Scaling-Up Renewable Energy in Africa

A NetZero Pathfinders report

November 9, 2022

Bloomberg Philanthropies

BloombergNEF

Contents

Table of tables

Section 1. Executive Summary

0.6%

Share of total global renewable energy investment in Africa in 2021

1.3%

Share of total global solar capacity in Africa in 2021

36

Number of African countries with renewable energy targets out of 42 analyzed by BNEF

The ongoing global transition from high to low carbon emitting sources of energy has the potential to transform Africa: mass deployment of new, low-cost clean technologies should trigger billions in investment, expand energy access to millions, and help mitigate the worst effects of climate change. Despite the continent's abundant natural resources that make clean power the least-cost option today, it has reaped limited benefits from the energy transition. In fact, in 2021, Africa's clean energy investment fell to its the lowest level since 2011 – of the $434 billion invested globally to build wind, solar, and other clean power projects, only 0.6% or $2.6 billion, went to Africa.

The spotlight on Africa at COP27 in Egypt offers an opportunity to take stock of how far the continent's energy transition has advanced – and how much work remains to be done. In answer to this, several questions arise: What practical solutions could shift investment trends while ensuring a just and equitable transition for Africans? What policy-, infrastructure- and finance-related barriers have artificially inflated local clean technology costs and slowed deployment? Most importantly, how can these obstacles be overcome?

This report, jointly produced by BloombergNEF and Bloomberg Philanthropies, as part of the broader Bloomberg NetZero Pathfinders initiative, discusses the state of the energy transition in Africa, the key barriers that limit investment flows, and highlights solutions that have been implemented in other emerging markets to address similar challenges. The key barriers were identified based on BloombergNEF's survey of investors, developers, policy makers, and other stakeholders in 42 African nations during the first half of 2022. Bloomberg and Pathfinders encourage the input of all stakeholders and invite feedback on this report. To share measures that have successfully worked in your region, please contact us.

Key findings:

- **Clean energy investment in Africa reached the lowest level since 2011.** Renewable energy power-generating assets attracted $434 billion worldwide in 2021, but just 0.6% of that ($2.6 billion) went to African nations.
- **Investment is highly concentrated in a handful of markets.** South Africa, Egypt, Morocco, and Kenya have since 2010 accounted for nearly three-quarters of all renewable energy asset investment, at $46 billion. All others have secured just $16 billion over that time.
- **Over half of Sub-Saharan Africa still lacks access to electricity.** In 2020, barely half of the population in Sub-Saharan Africa had reliable electricity service, according to The World

Bank. That trailed far behind the Middle East & North Africa region at 97.4%, Latin America and the Caribbean (98.5%) and South Asia (95.8%).

Figure 1: Global renewable energy asset investment by region

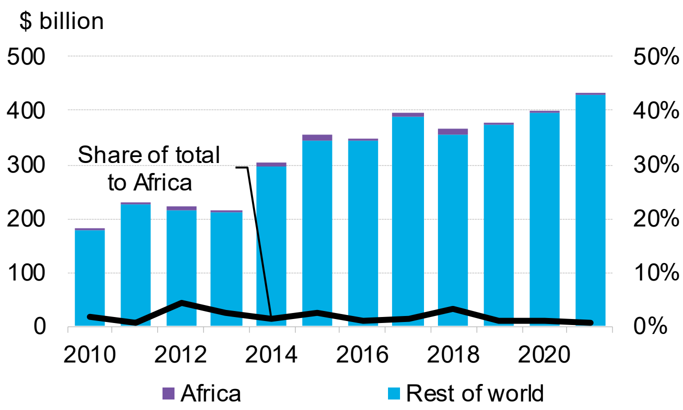
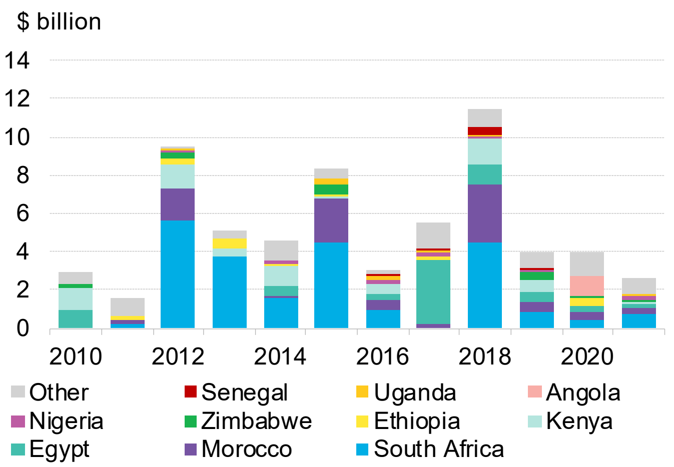


Figure 2: Africa renewable energy asset finance by country



Source: BloombergNEF.

- **Electricity supply growth has slowed.** The rate of new electricity generating projects added to Africa's grids has slowed since 2018. Year-on-year installed capacity growth averaged 6.6% annually from 2011 to 2018, but only 3.8% over 2019-2021.
- **Fossil fuels meet three quarters of Africa electricity demand.** Gas, coal and oil accounted for 75% of electricity produced in Africa in 2021. Gas was 41%and coal 27%. Hydro continues to play an important role, accounting for 18% of output. Wind and solar are a combined 5%.
- **High fossil fuel prices are straining national government budgets.** Africa's dependence on gas- and coal-fired electricity puts the continent at risk of economic shock when commodity prices fluctuate. At least 28 countries meet at least half of their power demand with fossil fuels, of which 16 rely on fossils for 80% or more of their power.
- **Africa has abundant solar energy potential but is home to just 1.3% of global solar capacity.** Existing capacity is 13GW or 5.5% of Africa's total. South Africa, Egypt and Morocco account for two thirds of the solar capacity.
- **Despite the small numbers, solar usage is increasing.** In 2021, as many as 24 countries installed at least 1MW of solar – a new high following five years of stagnation. Solar was also the top technology for new capacity added in 11 countries in the region in 2021. The modular nature of PV, along with steep equipment price declines over a decade helped drive the technology's deployment.
- **Inadequate policies and enforcement are limiting investment opportunities.** The share of African nations with long-term clean power targets in force jumped to 86% in 2022 from 57% in 2019, but the implementation of enforcement mechanisms to ensure the goals are met has been weak.
- **Half of the countries have policies to hold reverse auctions for clean power delivery contracts, but far fewer have successfully held tenders.** Net metering policies, which allow owners of distributed solar systems to be compensated for excess generation they feed back into the grid, are on the books in 29% of African nations.

- **Most African governments have energy access targets in force.** Access strategies generally prioritize grid expansion, with 64% of countries either placing high or medium priority on this. However, expanding grids to reach the entire population is often not viable. More than half of African countries have rural electrification initiatives that also rely on "off-grid" measures such as deploying mini-grids, or solar home systems.
- **Three barriers that limit clean energy deployment are common to many African nations:** (1) lack of consistent clean power procurement practices, (2) poor planning around electricity access and grid expansion efforts and (3) lack of knowledge of clean energy opportunities from domestic investors. Addressing these could unlock significant renewable energy investment flows.
- **Consistent clean power procurement processes signal investors and developers to build project pipelines.** Although demand for electricity is growing rapidly in Africa, government-organized efforts to ensure that the rising demand is met with the proper volumes of supply have been sporadic. Auctions and tenders have been the most successful procurement mechanism around the world, but contracts signed in Africa only represent 4% of the global total.
- **Improving on- and off-grid infrastructure is key to delivering reliable, cost-effective, low-carbon electricity.** Thoughtful, clearly communicated grid planning is key but just a third of African nations have transparent grid extension plans in force.
- **Local capital providers can do more.** Africa-based lenders and investors can play a fundamental role in scaling on-grid and off-grid renewables deployment. National commercial and development banks, for example, can offer in-depth knowledge of local clean energy sectors that foreign investors may lack; they have unique connections to local communities. Domestic financiers can also serve as intermediaries between international sources of capital and local projects or communities. Many local institutions still lack knowledge of the risks associated with clean technologies, but this could change through greater outreach efforts.

