Africa's energy landscape and the potential pathways to achieve a 1.5°C future. We spoke to leading experts and companies across the industry to understand the challenges they face and key gaps. This study synthesizes findings to offer potential areas for intervention by industry stakeholders.

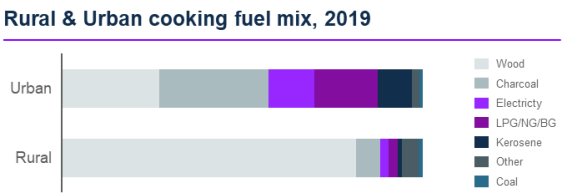
AFRICA'S CURRENT ENERGY LANDSCAPE

Africa's emissions totalled 1,233 MT in 2018, making up 6% of global emissions.[1] Almost 40% of these were from electricity and heat production with residential emissions mostly from cooking making up a further 7% of the total.[i] Africa's emissions are projected to reach 7,700 MT or 10% of the global total by 2050 under BAU scenarios – representing 18% of the total global emissions growth and posing a material threat to achieving a 1.5°C future.[2]

The electricity generation mix varies across regions of the continent; fossil fuels dominate the larger economies of South Africa, North Africa and much of West Africa, while renewables are the mainstay in East, Central and Southern Africa, mostly derived from hydroelectric plants[ii] but with growing shares of solar and geothermal.[3]



Cooking fuel is mostly sourced from wood, with growth in LPG in urban areas.[4] The high costs of LPG and electric cooking have slowed adoption, especially in comparison to low-cost charcoal and virtually no-cost dung and wood. Only electric cooking integrates with the grid.



Electricity access across Africa reached 56% in 2020, including on-grid, mini-grid and off-grid solutions. Yet 579 million still lack access - two-thirds of the global total without access.[5]

153 million Africans have an unreliable grid connection, relying on alternative sources to meet their needs.[6] To supplement poor service, customers often rely on multiple sources to provide a more consistent connection – and supplementary sources include polluting diesel generators that are neither regulated nor reflected in official statistics.

231 million people globally access electricity via off-grid solar (OGS) devices, and in 2018, 52% of sales were in Africa.[7] The off-grid solar market is particularly strong in East Africa, where competition among OGS companies is vibrant and distribution networks in Kenya and Uganda are relatively well established.

~900 million people in Africa lack access to clean cooking, and population growth is outpacing efforts to provide access, with only 4.5 million people gaining access annually.[8] The price of fuel is a key factor driving access, whilst behavioural norms can slow the adoption of alternative fuels.

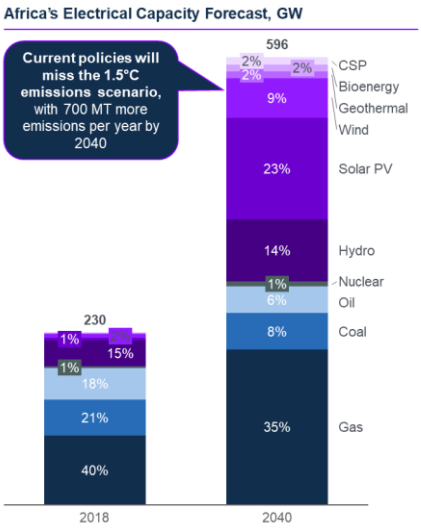
[i] Residential refers to all emissions from fuel combustion in households, for which stove emissions are a key driver.
[ii] Whilst Hydro is a renewable resource, there are environmental concerns associated with large-scale hydro due to disruption to communities and natural ecosystems. As a negligible proportion of production (outside SA), nuclear energy is excluded.

AFRICA'S FUTURE ENERGY LANDSCAPE

The technical potential of renewable energy is sufficient to power Africa's energy needs to 2050 and beyond. Across the continent, decreasing infrastructure costs and technological advances continue to increase the economic potential of renewables, presenting a leapfrog opportunity to expand capacity and generation to meet energy needs and access goals.

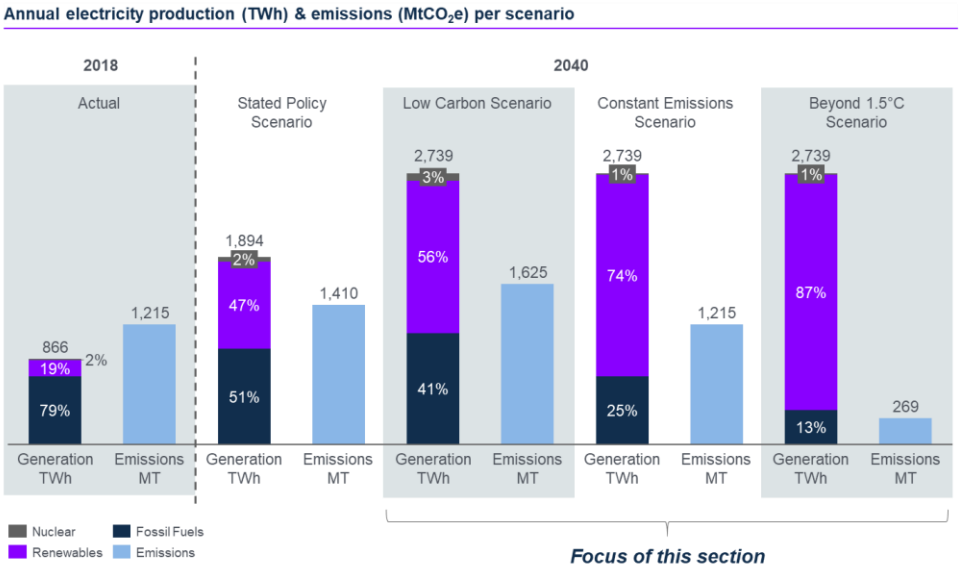
Africa will miss 1.5°C pathways under current policies, with a forecast 60% rise in fossil fuel capacity and a 45% increase in emissions.

