



An overview of the African energy sector: Now and the future

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Introduction

Energy & Utilities is pleased to present this 2-part report on the dynamic power sectors of Africa. It combines a useful overview of key sectors with close looks at twenty countries across the regions. As such, it serves as a useful primer for the Africa Energy Expo & Conference, occurring 4 - 6 November, in Kigali, Rwanda.

Africa is exciting. The continent is edging closer to a new energy paradigm that promises to provide affordable power to millions. Multilateral financing continues to play a critical role in most project developments. Yet Africa's own financial sectors are becoming increasingly more sophisticated and important capital accumulation is occurring. There is a growing momentum of new energy projects, and a growing role for renewables in various forms, with indigenous know-how and finance joining foreign investment and expertise.

In Part 1 we look at thermal, geothermal, hydroelectric, off-grid and minigrid, and investment trends. In Part 2 we provide insightful profiles of twenty African countries, handy overviews of their power sectors with data on installed capacity for thermal and renewables, with attention to key actors and policies in each country.

These offer helpful overviews to inform discussion at the Africa Energy conference and on the expo floor at Kigali.





PART 1

Africa Advances

a power sector overview

Africa advances on many paths

With some 1.3 billion people, Africa is home to around a fifth of the world's population, yet it accounts for just 3% of electricity use.

The huge gap between electricity supply and demand in Africa is well known. Only a handful of countries on the continent can boast of 100% electricity access, including Egypt and Tunisia, while a few others get close, such as Mauritius, Cabo Verde and Gabon, according to data from the World Bank (see table in Excel). Some of the larger economies, such as South Africa and Ghana, provide the vast majority of their people with power, but they are still not yet at 100% and power cuts remain a problem – particularly in South Africa where it is an increasingly important political issue.

Many other countries have far worse track records, particularly in rural areas – electricity access in Mozambique, Malawi, Sierra Leone, Liberia and some other countries is well below 10% in rural areas. Across the continent as a whole, electricity access in rural areas is less than 27%, according to the African Development Bank (AfDB).

Yet the gap is gradually closing, helped by the increasing diversity of power sources. Renewable power projects are growing in size and reach and storage solutions are starting to address the intermittency of solar and wind power. New forms of financing are also being deployed to make the most of local capital.

There remain plenty of challenges though. While the energy transition could allow African countries to create extensive, green energy networks, there remain numerous financial, regulatory and logistical problems that need to be overcome before the continent's full potential can be unleashed. In the meantime, governments insist on the need to continue expanding thermal power generation capacity.

Thermal power projects

Africa is home to some of the world's largest producers of hydrocarbons. Nigeria, Algeria, Angola and Libya

are among the world's 20 biggest oil producers, while Algeria, Egypt and Nigeria are among the 20 largest natural gas producers. Several African countries also produce coal, most notably South Africa, but also some of its neighbours including Botswana, Mozambique and Zimbabwe.

Given that situation, it is perhaps unsurprising that coal and natural gas are the two largest sources of electricity generation across the continent, followed by hydropower and oil. The three carbon fuels in that list – gas, coal and oil – between them accounted for about 77% of Africa's total electricity generation in 2019, according to a 2022 report by the International Renewable Energy Agency (IRENA), in collaboration with the AfDB.

While much of the world's attention has been on the ramping up of renewable energy sources, including hydropower, wind, solar and geothermal power, there remains a strong appetite for conventional fuels, with natural gas in particular identified by many African governments as a vital 'transition fuel' in the continent's journey to reach its net zero carbon emission targets. This has been the cause of some friction with international partners and, as a result, sourcing finance for gas-fuelled plants has become more difficult in recent years as western backers have shied away from such projects.

Nonetheless, there are numerous thermal power plants under development, or at least under consideration, around the continent – both in terms of new plants being built and existing plants being expanded.

A key consideration is often the need for reliable baseload power – something that wind and solar power plants cannot provide due to intermittency of those sources and the under-developed nature of existing power storage technology.

Hydroelectric Power

According to the International Hydropower Association (IHA), there was some 33.4GW of installed hydroelectric power capacity across sub-Saharan Africa as of 2021 (see table). The most important country is Ethiopia, which has installed capacity of just over 4GW. It is followed by Angola (3.8GW), South Africa and Democratic Republic of the Congo (2.8GW).

On an electricity generation basis, the picture is slightly different, with Mozambique the leading actor with 15TWh in 2021, followed by Zambia (14.9TWh), Ethiopia (13.6TWh) and Angola (10.7TWh).

The Paris-based International Energy Agency (IEA) estimates that hydropower provided 16% of Africa's electricity output in 2020, with 90% of the generation capacity located in sub-Saharan Africa (SSA).

Even within SSA though, the industry is concentrated in a relatively small number of countries. Just 15 countries across SSA account for more than 90% of the installed hydropower capacity and generation.

That concentration is likely to increase in the years to come. The IEA says large hydropower projects are planned in 15 countries, including existing sector-leaders such as Angola, Ethiopia, DRC, Nigeria and Tanzania. Reservoir plants make up around 83% of this project pipeline – these are more flexible in producing power and better at managing water flow than run-of-river plants, which account for 6% of the planned schemes. A further 6% are pumped storage plants and the make-up of the remaining 5% is unknown.

Selected major hydropower projects in SSA, planned or underway

Source: E&U

Country	Project	Capacity (MW)
Angola	Caculo Cabaça	2,172
Cameroon	Nachitgal	420
Democratic Republic of Congo	Grand Inga	40,000
Ethiopia	Grand Ethiopian Renaissance Dam (Gerd)	6,450
Nigeria	Mambilla	3,000
Nigeria	Zungeru	700
Tanzania	Julius Nyerere	2,115
Zambia / Zimbabwe	Batoka Gorge	2,400

Geothermal

Africa's geothermal power capacity is concentrated around the East African Rift System, and in Kenya in particular. According to IRENA, Kenya currently has some 863MW in installed capacity in 2021, putting it far ahead of the next nearest country Ethiopia, which has just 7MW. Indeed, for Kenya, geothermal power was the largest single element of its electricity supply industry.