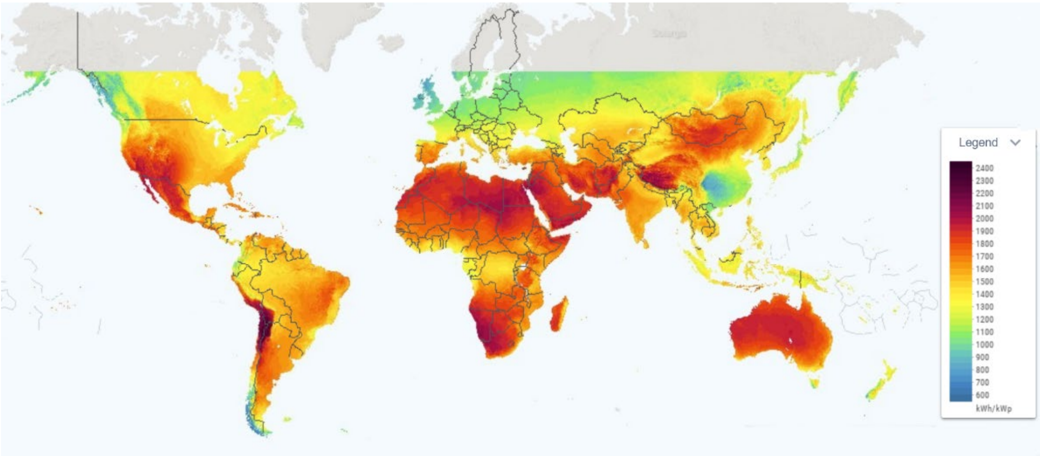
Section 2. State of energy transition in Africa

Rising public concerns over climate change, growing energy demand and cost competition are driving rapid deployment of new, zero-carbon power and transport technologies around the globe. While this "energy transition" presents tremendous opportunities for economic growth and development, relatively few of its benefits are accruing today to Africa. Clean energy build on the continent has lagged behind other regions.

The energy transition also represents an unprecedented opportunity to improve energy access for millions. Africa trails far behind the rest of the world in achieving UN Sustainable Development Goal 7 of having clean, affordable energy for all its citizens. Among those lacking access to electricity globally, 77% or 564 million reside in sub-Saharan Africa, the UN said in 2020. Another 90 million have access but cannot afford to pay for electricity. This yawning gap between energy demand and supply represents both a massive challenge and major opportunity for the private sector. Unprecedented volumes of new capital will be required to underwrite the transition to better access for millions of Africans and most will need to come from private sources.[1]

All the potential is there for Africa. The continent is home to abundant natural resources for renewable energy development, including exceptionally strong sunlight (Figure 3). As a result, Africa is the continent that offers the best average long-term practical yield for a utility scale solar energy installation -- at an average of 4.51 kilowatt hours produced per each installed kilowatt of technology per day.[2] These resources have the potential to be transformative in expanding power-generating capacity and access to electricity.

Figure 3: Solar potential by region (kWh/KW), 2022



Source: Global Solar Atlas

[1] For more, see '*The Sustainable Development Goals Report 2022'* (link).

[2] For more, see '*The future looks bright for Africa's solar energy output'* (link).

2.1. Investment

Clean energy investment in Africa has sunk to an 11-year low

Renewable energy power-generating assets attracted $434 billion worldwide in 2021, but just 0.6% of that ($2.6 billion) went to African nations, according to BNEF data. The rate at which capital has flowed to Africa over the last decade has also been highly inconsistent. Investment spiked to above $9 billion in 2012 and 2018 when a small number of large projects reached financial close in South Africa and Kenya, respectively. But since 2018, investment has not topped $4 billion in any year. Worse still, 2021 marked the lowest level for clean energy investment in the region since 2011.

Figure 4: Global renewable energy asset investment by region

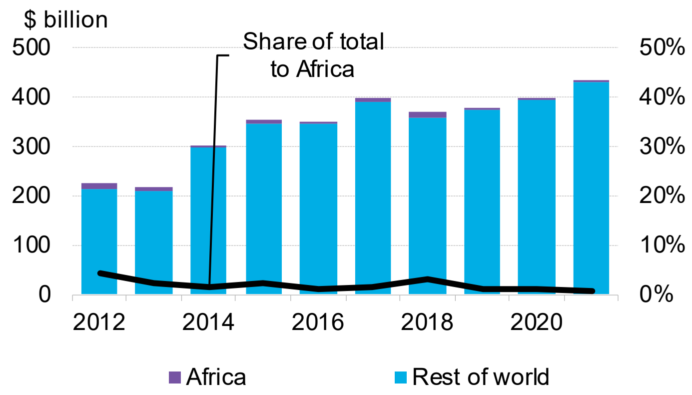
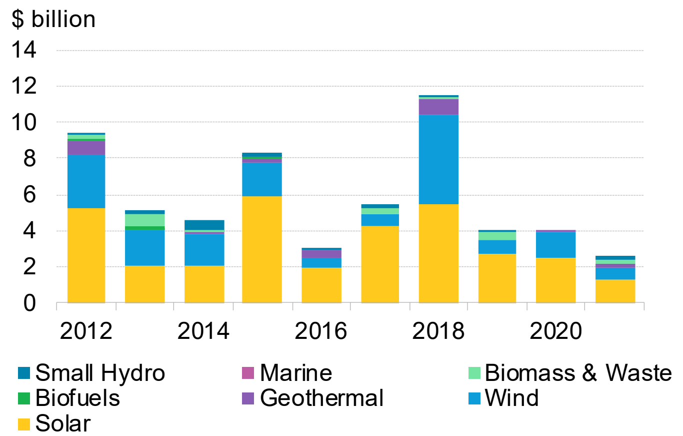


Figure 5: Renewable energy asset investment by technology, Africa



Source: BloombergNEF

As solar is the dominant renewable energy technology installed across the continent, it also accounted for the majority of investment – 57% over 2010-2021. Wind was 30% over the same period. Solar investment hit a high of $5.9 billion in 2015 then came near that in 2018 at $5.4 billion. But the fund flows have slowed considerably since. New investment in solar totaled just $1.3 billion in 2021 – the lowest level since 2011. Wind investment sank to $734 million in 2021, a four-year low.

Investment is concentrated in just a handful of major markets

South Africa, Egypt, Morocco, and Kenya have – since 2010 – accounted for nearly three-quarters of all renewable energy asset investment, at $46 billion (Figure 6, Figure 8). All others combined have secured just $16 billion over that time.

Figure 6: Africa renewable energy asset finance by country

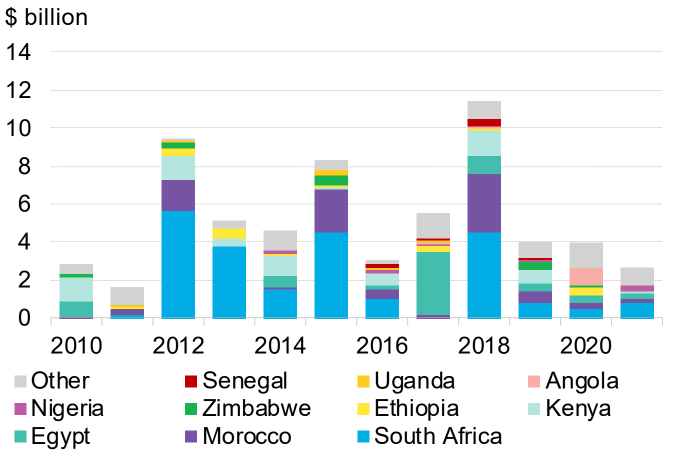
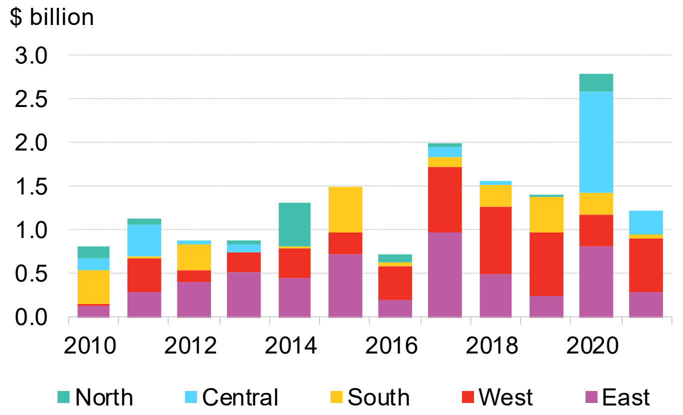


Figure 7: Africa renewable energy asset finance by country excluding major markets South Africa, Morocco, Kenya, and Egypt



Source: BloombergNEF. Note: renewable energy includes small hydro (up to 50MW), wind, solar, geothermal, biomass and waste. Asset finance includes equity and debt.