Under current policies, Africa will miss the 100% access goal by 2030 and fail to ensure a just transition. Energy access is projected to reach 68% by 2030, with an additional 415 million connected. However, due to the forecasted population increase of 30% across the continent, 530 million people will still lack access by 2030 – almost the same number that lack access today.[9] Reaching 100% access to electricity requires not just increased generation capacity, but also diverse and decentralised solutions to reach the last mile. Reaching 100% access to clean cooking is likely to require a mix of fuels and cookstove solutions. Clean access options include both electricity and ethanol, yet the electrification of cooking is only renewable if the grid it relies on is renewable-powered.[10]



WHAT COULD A 1.5°C SCENARIO LOOK LIKE?

Achieving a 1.5°C scenario in Africa's energy sector does not require sole dependence on renewables. It is possible to shut down highly emitting fuels to reach emissions targets and meet 100% access goals.[iii]



We built on the IEA's 'Low Carbon scenario' to create two further emissions scenarios for 2040.[11] One holds 2018 emissions constant, with no future growth in fossil fuels; the other includes a decommissioning of coal and oil, plus constant gas capacity to reduce in emissions by 78%, going beyond 1.5°C pathways.[12]

A 'Beyond 1.5°C' scenario outlines a path for Africa's energy sector to do more than its 'fair share' of emissions reduction. This provides leeway for other sectors of the economy – which may be harder to decarbonise – to have smaller emissions reductions and still reach 1.5°C overall.

IEA Low Carbon Scenario	Constant Emissions Scenario	Beyond 1.5°C Scenario
• Greater access and lower emissions future than current policy projections, but fossil fuels still increase • Almost half of the energy will be produced by fossil fuels in 2040 • Does not meet the Race to Zero breakthroughs target of 60% renewables share • 34% increase in emissions from 2018	• Maintains fossil fuels from 2018 • Nuclear energy is constant vs. 2018 • Exceeds the Race to Zero breakthroughs target of 60% renewables share • Renewables make up the gap in the same proportion as IEA scenarios • 0% increase in emissions from 2018	• Reduces high emissions fossil fuels first, requiring a total shut down of coal and oil in electricity generation • Nuclear energy and gas are constant at 2018 capacity • Exceeds the SBTi median target of 4.5% annual emissions reduction; in line with the UN Climate Change Conference at Marrakech • 78% decrease in emissions from 2018 – Beyond a 1.5 °C scenario

Upfront costs in the 'Beyond 1.5°C' scenario are higher due to the weighting of more renewables, plus decommissioning costs.[13] Renewables have a higher upfront investment for installation, but lower operation and maintenance cost. However, after 13 years, the lower running costs of the 'Beyond 1.5°C' scenario mean that this scenario breaks-even with the low-carbon scenario, and thereafter makes annual savings.[iv]

[iii] The scenarios outlined here do not include generation and emissions from cooking, with the exception of electric cooking

Across all three low carbon future scenarios, generation increases to meet 100% access goals, from 866 TWh in 2018 to 2,739 TWh in 2040. This drives up the overall annual cost compared to 2018, but the levelised cost of energy (LCOE) is in fact lower in a 'Beyond 1.5°C' scenario than in a 'low carbon' scenario.[v] LCOE is lower across the 'Beyond 1.5°C' scenario due to (a) the different energy mix including lower nuclear capacity, (b) a 37% price decrease in LCOE for renewable energy, and (c) removing coal and oil.[14] **By 2040, it is more cost effective to pursue a 'Beyond 1.5°C' scenario than to continue with current policies, whilst achieving a fair and just transition to 100% access.**

Setting an ambitious agenda could bring these scenarios forward, making a 1.5°C pathway possible even by 2030. A 2040 target is outside many policy planning timeframes and does not compel immediate action. Policymakers may be tempted to plan for half this capacity by 2030 and half in the next decade, relying on future technologies to fill the gap. However, to meet 100% access goals by 2030, the majority of this infrastructure needs to be built by 2030. The urgency of the climate crisis and the risk of locking into fossil fuel pathways highlights the need for ambitious goals within the next decade.

LEVERS TO REACH 1.5°C

In order to achieve a 1.5°C pathway, Africa needs to overcome five key challenges in the energy landscape.