Where Kenya has led, others are seeking to follow, with activity in a number of nearby countries. In December, the African Development Bank Group approved a \$10m grant from the Sustainable Energy Fund for Africa (SEFA) for the Tulu Moyo geothermal project – a drilling programme that should will add 50MW to Ethiopia's power system, with a potential second phase adding a further 100MW.

In August 2022, the UK's Northern Powerhouse Investment Fund (NPIF) reported that Marriott Drilling Group had raised a "seven-figure loan" from NPIF - Mercia Debt Finance to help finance its work on the construction of two geothermal power stations in Ethiopia.



The Tanzania Geothermal Development Company (TGDC), a subsidiary of the state-owned Tanzania Electric Supply Company, issued tenders in November for drilling services and equipment to be used in its Ngozi geothermal drilling programme. That is one of several sites earmarked for development around the country, as part of wider ambitions by TGDC to develop up to 200MW of geothermal capacity in the coming years.

Off-grid, mini-grid and home systems

With large parts of Africa far from electricity transmission lines, the trend for off-grid and mini-grid networks continues to grow. These are generally powered by fossil fuels or solar photovoltaic plants, but there are also some schemes based on power from hydroelectric, wind and biofuel sources.

According to the World Bank's Off-grid Solar Market Trends Report 2022, some 586 million people in SSA are not connected to the grid – with the largest number being in West Africa, where 213 million are without a link. A further 182 million people around the continent have unreliable grid access.

Electricity grid access (millions of people)

Source: World Bank

Region	Unconnected	Unreliable grid
Central Africa	109	14
East Africa	161	41
West Africa	213	94
Southern Africa	103	33
Total	586	182

The World Bank estimates that the majority of new electricity connections in the period 2020-25 will come from off-grid solar, including 53% of new connections in Southern Africa, followed by 55% in West Africa, 64% in East Africa and 81% in Central Africa. However, the rate of growth has shown sharply divergent trends in different regions in the past few years.

Sales of solar home systems (SHS) in the East Africa region fell from 737,000 in 2019 to 721,000 in 2020 and 569,000 in 2021. Lanterns and multi-light systems (MLS) have fared better, with sales of 3.4 million in 2019, dipping to just over 3 million in 2020 before rising to 3.5 million in 2021.

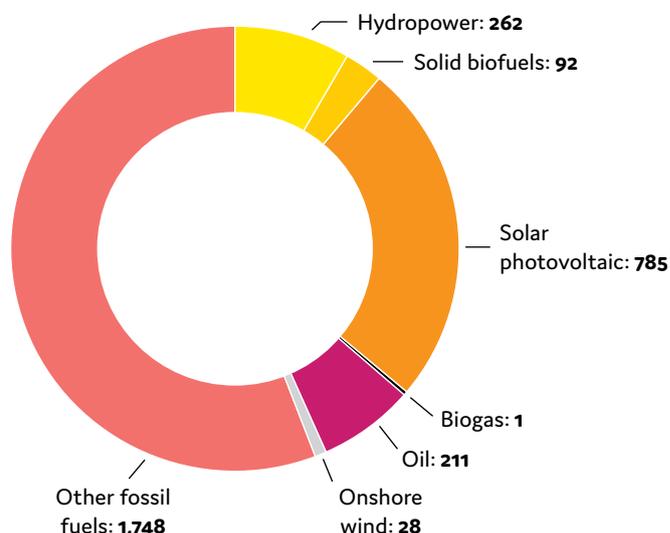
In West Africa the trend has been much more positive, with a steady increase in sales over the past three years in both categories, with lantern and MLS sales reaching 685,000 in 2021 and SHS sales reaching 377,000 that year.

In Central Africa, sales of lantern and MLS systems shot up to 348,000 in 2021, a rise of 140% on the year before. Sales of SHS were more modest but also more than doubled year-on-year to 64,000 in 2021.

Despite the growth seen in the sector to date, there is plenty of room for further development. Off-grid services provide just 2.5% of electricity access across SSA, according to data from IRENA for 2021. The off-grid total capacity of 3.1GW compares to 122.4GW for on-grid electricity.

Off-grid electricity generating capacity by fuel (MW)

Source: IRENA



Off-grid funding

Funding has been forthcoming for this sector. Globally, the off-grid solar sector attracted \$2.3 billion of capital from 201-2021, according to the database maintained by GOGLA, the global association for the off-grid solar energy industry.

That finance comprises a mixture of debt, equity and grants, but it has been heavily concentrated, both in geographic and commercial terms. Some 49% of funding was assigned to East Africa. In addition, seven large companies absorb the majority of investments, all of which are active in Africa. They are: Bboxx, d.light, Engie Energy Access, Sun King, Lumos, M-Kopa and Zola.

Investment trends

Between 2000 and 2019, \$109 billion worth in public commitments were made to the energy sector across Africa, according to IRENA. More than half of the total – \$64 billion – was directed towards renewable energy, of which \$50 billion went towards hydropower projects from 2010 onwards. This is a reflection of the general trends for more finance to be directed into renewables – while the renewables sector attracted 14% of public investment in energy in 2000, by 2017 it had reached a record 79%.

A small number of investors accounted for the majority of those financial commitments, led by China (51% of the commitments), the International Bank for Reconstruction and Development (14%) and the Islamic Development Bank.

While investments in renewable energy have increased, they are unevenly distributed, with most going to the more developed economies. The top five recipients over the period were South Africa, Egypt, Nigeria, Morocco and Kenya – between them, they received more than half of all renewable investments. The 33 least-developed countries (LDCs) in Africa attracted just 37% of renewable energy commitments in Africa from 2010-19.