Investment outside the big four nations peaked in 2020 at $2.8 billion, then dropped 61% in 2021 to $1.2 billion. Countries that saw activity jump in 2021 include Cote d'Ivoire, which received $282 million for a 46MW biomass plant -- the country's largest investment in a renewable energy asset to date. Gabon and Tanzania also attracted over $150 million each in 2021 (Figure 9).

Figure 8: Top 10 African countries for cumulative renewable energy investment, 2010-2020

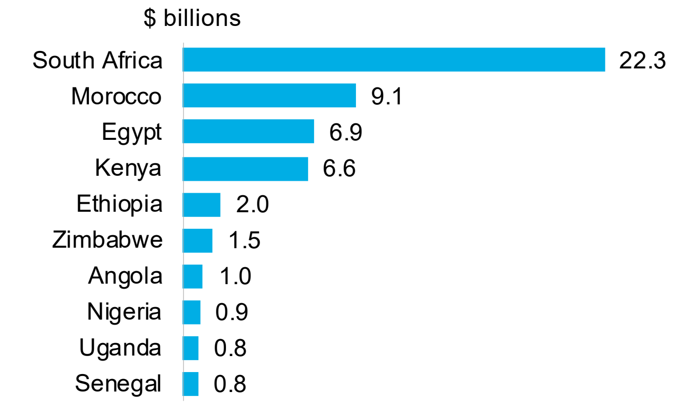
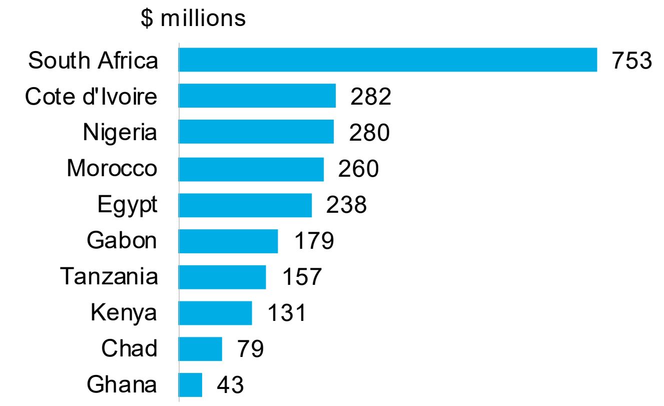


Figure 9: Top 10 African countries for renewable energy investment, 2021



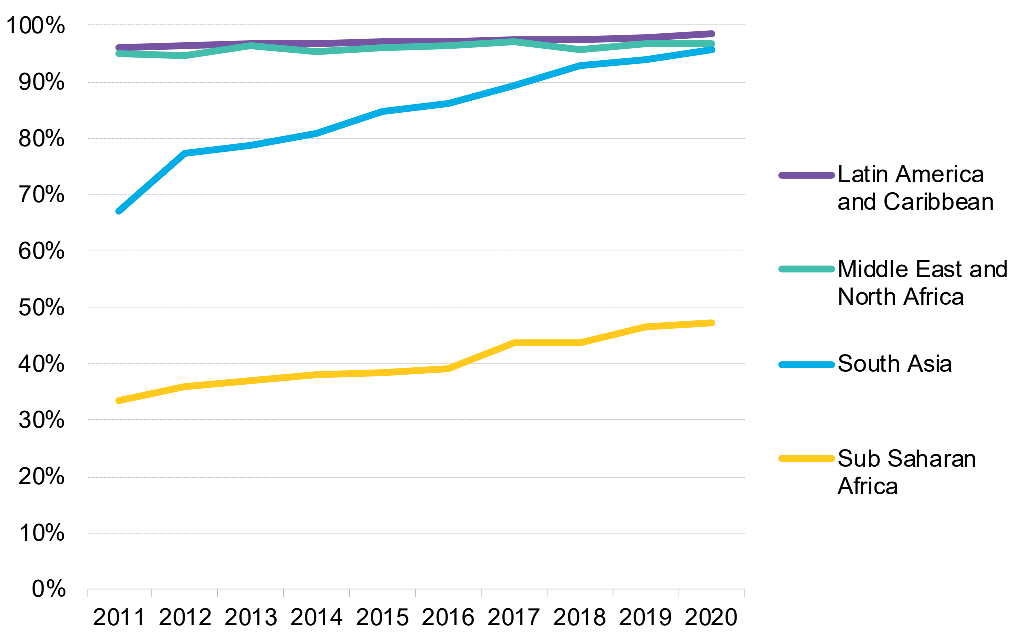
Source: BloombergNEF. Note: renewable energy includes small hydro (up to 50MW), wind, solar, geothermal, biomass and waste. Asset finance includes equity and debt.

2.2. Progress

Over half of Sub-Saharan Africans still lack access to electricity

Despite some progress over the past decade, the energy access rate in Sub-Saharan Africa remains stubbornly low (Figure 10). In 2020, just 48.4% of those living in the region had reliable electricity access, according to The World Bank. That trailed far behind the Middle East & North Africa region at 97.4%, Latin America and the Caribbean (98.5%) and South Asia (95.8%).

Figure 10: Electrification rates of emerging markets

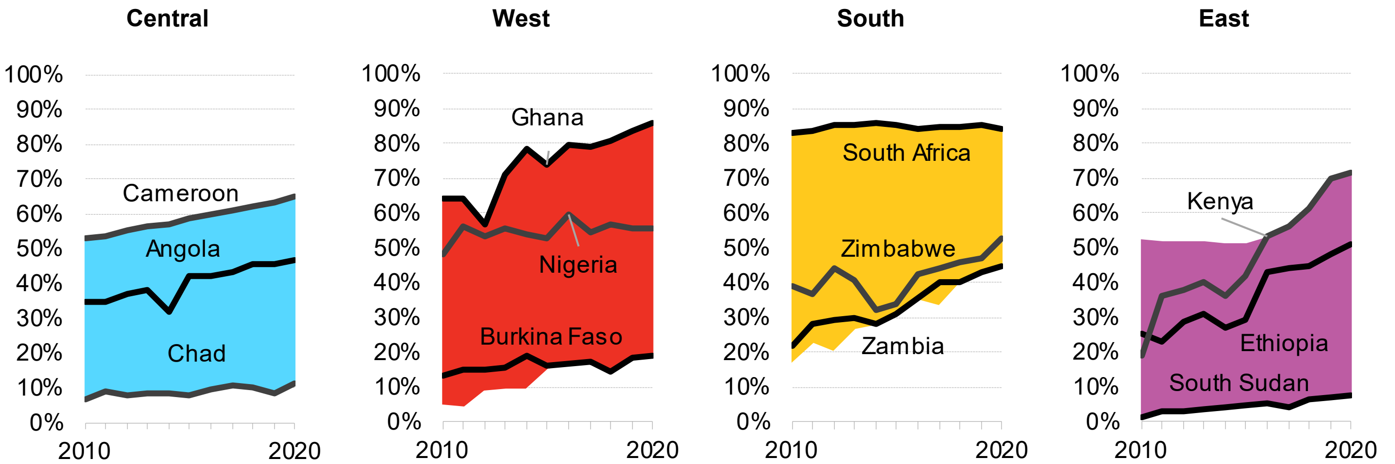


Source: World Bank, BloombergNEF.