Renewable Energy	Load Balancing	Last Mile	Bankable Demand	Clean Cooking
Increase the share of renewables as a proportion of total electricity capacity mix, in line with the need for emissions cuts to reach a 1.5°C pathway	Switching to renewables can cause **load balancing challenges** for a grid system without a reliable baseload	**Lack of user-centric last mile solutions** to provide electricity to remote households	**Lack of "bankable" future demand** across the continent raises the need for anchor energy offtake	**Polluting cooking fuels continue to dominate** – Wood, charcoal and kerosene continue to dominate cooking fuels without sufficient alternatives

INITIATIVES

We have focused on three key levers for next steps: (1) 1.5°C pathways planning, (2) bankable energy demand, and (3) climate accelerator.

1.5°C Pathways Planning	Bankable Energy Demand	Climate Accelerator
• Misconceptions on emissions growth, a lack of information & poor enabling environment **hamper progress towards 1.5°C** • **Outlining a clear pathway** to reach 1.5°C in the energy sector is key to help attract investment in renewables	• Bankable clean energy demand can help to **drive deployment of renewables and raise profitability** • **Sustainable industrial parks, emerging climate technologies** – particularly hydrogen, **off-grid productive use** and **anchor clients** present opportunities • There are **few projects on the continent** and a lack of understanding about applications in African markets	• Businesses can help create an **innovative, diverse & decentralised and user-focused** energy system • However, they face challenges in **deploying technologies, reaching the last mile, and accessing finance**
• Africa's energy industry needs **guidance on how to reach 1.5°C**, and a guide for policy makers to **enable the private sector** • Climate change, decarbonisation, and **the 1.5°C target should be front and centre of all initiatives** and country development plans	• To attract bankable energy demand, there is a need to **map the potential opportunities, engage players and identify mechanisms**	• Africa's energy industry needs a **climate accelerator** to incubate, scale and advise RE businesses • Accelerators can help to **build the pipeline** of renewable energy and climate technologies in Africa

[iv] Investment costs have been discounted to 2018 values in line with the IEAs 2018 baseline scenario. Break-even analysis assumes linear investment in new capacity to 2030, not incorporating any discounted cash flow

[v] Annual cost of electricity calculation based on levelised cost of energy (LCOE), the ratio of lifetime costs to lifetime electricity generation. Both are discounted back to a common year using a discount rate that reflects the average cost of capital

Africa can lead the world in deploying a just, clean energy system that meets access goals and aligns with a 1.5°C pathway

A fossil-fuel driven, centralised, utility-led energy system does not work for a renewable energy system and is incompatible with reaching net zero and a 1.5°C pathway. Yet there is a continuous narrative that fossil fuels and utilities are the preferred route for African systems in order to meet development goals. Continuing on this path will only lead to more emissions, more climate damage, and more stranded fossil fuel assets in future – ultimately putting development goals further out of reach.

The transition to net zero and building an innovative, diverse and decentralised and user-focused clean energy system renewables is a major opportunity for Africa. Africa has enough renewable energy to power the needs of the entire continent. Choosing a 1.5°C pathway is more cost-effective in the long run and technology costs are expected to continue to decline as new applications and innovations transform the global economy.

The private sector has a key role to play in deploying low-carbon infrastructure and new technologies that meet Africa's access goals for both large-scale on grid projects but also innovations that reach the last mile. Forward-thinking governments can facilitate this transition, helping to leapfrog legacy energy systems by outlining the path to a low-carbon future, setting the appropriate policy framework and attracting the right players and projects for deployment.

Achieving a 1.5°C pathway will enable Africa to demonstrate global leadership in the energy transition – broadening access with a just transition and increasing energy security whilst decreasing emissions. At the same time, a 1.5°C pathway will power economic development, build more robust economies and lead to the creation of green jobs and sustainable livelihoods.

The 1.5°C pathway outlined in this report is both feasible and affordable – but is just one part of the systems transition needed. Further research and analysis is needed into the outstanding levers, not prioritised in this report. Particularly, we need a better understanding of what a decarbonised, high access cooking sector looks like for Africa. A true 1.5°C pathway needs to include all sectors and all society in a **holistic and systems-wide transition to a just and low-carbon future**.

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[1] IEA, Data and Statistics, 2020
[2] Dalberg, Opportunities for Deeper Climate Philanthropy Engagement in Africa; Annex 1: Sector Emissions Drivers, 2019
[3] IEA, Africa Outlook Report, 2019
[4] Dalberg, The State of Access to Modern Energy Public Disclosure Authorised Cooking Services, 2020
[5] World Bank data, 2019
[6] GOGLA, Off grid solar market trends report, 2020
[7] GOGLA, Off grid solar market trends report, 2020
[8] World Bank data, 2019; IEA, World Energy Outlook, 2020
[9] IEA, Africa Outlook Report, 2019
[10] IEA, Africa Outlook Report, 2019
[11] All scenarios based on Dalberg Analysis and IEA, Africa Outlook Report, 2019
[12] SBTi, Foundations of SBT Setting, 2019
[13] Sweden Royal Institute of Technology, "Electrified Africa – Associated investments and costs", 2016
[14] IEA, Data and Statistics, 2020