The discussion around financing of power projects in Africa has become inextricably linked with the global push to take action to minimise the damage from climate change. Many western financing institutions are now refusing to support oil and gas projects, or at least heavily prioritising renewable schemes. At the same time, most African governments insist that natural gas in particular must be allowed to play a role in their electricity supply industries in the short-to-medium term.

New financial frameworks continue to be drawn up, including South Africa's \$8.5 billion Just Energy Transition (JET), which was announced in November 2021 at the COP26 summit in Glasgow and which offers a model which could be replicated in some other parts of the continent. This scheme involves a partnership between the governments of South Africa, France, Germany, the UK, US and the EU and aims to accelerate the decarbonisation of South Africa's economy.

Governments are also increasingly keen to develop and tap local sources of finance, although this is not a realistic option in many parts of the continent.

The AfDB says it has a portfolio of energy projects worth more than \$12 billion. Its key initiatives include the New Deal on Energy for Africa, which launched in 2016 and aims for universal energy access, with priority given to the use of low-carbon technologies. From 2016-20, the AfDB approved \$7.2bn in funding under the New Deal and mobilised a further \$850m in co-financing resources. Overall, this funding is expected to add 3GW of installed generation capacity, of which 2.2 GW will come from renewable energy sources. The funding will also support the construction of more than 7,000km of transmission lines, including 3,000km of regional interconnections.

Other AfDB initiatives include the Desert-to-Power initiative (DtP) to accelerate economic development in the Sahel region through the deployment of solar technologies; the Sustainable Energy Fund for Africa (SEFA); and the Facility for Energy Inclusion investment platform.



PART 2

Country snapshots

a closer look at 20 countries

Africa Snapshots: a closer look at 20 countries across North, West, East and Southern Africa

Angola

Angola's electricity sector is dominated by natural gas-fired plants, which provided 4.7TWh of electricity in 2021, and hydroelectric sources, which provided a further 11.7TWh. A small amount of power is also generated from biomass sources. Access to electricity stands at 48% country-wide, with 75% in urban areas and 7% in rural areas; those without a connection tend to rely on diesel generators. The government is aiming to increase the national electrification rate to 60% by 2025. Several gas-fired, hydro and solar projects are being developed and the government is also encouraging the development of smaller, off-grid projects.

The General Electricity Act 2015 set a legal framework for independent power generation, and subsidy cuts in 2019 helped to move the country closer to cost-reflective tariffs, which has encouraged potential private sector investors.

Angola's transmission system comprises three separate grids, in the north, centre and south of the country, along with a number of smaller isolated grids in the east. There are limited links between the three main grids at the moment, but there are plans to connect them grids a national backbone.

Key actors: Ministry of Energy and Water; Instituto Regulador dos Serviços de Electricidade e Águas (IRSEA); Prodel (electricity generation); RNT (transmission); ENDE (distribution).

Key policies / legislation:

- General Electricity Act
- National Renewable Energy Strategy
- Sustainable Energy for All 2030
- Presidential Decree No. 117/20 (on environmental impact assessment and licensing)

Cameroon

Cameroon has a relatively small electricity supply industry given its population of almost 28m. The country's installed capacity is around 1.8GW, with 48% of that coming from hydroelectric plants. Under its National Development Strategy 2020-30, the government is aiming to add a further 3.5GW by 2035, most of which is to be developed by private sector partners. The authorities are also aiming add 1m new connections by 2035 in pursuit of universal electricity access; at the moment some 65% of Cameroonians have access, with 95% in urban areas and 25% in rural areas. The plans will be significantly helped if distribution losses of some 25% can be reduced.

If achieved, the capacity additions should enable Cameroon to export some of its excess electricity to neighbouring countries. Investment is also needed to bolster the country's planning and regulatory capacity to make the most of any additional capacity.

Cameroon has independent grids in the north, south and east of the country. There are plans to unify the grids by 2035 and to also build an interconnection with Chad, backed by the African Development Bank (AfDB) and the World Bank.

Key actors: Ministry of Water and Energy; National Society of Transport Electricity (Sonatrel), Rural Electrification Agency, Cameroon Electricity Corporation

Key policies / legislation:

- National Development Strategy 2020-30
- Electricity Sector Development Plan 2035
- Energy Sector Development Project



Republic of Congo

The Republic of Congo's electricity system has a total generating capacity of 641MW, of which 39% comes from renewable sources (hydroelectric). Access to electricity is currently running at around 50% nationwide, rising to 67% in urban areas and 12% in rural areas.

In 2021, total generation was around 4TWh, but there is plenty of potential to generate far more. According to the US Energy Information Administration (EIA), the country has as much as 2.5GW of hydropower potential, but less than 5% of this has been exploited to date.

Existing facilities include the 15MW Djoué, 120MW Imboulou and 74MW Moukoulou power plants. Others are being planned, the largest of which are the 600MW Chollet plant on the Ngoko River and the 1.2GW Sounda Gorge plant. Investment is also needed to reduce distribution losses.

Key actors: Ministry of Energy, Société Nationale d'Électricité (SNE).

Key policies / legislation:

- Laws No. 14-17 of 2003
- Decree No. 2010-822 of 2010 on the development strategy for power and water

Democratic Republic of Congo

Hydroelectric power accounts for almost all the electricity generated in the Democratic Republic of Congo (DRC), with most of it coming from the Inga I and II dams, which have an installed capacity of 1,775MW. However, more could be done to improve the electricity access rates though. They are currently running at 21% across the country, including 44% in urban areas and 1% in rural areas. Much of the power generation development has to date been closely linked to the country's extensive mining sector.

To improve the situation, the government of President Félix Tshisekedi is seeking to increase power generating capacity, with ambitions to make more of the country's ample hydroelectric potential from its many rivers.

Off-grid and metro-grid projects are also being seen as a viable way to supply more isolated towns and cities in the interior of the country.