Electrification within Africa also varies by location, with urban rates exceeding those in rural areas. Urban access is often higher because it is lower cost and more economically viable to expand grids in cities due to population density and residents having higher incomes. Additionally, terrain can play an important role. Nigeria, for example, struggles to electrify its far-flung areas because of rocky and uneven conditions. While North Africa is virtually fully electrified, other regions have been slow to improve electricity access in both urban and rural areas over the last decade.

While over 90% of African nations have policies in place to boost energy access, these have had limited impact. Still, there have been some notable success stories. Kenya, for example, has rapidly raised access for its citizens over the last decade through a combination of on- and off-grid solutions, offering flexible financing for grid connection costs and solar home systems. From 2010 to 2021, the national electrification rate in Kenya rose from 19% to 71% (Figure 11). Countries in West Africa such as Ghana, Guinea and Liberia have also seen sharp increases thanks to government efforts, while Nigeria, Burkina Faso, and Mauritania have moved slower.

Figure 11: National electrification rates by African region, and select markets

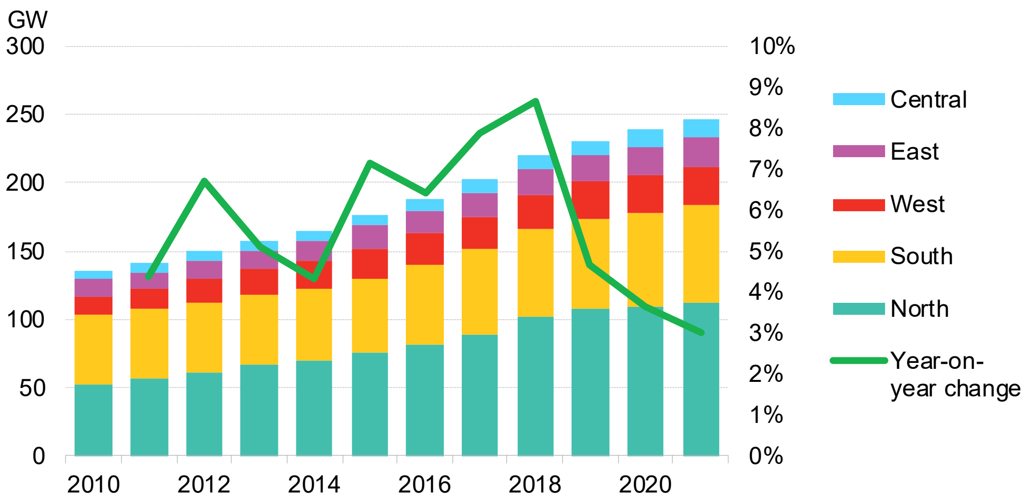


Source: World Bank, BloombergNEF. Note: Colored range shows minimum and maximum national electrification rates in each region. Note: North Africa region not included, the World Bank reports this region has reached full electricity access as of 2020.

Africa electricity supply growth has slowed

In 2021, installed electric generating capacity in Africa reached 246GW, up 3% from 2020. However, the rate at which new projects are being added to the grid has slowed since 2018. Year-on-year growth averaged 6.6% annually from 2011 to 2018, but only 3.8% over 2019-2021 (Figure 12).

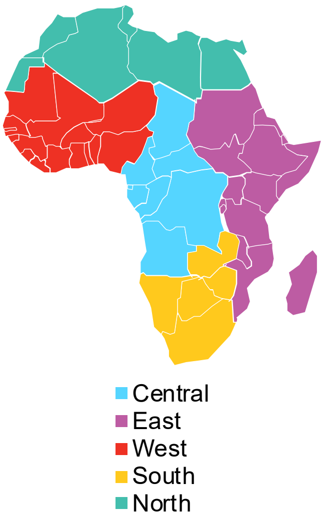
Figure 12: Power-generating capacity by region (left-hand axis) and year-on-year growth rate (right-hand axis)



Source: BloombergNEF

In 2021, North Africa was home to 45% of all installed capacity across the continent at 112GW. This region includes the relatively large markets of Egypt, Algeria, and Morocco (Figure 13). North Africa saw capacity grow at a peak rate of 14.9% in 2018 with large natural gas power plants coming online in Egypt and Algeria, but this slowed to just 3.5% in 2021. Southern Africa, host to large markets including the country of South Africa, also accounts for a major portion of installed capacity, at 71GW. Capacity growth in this region has averaged 3.5% per year since 2010.

Figure 13: Sub-regions in Africa covered in this report



Source: BloombergNEF.

Capacity growth in West Africa has slowed after peaking at 21% from 2011 to 2012 with the addition of large oil and diesel power plants in Mali and Burkina Faso that year. For 2020-21, capacity grew just 4.2%. Similarly, East Africa's annual growth peaked in 2015 at 16.6% and slowed to 3.4% in 2020. However, the region did see a rebound in capacity growth in 2021 with a 7.3% increase.

Central Africa has the smallest installed capacity base on the continent at just 13GW, most of it gas and oil plants. Growth in Central Africa has been very sporadic, ranging from a low of 0.4% in 2016 to 22% in 2017 and 2019. In regions with low installed capacity bases, the addition of just one or two new projects can influence capacity growth figures significantly.

In terms of countries, installed capacity is heavily concentrated in the five largest economies in Africa: South Africa, Egypt, Algeria, Nigeria, and Morocco. Between them, they account for 69% of the region's capacity base, or 172GW. In population terms, Nigeria and Egypt are in the top five in Africa, while South Africa and Algeria are in the top 10, and Morocco ranks 11th. All five countries have relatively high electrification rates compared to other African nations.

Fossil fuels meet three quarters of Africa's electricity demand

Fossil fuels – primarily coal and gas – accounted for 75% of the 813TWh produced in the African continent in 2021 (Figure 14 and Figure 15). Gas led with 41%, up from 31% in 2012, followed by coal with 27%, down from 36% a decade ago. Oil accounted for 7%, down from 13% a decade earlier. Gas has overtaken coal in providing power to the region, thanks largely to expanding local gas production in North Africa and increased gas power capacity including in Egypt and Algeria.

Hydro continues to play an important role, accounting for 18% of 2021 Africa power production, but other low-carbon sources lag well behind. Despite growing consistently for a decade, wind and solar together still only account for 5% of power produced on the continent.

Figure 14: Annual power generation by technology in Africa

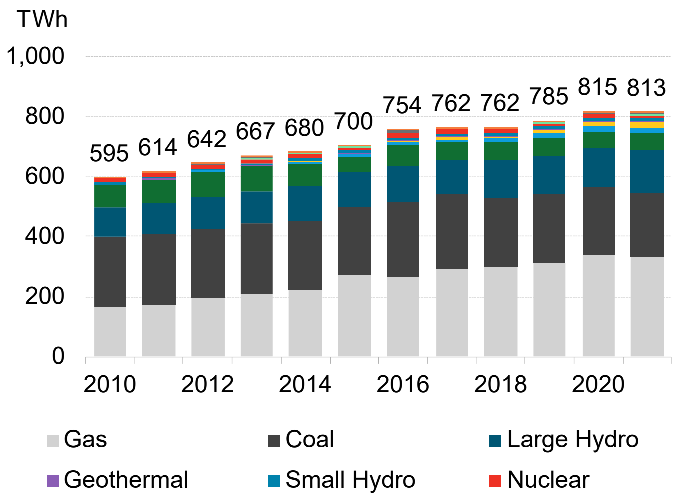
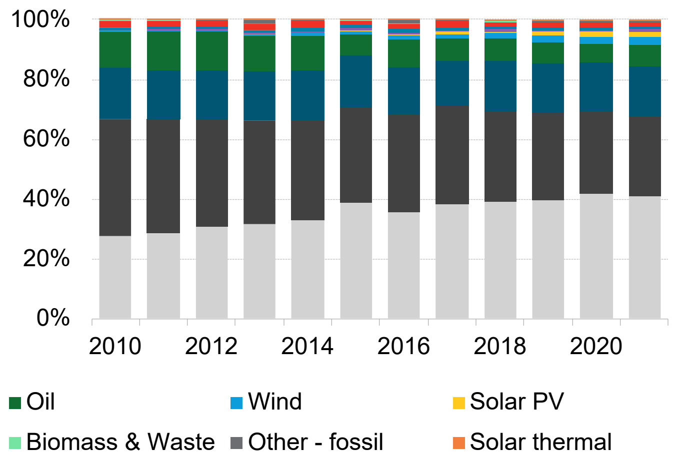


Figure 15: Share of annual power generation by technology in Africa



Source: BloombergNEF

Fossil fuel plants are particularly concentrated in the North, South, and West Africa. In the South, coal accounted for the vast majority of the generation at 78% in 2021 as South Africa and Botswana rely heavily on the locally-mined fuel. The North is dominated by production from gas, primarily within Egypt and Algeria.

While wind and solar contributions remain low compared to those of fossil fuels, there are some regions with high proportions of clean power thanks to strong hydropower output, namely East and Central Africa. Angola and the Democratic Republic of the Congo rely particularly on hydro, which also accounts for 60% of East Africa generation. However, hydro output is becoming increasingly variable, particularly given the rising severity of droughts in Africa.

Figure 16: Share of electricity generation from fossil fuels in Africa

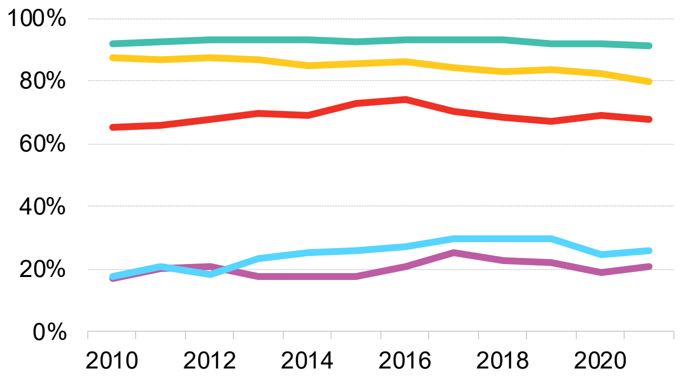
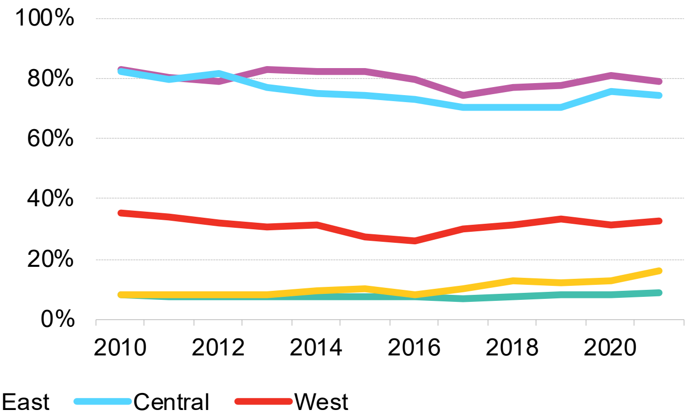


Figure 17: Share of electricity generation from renewables (including hydro) in Africa



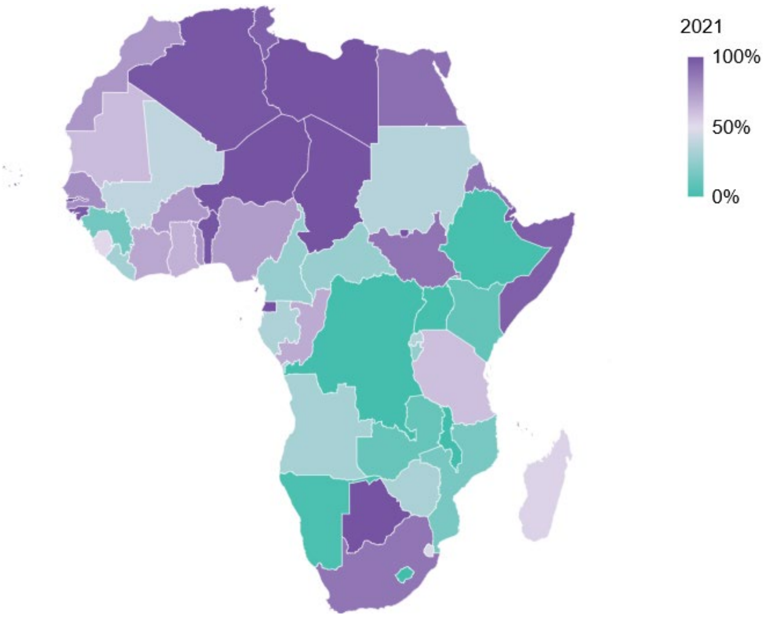
Source: BloombergNEF. Note: renewable energy share includes large hydro, small hydro, solar, wind, biomass & waste and geothermal.

Geothermal also plays an important role in parts of the region, particularly in East Africa where the natural resource potential is good. Almost all the existing geothermal generating capacity is concentrated in Kenya, although Ethiopia also has some capacity installed. In Kenya, geothermal represented 25% of the installed capacity base in 2021, up from 14% in 2010, and has supplied a consistent 45% of the country's generation needs over the last five years.

Reliance on fossil fuels poses challenges as energy prices grow

Africa's reliance on fossil fuels to meet three quarters of its electricity needs not only bodes poorly for climate change, it also puts the region at risk of economic shocks when prices for those commodities gyrate wildly as they have over the last year. At least 28 countries meet over half of their power demand with fossil fuels. Among them, 16 rely on fossils for 80% or more of their power (Figure 18).

Figure 18: Share of electricity generation from fossil fuels, 2021



Source: BloombergNEF

Current disruptions in global energy markets compounded by war in Ukraine have had direct consequences for African nations so reliant on coal and gas. Countries that subsidize energy for their citizens today are most exposed as their national budgets are strained directly by higher commodity prices.

Such prices also make it harder to expand energy access to the lowest-income citizens. Subsidizing electricity is particularly important in many African countries, where a significant share of the population cannot afford power. These are present in 52% of the 42 African nations surveyed by Climatescope. Subsidies directed to electricity tariffs on the continent totaled $177 billion for 2010-2020. In addition, governments have provided nearly $445 billion to lower the cost of coal, gas and oil directly, reducing the price of transport and power (Figure 19).

Figure 19: Annual fossil fuel subsidies in Africa

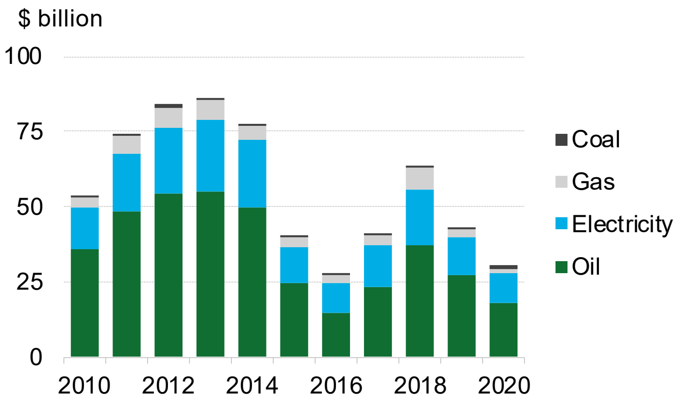
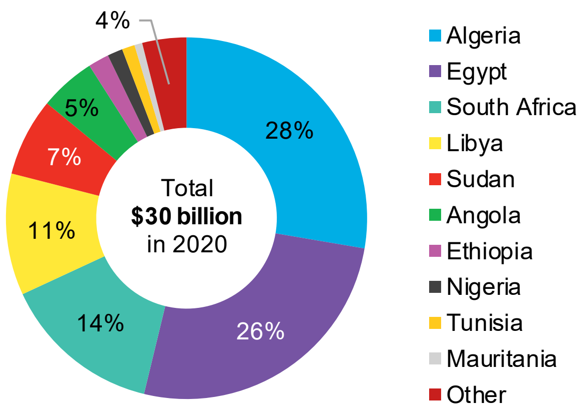


Figure 20: Share of fossil fuel subsidies in Africa, 2020



Source: BloombergNEF, Organisation for Economic Co-Operation and Development (OECD), International Institute for Sustainable Development (IISD).