The government is also looking to build or rehabilitate several geothermal stations across the country. Within this, a priority is rehabilitating the turbines at the Inga I and II plants and building the 4.4GW third phase of the Inga project, with the bulk of its power due to support mining activities and provide exports to South Africa. This is part of a wider, eight-dam Grand Inga project that could ultimately generate as much as 40GW.

Key actors: Ministry of Hydraulic Resources and Electricity; state utility Société National d'Électricité (SNEL)

Key policies / legislation:

- Law No. 14/011
- Regional and Domestic Power Markets Development Project
- Investment Code Law No.0004/2002

Egypt

Egypt has emerged as an important regional market for renewable energy and transition fuels, including hydrogen, in recent years. The COP27 United Nations climate change summit held in Sharm El Sheikh in November 2022 saw a string of major investment announcements being made, including a 10GW wind farm to be developed by the UAE's Masdar. Construction of the country's first nuclear power plant began in mid-2022, at a site on the Mediterranean coast.

The government is aiming for 42% of electricity supply to come from renewable sources by 2030, rising to 60% by 2040. As of 2022, the figure stood at 10%. The government wants the country to become a regional energy hub and, with that in mind, interconnectors have been set up with neighbours including Jordan, Sudan and Libya; another connection to Saudi Arabia is currently being built and others to Europe are being discussed. Significant investment needs to be made to upgrade the country's distribution network and there are also macroeconomic challenges stemming from the weakness of the Egyptian pound.

Key actors: New and Renewable Energy Authority; Egyptian Electricity Holding Company; Egyptian Electricity Transmission Company; The Sovereign Fund of Egypt (TSFE)

Key policies / legislation:

- Renewable Energy Law No. 203/2014
- New Electricity Law No. 87/2015
- Investment Law No. 72

Equatorial Guinea

Equatorial Guinea relies on natural gas for most of its generating capacity. Access to electricity in urban areas is around 90% but much lower in rural areas, leaving a national average of some 67%. Almost all the generating capacity is in the hands of the state, with the only independent power producer (IPP) being a 10MW plant operated by methanol producer Ampco Gas.

National gas company Sonagas GE is aiming to develop more natural gas-fired generating capacity, as well as 100MW of solar power and 50MW of battery storage, in order to free up more natural gas which can then be sold to export markets. There is also the potential to develop geothermal power, particularly on Bioko island which is home to the capital Malabo and which, like the country's other islands, is volcanic.

Key actors: Ministry of Mines, Industry and Energy; Sociedad de Electricidad de Guinea Ecuatorial (SEGESA)

Key policies / legislation:

- National Action Plan for the Development of Renewable Energies 2018-25
- Law 7/2003. Regulation on Equatorial Guinea's Environment

Ghana

Under a \$3bn support deal with the International Monetary Fund, which was formally approved in May 2023, Ghana is expected to make significant reforms to its power sector, in order to reduce the debt levels of

the Electricity Company of Ghana and place the sector on a more sustainable footing.

The total installed capacity is 5,349MW. Some 68% of power generation is fuelled by oil, natural gas and diesel, with hydropower making up the rest. The latter is controlled by the Volta River Authority and Bui Power Authority. The government set out ambitions in its 2019 Renewable Energy Master Plan to boost the position of renewable energy over a 12-year period.

The national electricity access rate is relatively high, standing at close to 87%, including 74% for rural residents and 95% for urban residents. Excess generation has been a problem at times, but Ghana exports power to nearby countries including Togo, Benin and Burkina Faso. Ongoing grid expansions will enable exports to other neighbours. Distribution losses are low at 6%.

Key actors: Ministry of Energy; Bui Power Authority; Volta River Authority; Ghana Grid Company; Electricity Company of Ghana; Northern Electricity Distribution Company (Nedco).

Key policies / legislation:

- Renewable Energy Act 2011
- Renewable Energy Master Plan
- National Energy Policy
- Energy Sector Strategy and Development Plan

Kenya

Kenya has one of the lowest development costs for geothermal power in the world, an advantage that means a majority (68%) of installed capacity now comes from renewable sources. Total generating capacity in 2022 was almost 3,500MW, but that is expected to rise to 5,000MW by 2030, with most of the additional capacity coming from geothermal, wind, solar and imported natural gas. Kenya already has the largest wind power plant in Africa, the 310MW Lake Turkana plant. There is also a long-term goal to develop nuclear power.

Around a third of Kenya's installed capacity is run by independent power producers (IPPs). The rest is operated by the state-controlled Kenya Electricity Generating Company (KenGen). Further investment needs to be made in the transmission and distribution networks to address losses which are currently running at around 25%.

Key actors: Kenya Electricity Generating Company (KenGen); Kenya Electricity Transmission Company (Ketraco); Kenya Power (KP); Rural Electrification and Renewable Energy Corporation (REREC).

Key policies / legislation:

- Energy Act 2019
- Energy (Liquefied Petroleum Gas) Regulations 2019
- Public Private Partnerships Act 2013

Libya

The civil war which began in 2011 has led to regular power cuts across Libya, along with the retreat of most international partners and numerous projects being put on hold. However, while the security situation remains tense in many areas, there have been signs of progress in 2023 amid improving political stability– with rival centres of power in the east and west of the country moving towards greater cooperation, not least in terms of the critical oil sector.

There has also been progress in terms of power. Qatari firm Urbacon and Egypt's El Sewedy signed a deal in April with the state-owned General Electric Company of Libya (Gecol) to develop a 1GW plant in Zlitan. South Korea's Daewoo Engineering is also building two plants. Gecol said in early 2023 it had completed 13 major overhauls of power plants in its fleet, with work on a further 14 being planned.

The authorities are also pushing renewable energy schemes, including a 500MW solar plant being developed by France's TotalEnergies. Investments are also being made in transmission and distribution networks. However, further progress depends on the political situation continuing to improve.