Solar is expanding, but slowly

Coal, gas and oil together account for 75% of Africa's installed power-generating capacity (Figure 21 and Figure 22). The three technologies saw their combined capacity expand by 75GW over 2010-2021, mainly due to gas additions in Northern Africa. Southern Africa followed with 21GW added over the period, mostly from coal and solar (Figure 23 and Figure 24).

Figure 21: Installed capacity by technology in Africa

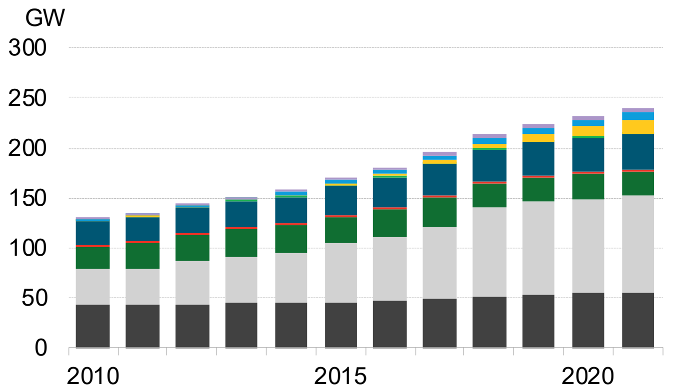
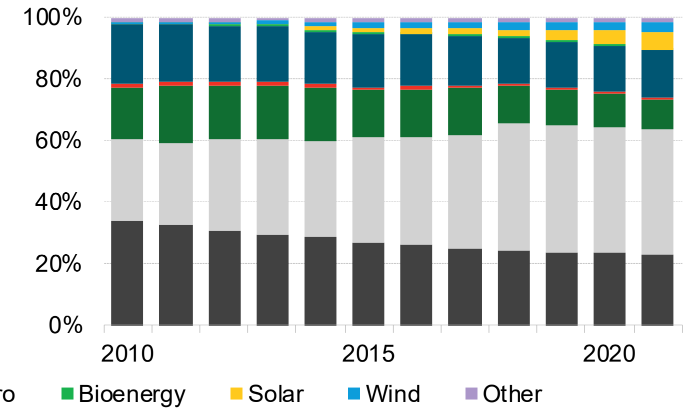


Figure 22: Share of installed capacity by technology in Africa



Source: BloombergNEF

Wind and solar in Africa have grown consistently over the past decade, but still account for just 8.6% of the total capacity in the region. Solar's participation expanded from 1.8% in 2017 to 5.5% in 2021. Wind's growth was more modest, rising from 2.2% to 3.2% over the same period.

Figure 23: Annual net capacity additions and retirements by technology in Africa

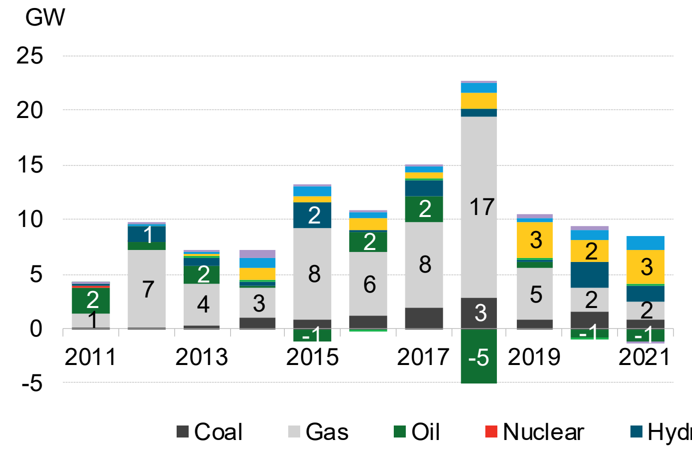
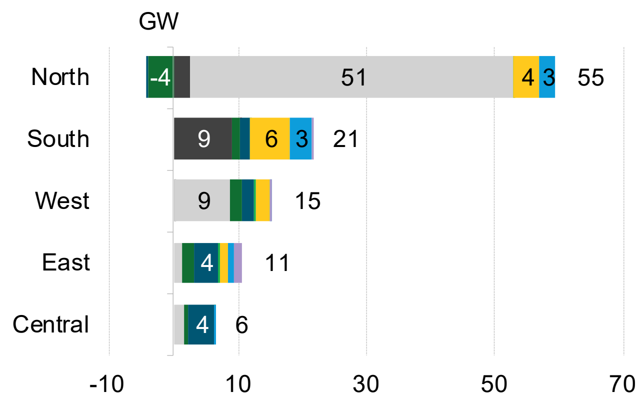


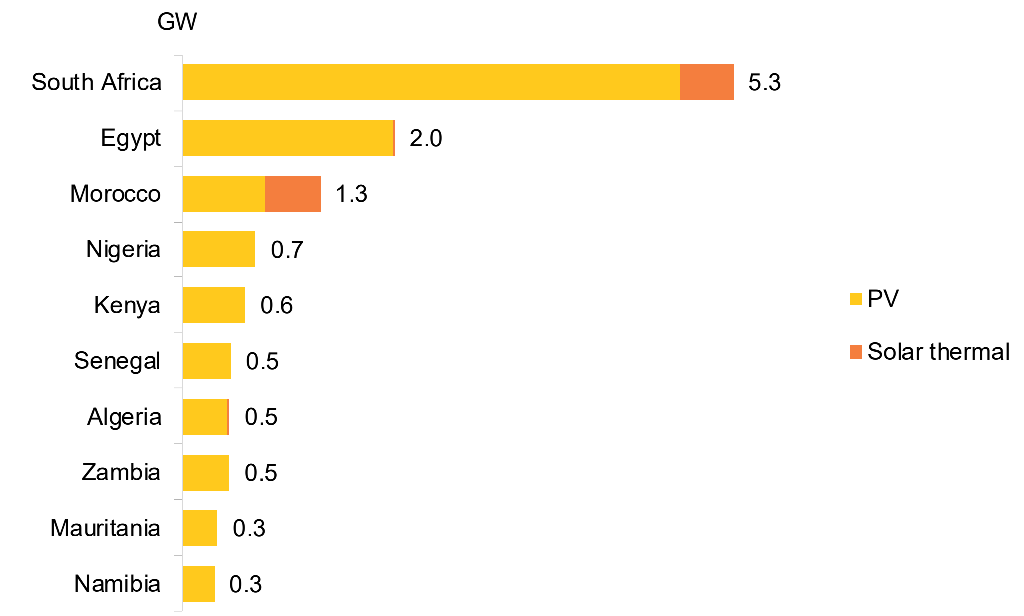
Figure 24: Cumulative net capacity change in Africa by technology and region, 2010-2021



Source: BloombergNEF.

By 2021, the continent had surpassed 13GW of solar capacity installed, with 8GW of this added since 2019 (Figure 23). These capacity additions were concentrated in the South and North of the region (Figure 27). The three largest markets for solar – South Africa, Egypt and Morocco – accounted for 65% of all installed solar capacity in Africa in 2021 (Figure 25).

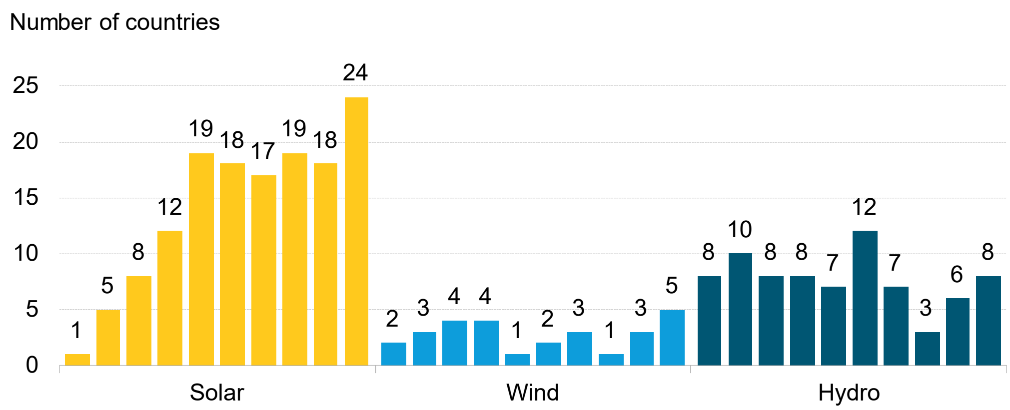
Figure 25: Top 10 countries in Africa for solar, by installed capacity in 2021



Source: BloombergNEF

Solar is rapidly proliferating in the region. In 2021, 24 countries in Africa installed at least 1MW of solar capacity, a new high following five years of stagnation. The modular nature of PV, along with steep equipment price declines over a decade helped drive the technology's deployment. Wind, on the other hand, only recorded new installations above 1MW in five nations, up from three in 2020 and just one in 2019. Wind capacity now totals 7.8GW.

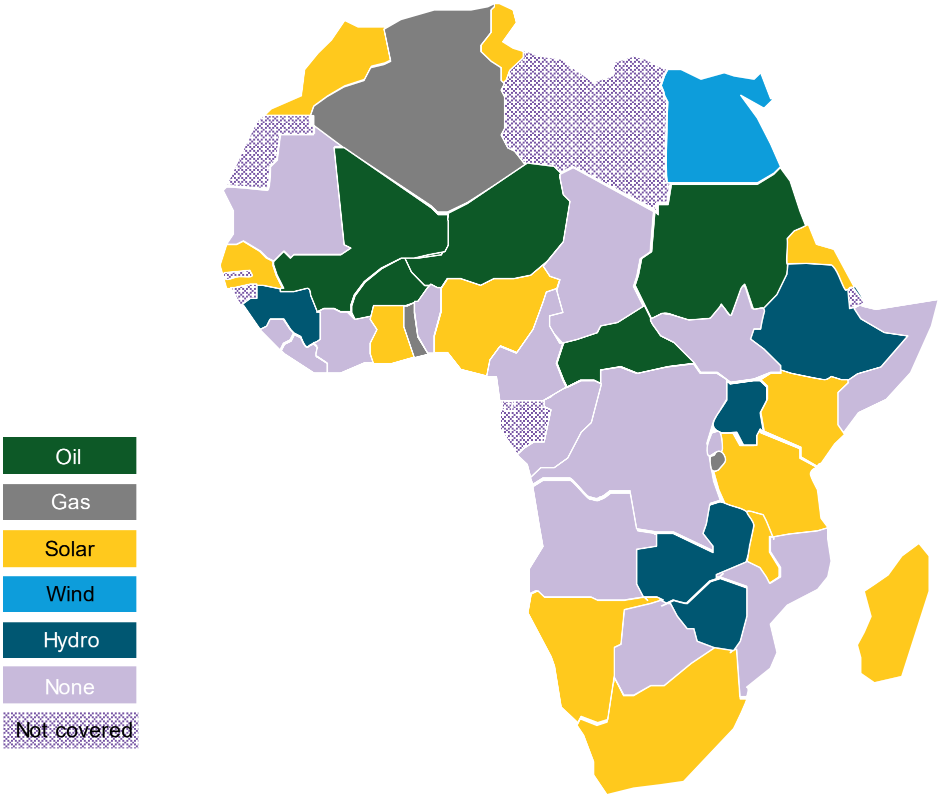
Figure 26: Number of African countries with over 1MW installed per year, 2012-2021



Source: BloombergNEF

Solar was the top technology for new capacity added in 11 countries in the region in 2021, including South Africa, Namibia, Morocco, and Madagascar (Figure 27). This is up from just three African countries in 2018 that had solar as the primary technology for new capacity.

Figure 27: Top technology as measured in new capacity additions in 2021, by country



Source: BloombergNEF. Note: 'None' refers to countries which did not add any capacity in 2021. Climatescope covers 42 countries in Africa. For more details and full country list see www.global-climatescope.org

2.2 Policy

Inadequate policies limit investment opportunities

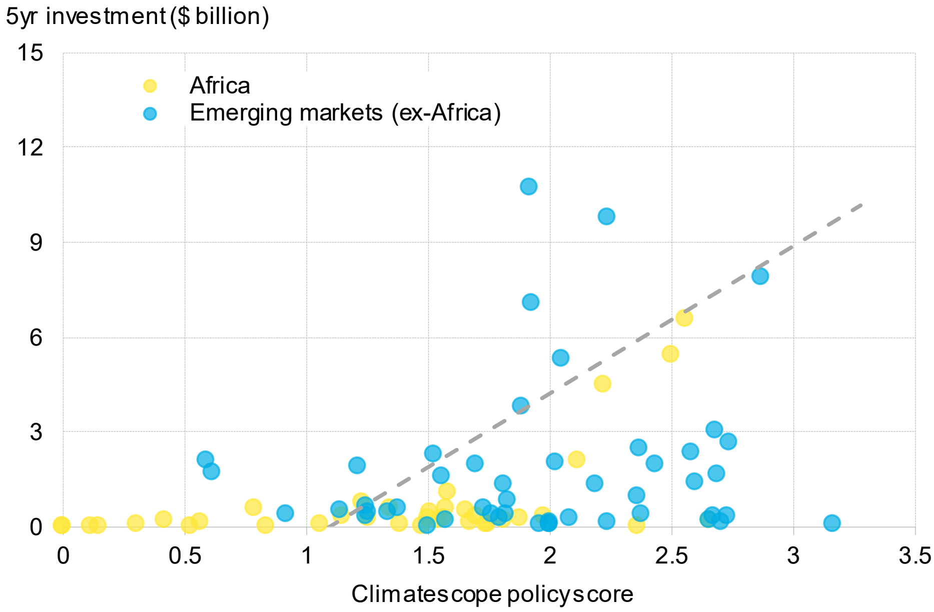
Stable, well-defined clean energy enabling environments are critical to kicking off and then accelerating countries' renewable energy markets. These can include policy mechanisms explicitly to accelerate renewables deployment such as auctions, feed-in tariffs, tax incentives, or national targets. But they also include broader power sector policies to foster competition and transparency. Unbundled, non-monopolized power markets are typically most conducive to rapid clean energy growth led by independent project owners, particularly in emerging markets where private players can sign transparent and long-term power-purchase agreements (PPAs).

BloombergNEF's annual Climatescope survey evaluates markets' clean energy policy regimes by analyzing the ambition, accessibility, stability and success of each type of policy implemented. Climatescope scores nations based on these metrics and the scores illuminate the relationship between good policy-making and strong investment.

Conversely, countries with weak policy environments (and thus poor Climatescope policy scores) tend to see fewer results. For instance, among the 15 markets that fared poorest in the Climatescope policy ranking, just one attracted more than $2 billion in clean energy investment from 2017-2021. Instead, these economies attracted, on average, $385 million apiece over the 5-

year period. By contrast, the 15 highest scoring countries attracted on average $9.5 billion over the period. Eight of the 10 lowest scoring countries in the Climatescope policy ranking are in Africa (Figure 28).

Figure 28: Climatescope policy score vs. 5-year clean energy asset finance



Source: BloombergNEF. Note: China not included. India, Brazil Vietnam, Mexico and Chile were omitted to facilitate visualization, but are included in the trendlines. The emerging markets trendline includes Africa.