Key actors: General Electric Company of Libya (Gecol); Supreme Council for Energy Affairs (Scea); Renewable Energy Authority of Libya (REAOL)

Key policies / legislation:

- Renewable Energy Strategic Plan 2013-2025
- Law No. 426 establishing REAOL

Morocco

Morocco's energy sector depends heavily on fossil fuels, which currently account for 10.3GW of its total 14.3GW capacity. Since Algeria cut supplies of natural gas through the Maghreb-Europe Pipeline in 2021, Rabat has been importing gas from Spain, via a reconfiguration of the pipeline.

The government is aiming to increase its long-term energy security by reducing the need for imported fuels, both by encouraging domestic exploration and production of natural gas and by ramping up its renewable energy sector. As of 2022, renewables accounted for 25% of total capacity, but the aim is to raise this to 52% by 2030 at the latest.

The country is thought to have the potential to generate 25GW of wind power, but currently has 1.4GW installed. The National Office of Electricity and Water is aiming to have 10GW of renewable energy capacity by 2030, including 4.5GW of solar, 4.1GW of wind and 1.3GW of hydropower. Morocco also has ambitions plans to develop green hydrogen production, using renewable energy sources.

Key actors: Ministry of Energy, Mines and Environment; Moroccan Agency for Sustainable Energy (Masen); National Office of Electricity and Water (ONEE)

Key policies / legislation:

- Industrial Recovery Plan 2021-2023
- Law No 57-09 – setting up the Morocco Agency for Sustainable Energy (Masen).
- Law No 48-15 – setting up the Moroccan Energy Authority (ANRE)

Mozambique

Mozambique has huge power generation potential. The country has installed capacity of 2.8GW, but USAID's Power Africa has estimated that Mozambique could generate as much as 187GW from a combination of coal, hydroelectric, gas and wind. Doing so will require international capital and making improvements to its transmission and distribution networks, among other things.

Most of the power currently generated comes from dams, but natural gas and renewable sources could also make a significant contribution in the future, particularly if a trio of ambitious liquified natural gas projects (LNG) are completed in the north of the country. An insurgency in the Cabo Delgado region led to several projects being put on hold in 2021, but the international energy majors involved appear to be close to returning.

The country's first utility-scale solar project, a 40MW facility, was commissioned in 2019 and more are planned. A new Electricity Law was passed in 2022 which could encourage investment in mini-grids. Mozambique is a net exporter of energy to the Southern African Power Pool (SAPP), with South Africa its largest customer.

Key actors: Electricidade de Moçambique (EDM); Hidroeléctrica de Cahora Bassa (HCB); Mozambique Energy Fund Institute (FUNAE), Autoridade Reguladora de Energia

Key policies / legislation:

- Electricity Law
- Mozambique Energy Strategy 2014-2023
- EDM Integrated Power Sector Master Plan

Namibia

Namibia's domestic electricity supply industry has found it hard to keep pace with demand and the country relies on power imports from South Africa and other neighbouring countries. However, the government is aiming to make the country self-

sufficient in energy – and possibly even a net exporter of electricity – by developing new hydroelectric, solar and wind power resources.

Following a series of liberalising steps in recent years, Namibia now allows independent power producers (IPPs) to sell electricity directly to large power consumers across the national grid, with users able to buy 30% of their power needs directly from an IPP.

With up to 60% of Namibians without a grid connection, the government has adopted an Off-Grid Energisation Master Plan (OGEMP) to promote the use of renewable energy. However, the sector has faced challenges in attracting international investment due to concerns over foreign currency exchange.

Key actors: Electricity Control Board (ECB); Ministry of Mines and Energy; NamPower;

Key policies / legislation:

- Off-Grid Energisation Master Plan
- National Renewable Energy Policy
- Petroleum Products and Energy Act
- Net-Metering Rules 2015

Nigeria

Nigeria has the largest population of any country in Africa, but its electricity system has at times found it hard to keep pace with wider economic developments. Around 60% of Nigerians currently have electricity access, including some 89% in urban areas and 26% in rural areas.

The government of President Bola Tinubu took office in May 2023 and has shown a willingness to implement economic reforms, which could benefit the electricity sector in the coming years.

Sector reforms which began in 2005 created a network of six generation companies (gencos) and 11 distribution companies (discos) which are now part-privatised. Total capacity is 11.7GW, of which around 18% comes from renewable (mostly hydroelectric) sources. Under the 2011 Renewable Energy Master Plan, the government

is aiming to increase the share of renewable energy to 23% by 2025 and 36% by 2030.

Large investments are needed to hit those targets and carry out related work such as expanding generation capacity and improve collection rates. The US International Trade Administration has estimated that \$100bn is needed over the next 20 years to maintain the current levels of service.

Key actors: Nigerian Electricity Regulatory Commission (Nerc); Transmission Company of Nigeria; regional generation (genco) and distribution (disco) companies

Key policies / legislation:

- Renewable Energy Master Plan
- Energy Act 2023
- Nigerian Economic Sustainability Plan

Rwanda

Almost half of Rwandans have access to electricity, with 98% in urban areas and 38% in rural areas. The government has set a target of universal access by 2024, which will require rapid expansion of the generation, transmission and distribution networks – although not all will require a grid connection: the Rwanda Development Board estimates that 52% of the population will have grid access, while 48% will have off-grid power.

Total generating capacity was 272MW in 2022, with 55% of that coming from renewable sources. The government is aiming for 556MW of installed generation capacity by 2024 and has been encouraging investment from independent power producers (IPPs).

A key issue that needs to be addressed is the rate of distribution losses, which are running at around 23%. Interconnections to neighbouring countries are also being planned. Since 2015, the government has been reducing subsidies to national utility the Rwanda Energy Group in an effort to move to cost-reflective tariffs.

Key actors: Ministry of Infrastructure; Rwanda Utilities Regulatory Authority; Rwanda Energy Group

Key policies / legislation:

- Rwanda Energy Policy
- Electricity Sector Strategic Plan
- Rural Electrification Strategy
- Rwanda Universal Energy Access Programme

Senegal

Due to a reliance on imported liquid fuels for much of its power generation, Senegal has some of the highest electricity generation costs in Africa, although government subsidies have protected consumers to some extent.

Renewable energy accounts for around a third of total installed capacity and there are initiatives under way to develop more wind and solar power and harness more of the hydroelectric potential of the Senegal River. National utility Senelec has also been pursuing gas-to-power projects under a strategy unveiled in 2018.

The electricity access rate is 68% nationwide, with 94% in urban areas and 43% in rural areas, but the government is aiming for universal access by 2025.

The plans for the electricity sector are a key part of the Emerging Senegal Plan, a national strategy for the country to reach middle-income status by 2035. Further planned reforms include the unbundling of Senelec into separate production, transmission and distribution divisions.

Key actors: Ministry of Energy; Senegal National Electricity Company (Senelec); Organisation of the Senegal River Development (OMVS); Commission de Régulation du Secteur de l'Électricité (CRSE); Agence Sénégalaise d'Électrification Rurale (ASER).

Key policies / legislation:

- Emerging Senegal Plan
- Energy Sector Development Policy Letter
- Senegal Energy Access Scale Up Project

South Africa

South Africa is a regional economic giant and has to date relied on a fleet of coal-fired plants for much of its electricity generating capacity. It is though now shifting its emphasis to renewable energy, in a bid to improve the reliability of the grid and to meet its climate change goals.

A series of renewable energy procurement rounds have attracted substantial investment in recent years, with 6.4GW of planned capacity additions. Under the government's integrated resource plan, it aims to add 29.5GW of capacity by 2030, mostly from wind and solar. Currently, renewable sources account for 16% of the total capacity of 63GW.

Under a deal announced at COP27, South Africa is hoping to leverage the \$8.5bn pledged by western donors to help with its Just Energy Transition. The government has also been encouraging more private sector developments, lifting the requirement for licences on private power plants in 2022.

Unusually, South Africa has a higher rate of electricity access among its rural population (93%) than in urban areas (87%); nationwide the figure is 89%.

Key actors: Eskom; Department of Mineral Resources and Energy; National Energy Regulator of South Africa (Nersa)

Key policies / legislation:

- Integrated Resources Plan
- IPP Procurement Programme
- Electricity Regulation Act
- Economic Reconstruction and Recovery Plan

Tanzania

About 41% of Tanzania's electricity capacity comes from hydroelectric power plants, but these are vulnerable to climate change, not least the lower than average rainfall of recent years. In response, the authorities have sought to develop a wider range of sources, including wind, solar and biomass. More

hydroelectric schemes are also planned, most notably the huge 2.1GW Julius Nyerere dam, which will more than double the country's total installed capacity, which currently stands at 1.6GW.

President Samia Suluhu Hassan has set a target of 6,000MW of renewable energy capacity by 2025. However, further regulatory reforms may be needed if it is to attract independent power producers (IPPs) at the scale that is needed.

The electrification rate was 43% nationwide in 2021, with urban areas at 77% and rural areas 23%. The government is aiming to raise the national figure to 75% by 2033.

Key actors: Ministry of Energy; Energy and Water Utilities Regulatory Authority (EWURA); Tanzania Electric Supply Company (Tanesco); Rural Energy Agency

Key policies / legislation:

- National Strategy for Growth and Reduction of Poverty
- Tanzanian Energy Development Access Programme
- Scaling up Renewable Energy Programme for Tanzania
- Small Power Producers (SPP) Framework

Uganda

Uganda has had a power surplus in recent years, with installed capacity of around 1.4GW and demand closer to 800MW. That oversupply will rise further when the 600MW Karuma Dam comes on line, starting in the second half of 2023.

Investment in the transmission and distribution systems is needed and cross-border interconnections are also required to make the most of its excess power. The government plans to build 13,000km of transmission lines over the next 20 years and is also keen to develop mini-grids for isolated communities.

National distribution company Umeme's concession runs out in March 2025, at which point the government may decide to make changes to that part of the industry. Currently, some 45% of Ugandans have electricity access.

Key actors: Ministry of Energy and Mineral Development; Electricity Regulatory Authority (ERA); Umeme; Uganda Electricity Transmission Company; Rural Electrification Agency

Key policies / legislation:

- Energy Act
- Electricity Connection Policy
- Renewable Energy Policy

Zambia

Around half of Zambians currently have access to electricity, including 15% in rural areas and 86% in urban areas, but the government is aiming for universal access by 2030. National installed generating capacity was 3.4GW in 2021, with most of that coming from hydroelectric plants, which have suffered from low rainfall in recent years.

There are five main generating companies, including the state-owned Zesco and privately-owned Copperbelt Energy Corporation, with the country's mining sector being a critical source of demand.

Ambitious plans to develop 600MW of solar power by 2020 failed to be realised, but some progress is now being made, with China's CIEG recently signing up to develop 2.4GW of solar capacity in the coming years, with an initial 600MW due to be in place by 2024.

Key actors: Ministry of Energy; Energy Regulation Board; Zesco.

Key policies / legislation:

- National Energy Policy
- Zambia Vision 2030
- Rural Electrification (Amendment) Act

Zimbabwe

Zimbabwe relies on hydroelectric dams and coal-fired power plants for most of its electricity, with the Zimbabwe Power Company the key actor in the generating sector. However, the Kariba South dam has suffered from droughts in recent times, reducing its output and putting pressure on the country's fleet of coal-fired power plants. Blackouts have proved unavoidable, although imports of electricity from Zambia and Mozambique have helped to alleviate the problems.

In response, the government has been seeking to attract developers for smaller hydroelectric projects, although some are wary of investing due to currency concerns. There have also been efforts to develop more solar power plants. The most important planned scheme for the electricity sector is the 2.4GW Batoka Gorge hydroelectric plant, which will generate electricity for both Zambia and Zimbabwe.

Key actors: Zimbabwe Power Company; Zimbabwe Electricity Transmission and Distribution Company (ZETDC); Zimbabwe Energy Regulatory Authority (Zera)

Key policies / legislation:

- National Energy Policy
- National Renewable Energy Policy
- National Climate Policy
- National Bio Fuels Policy



List of sources

- African Development Bank (AfDB)
- Energy Information Administration (EIA)
- Energy Institute – Statistical Review of World Energy
- International Energy Agency (IEA), including the IEA policies database
- International Renewable Energy Agency (IRENA)
- US AID – Power Africa
- US International Trade Administration
- World Bank – world development indicators
- National utilities and regulators





PART 3

Data tables

Access to electricity (% of population) - 2020

Source: World Bank

Country	Total	Rural	Urban
Angola	46.9	n/a	73.7
Benin	41.4	18.2	66.1
Botswana	72.0	26.4	90.7
Burkina Faso	19.0	n/a	65.8
Burundi	11.7	3.5	63.7
Cabo Verde	94.2	93.5	94.5
Cameroon	64.7	25.0	94.0
Central African Republic	15.5	2.3	33.6
Chad	11.1	2.0	40.6
Comoros	86.7	81.3	99.7
Congo, Dem. Rep.	19.1	1.0	40.7
Congo, Rep.	49.5	14.8	66.0
Cote d'Ivoire	69.7	43.1	94.5
Djibouti	61.8	24.8	72.2
Egypt	100.0	100.0	100.0
Equatorial Guinea	66.7	0.9	91.0
Eritrea	52.2	39.0	76.3
Eswatini	79.7	75.8	92.2
Ethiopia	51.1	39.4	93.2
Gabon	91.6	27.8	98.6
Gambia, The	62.3	31.6	80.6
Ghana	85.9	74.0	94.7
Guinea	44.7	19.3	88.1
Guinea-Bissau	33.3	15.2	56.3
Kenya	71.4	62.7	94.0
Lesotho	47.4	34.9	77.7
Liberia	27.5	8.4	45.2
Madagascar	33.7	10.9	70.2
Malawi	14.9	6.6	54.0
Mali	50.6	16.5	94.1
Mauritius	99.7	99.8	99.4
Mozambique	30.6	4.5	75.0
Namibia	56.3	36.3	74.7
Niger	19.3	13.4	48.4
Nigeria	55.4	24.6	83.9
Rwanda	46.6	38.2	86.4
Sao Tome and Principe	76.6	71.1	78.4
Senegal	70.4	47.4	95.2
Seychelles	100.0	100.0	100.0

Access to electricity (% of population) - 2020 (continued)

Source: World Bank

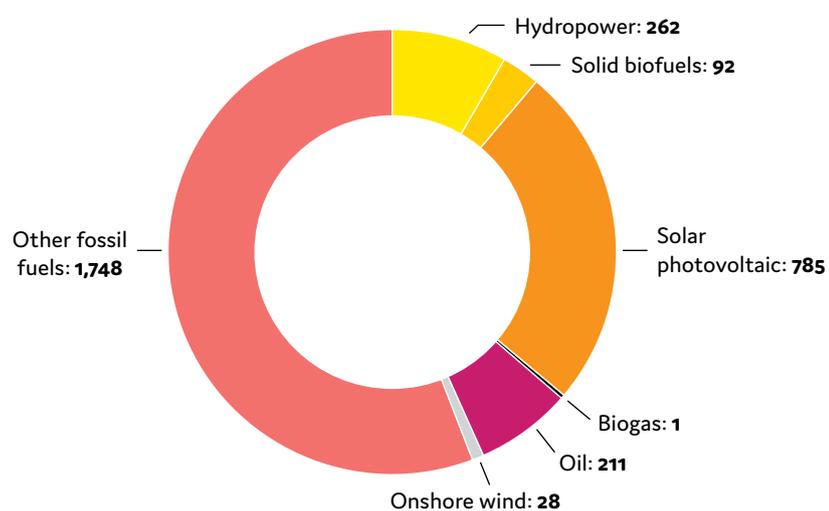
Country	Total	Rural	Urban
Sierra Leone	26.2	4.8	54.7
Somalia	49.7	32.3	70.1
South Africa	84.4	75.3	88.8
South Sudan	7.2	5.6	13.9
Sudan	55.4	41.2	81.5
Tanzania	39.9	22.0	72.9
Togo	54.0	24.0	94.1
Tunisia	100.0	100.0	100.0
Uganda	42.1	32.8	69.9
Zambia	44.5	14.0	82.4
Zimbabwe	52.7	37.1	85.7

Selected major hydropower projects in SSA, planned or underway

Source: Own research

Country	Project	Capacity (MW)
Angola	Caculo Cabaça	2,172
Cameroon	Nachitgal	420
Democratic Republic of Congo	Grand Inga	40,000
Ethiopia	Grand Ethiopian Renaissance Dam (Gerd)	6,450
Nigeria	Mambilla	3,000
Nigeria	Zungeru	700
Tanzania	Julius Nyerere	2,115
Zambia / Zimbabwe	Batoka Gorge	2,400

Off-grid electricity generating capacity by fuel (MW)



Sub-Saharan Africa (2021 data)

Source: International Hydropower Association (IHA)

Country	Installed hydro capacity (MW)	Generation (TWh)
Angola	3,836	10.7
Benin	33	0.1
Botswana	0	0.0
Burkina Faso	34	0.1
Burundi	57	0.2
Cameroon	822	5.9
Cape Verde	0	0.0
Central African Republic	19	0.1
Chad	0	0.0
Comoros	1	0.0
Congo	218	1.1
Cote D'Ivoire	879	2.6
Democratic Republic of the Congo	2,760	9.2
Djibouti	0	0.0
Equatorial Guinea	128	0.1
Eritrea	0	0.0
Eswatini	60	0.2
Ethiopia	4,074	13.6
Gabon	331	1.7
Gambia	0	0.0
Ghana	1,584	7.0
Guinea	706	2.5
Guinea-bissau	0	0.0
Kenya	837	3.3
Lesotho	73	0.5
Liberia	93	0.5
Madagascar	186	0.8
Malawi	371	1.3
Maldives	0	0.0
Mali	220	0.9
Mauritius	61	0.1
Mozambique	2,216	15.0
Namibia	347	1.0
Niger	0	0.0
Nigeria	2,111	8.4
Reunion	134	0.5
Rwanda	111	0.0

Sub-Saharan Africa (2021 data) (continued)

Source: International Hydropower Association (IHA)

Country	Installed hydro capacity (MW)	Generation (TWh)
Sao Tome And Principe	2	0.0
Senegal	81	0.3
Seychelles	0	0.0
Sierra Leone	64	0.2
Somalia	0	0.0
South Africa	3,600	5.7
South Sudan	0	0.0
Sudan	1,923	7.7
Tanzania	562	1.9
Togo	49	0.1
Uganda	1,073	4.3
Western Sahara	0	0.0
Zambia	2,703	14.9
Zimbabwe	1,081	7.3
Total	33,439	130

Electricity grid access (millions of people)

Source: World Bank report - Off-grid Solar Market Trends Report 2022

Region	Unconnected	Unreliable grid
Central	109	14
East	161	41
West	213	94
Southern	103	33
Total	586	182

Off-grid electricity generating capacity by fuel (MW)

Source: World Bank report - Off-grid Solar Market Trends Report 2022

Region	Unconnected
Biogas	1
Oil	211
Onshore wind	28
Other fossil fuels	1,748
Hydropower	262
Solar photovoltaic	785
Solid biofuels	92
Total	3,127

Access to electricity

Source: World Bank world development indicators

Country	Population	Rural	Urban	Total
Angola	35,588,987	7.3	75.0	48.2
Cameroon	27,914,536	24.8	94.7	65.4
DRC	99,010,212	1.0	43.8	20.8
Congo, Rep	5,970,424	12.4	67.0	49.7
Egypt	110,990,103	100.0	100.0	100.0
Equatorial Guinea	1,674,908	1.4	90.3	66.8
Ghana	33,475,870	74.0	95.2	86.3
Kenya	54,027,487	68.2	97.5	76.5
Libya	6,812,341	n/a	100.0	70.2
Morocco	37,457,971	100.0	100.0	100.0
Mozambique	32,969,518	3.8	77.4	31.5
Namibia	2,567,012	33.2	74.7	55.2
Nigeria	218,541,212	26.3	89.2	59.5
Rwanda	13,776,698	38.2	98.0	48.7
Senegal	17,316,449	43.4	93.9	68.0
South Africa	59,893,885	93.4	87.4	89.3
Tanzania	65,497,748	23.3	77.3	42.7
Uganda	47,249,585	35.9	72.3	45.2
Zambia	20,017,675	14.5	85.7	46.7
Zimbabwe	16,320,537	31.6	85.3	49.0



Installed capacity (MW)

Source: Energy Information Administration (EIA)

Country	Population	Fossil fuels	Renewable	Total	% renewable
Angola	35,588,987	3,444	3,900	7,344	53.1
Cameroon	27,914,536	918	836	1,754	47.7
DRC	99,010,212	155	2,764	2,919	94.7
Congo, Rep	5,970,424	391	250	641	39.0
Egypt	110,990,103	53,802	6,271	60,073	10.4
Equatorial Guinea	1,674,908	222	128	350	36.6
Ghana	33,475,870	3,649	1,700	5,349	31.8
Kenya	54,027,487	1,113	2,370	3,483	68.0
Libya	6,812,341	10,511	6	10,517	0.1
Morocco	37,457,971	10,276	3,521	14,262	24.7
Mozambique	32,969,518	480	2,285	2,765	82.6
Namibia	2,567,012	113	497	610	81.6
Nigeria	218,541,212	9,539	2,157	11,696	18.4
Rwanda	13,776,698	122	150	272	55.2
Senegal	17,316,449	1,001	503	1,504	33.4
South Africa	59,893,885	48,380	10,130	63,276	16.0
Tanzania	65,497,748	931	658	1,589	41.4
Uganda	47,249,585	199	1,261	1,460	86.4
Zambia	20,017,675	524	2,842	3,365	84.4
Zimbabwe	16,320,537	144	3,771	3,915	96.3



Electricity use (GWh)

Source: Energy Information Administration (EIA)

Country	Population	Generation	Consumption	Imports	Distribution losses	% losses
Angola	35,588,987	16,429	14,560	0	1,869	11
Cameroon	27,914,536	8,045	6,084	20	1,981	25
DRC	99,010,212	11,040	8,920	365	2,310	21
Congo, Rep	5,970,424	4,020	2,215	18	1,807	45
Egypt	110,990,103	202,255	168,323	98	33,117	16
Equatorial Guinea	1,674,908	1,418	1,270	0	148	10
Ghana	33,475,870	20,931	18,274	59	1,247	6
Kenya	54,027,487	11,833	9,061	157	2,912	25
Libya	6,812,341	32,020	27,180	1,347	6,188	19
Morocco	37,457,971	41,151	35,386	1,825	6,739	16
Mozambique	32,969,518	19,908	13,489	8,276	2,747	14
Namibia	2,567,012	1,567	3,434	2,785	325	21
Nigeria	218,541,212	31,458	26,596	0	4,862	15
Rwanda	13,776,698	855	692	36	192	23
Senegal	17,316,449	5,616	5,300	356	672	12
South Africa	59,893,885	221,500	191,441	10,404	25,922	12
Tanzania	65,497,748	8,169	7,193	115	1,091	13
Uganda	47,249,585	4,401	3,073	21	1,127	26
Zambia	20,017,675	17,714	14,321	142	2,195	12
Zimbabwe	16,320,537	19,640	15,323	119	2,575	13

Notes

Population figures are for 2022

All other figures are for 2021 (or nearest available)





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