National policies setting long-term goals for renewable energy deployment have been widely adopted in Africa. Clean energy targets are on the books in 86% of African countries. While that is less than the 97% in Asia Pacific, 95% in the Americas, and 97% in Europe, it still represents important progress. Among the 42 nations surveyed by Climatescope, only six lack targets for renewables.

While African nations have been forward-looking in setting clean energy targets, far too few have implemented policies to make those goals a reality. Most notably, just half of African nations have policies in place to hold reverse auctions for clean power delivery contracts. Only 29% have “net metering” policies that allow owners of distributed solar systems to be compensated for feeding any excess power they generate back onto the grid.

The scale and effectiveness of clean energy incentives in Africa must improve if the continent hopes to drive further clean energy investment and deployment. From 2010 through 2021, just 1.3GW per year, on average, of new renewables projects signed power-delivery contracts with governments or utilities on the continent. That was far behind the 4.8GW/year of projects that signed contracts in Latin America, 8.4GW in India and 11GW in China.

Finally, there is the basic challenge associated with the fact that Africa’s power markets are highly regulated and centralized. Currently, no country there hosts a wholesale power market, limiting the ways private sector players can participate. Additionally, 94% of countries on the continent have vertically-integrated utilities that, in many cases, have monopolies on transmission, and retail sales. While all countries in Africa are open to private sector participation in generation, only 15% are open to private sector participation in transmission and 33% in retail.

Figure 29: African nations with auctions, feed-in tariffs or both policies in force

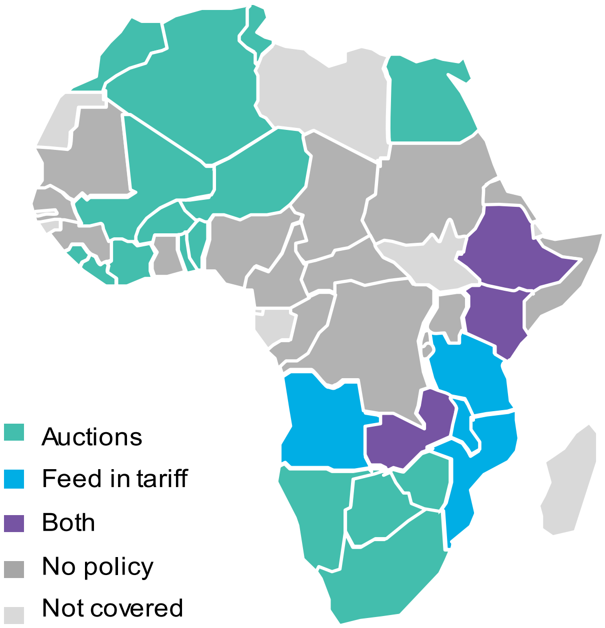
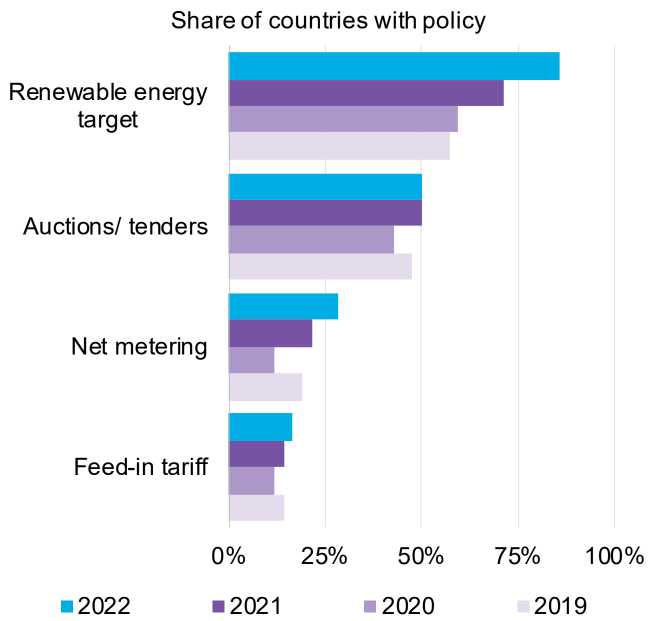


Figure 30: Share of African countries where renewable energy policy is present



Source: BloombergNEF. Note: Based on BNEF's Climatescope database which covers 42 African countries.

Rural electrification targets will require both on- and off-grid solutions

Expanding energy access remains a crucial priority for African policymakers, particularly given the slow progress achieved to date in providing electricity to rural communities in Sub-Saharan nations. The large majority of African governments (81%) have set energy access targets and paired them with rural electrification strategies currently being implemented (Figure 4).

Figure 31: Availability of energy access policies in African countries, 2021

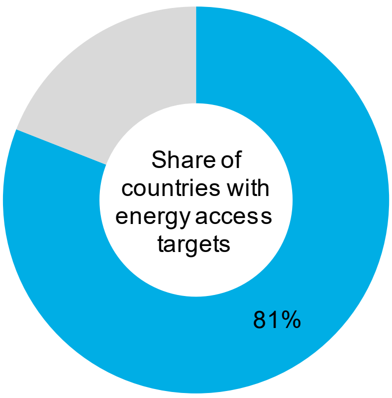
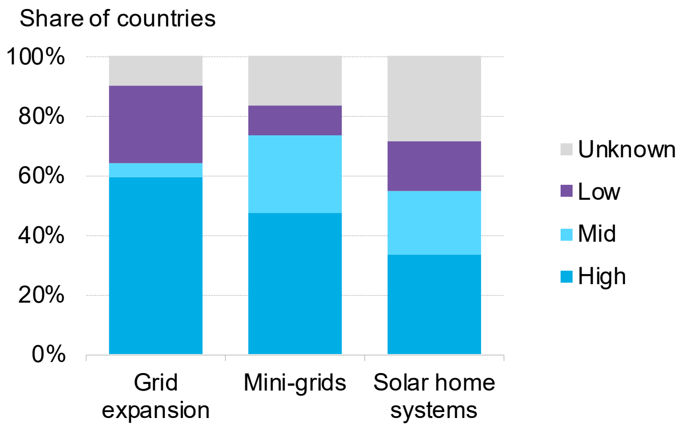


Figure 32: Priority level for energy access and rural electrification technologies among African countries, 2021



Source: BloombergNEF. Note: Based on BNEF's Climatescope database which covers 42 African countries.

Delivering on energy access goals in Africa will rely on a range of both on- and off-grid solutions, but today national electrification strategies tend to place a heavy emphasis on building out conventional grids. As many as 60% of the 42 countries surveyed by BNEF emphasize grid expansion highly in their energy access plans.

However, expanding grids to entire populations is often not economically viable and, in some cases, not possible due to terrain. Just over half of the countries in the region have rural electrification initiatives that rely on deployment of off-grid measures such as mini-grids, or solar home systems. Some markets are relying even more heavily on off-grid solutions to expand energy access than extending the main grid: 17% of countries prioritize mini-grid deployment over main grid expansion, including Zimbabwe and Nigeria.

Section 3 Scaling-up investment

Despite its outstanding natural resources and the fact that clean energy technologies are more cost competitive than ever, Africa has thus far reaped only limited benefits from the global energy transition. This is largely due to a slew of policy-, infrastructure- and finance-related barriers that have artificially inflated the costs of clean technologies or made them difficult to deploy. To gain a better understanding of obstacles in each of these areas, BNEF surveyed investors, developers, policy makers, and other stakeholders in 42 African nations during the first half of 2022. This section examines the most common policy, infrastructure and finance barriers in Africa today and provides case studies to illustrate how other emerging markets have attempted to address those.

3.1 Ensuring consistent procurement

Demand for electricity is growing inexorably in Africa, but government-organized efforts to ensure that rising demand gets met by the proper volumes of supply have been sporadic, at best. This has made it difficult for private project developers or financiers to build "pipelines" of wind, solar or other power-generating facilities they can bring online over years.

On the other hand, when governments or state-run utilities send clear signals about when and how they plan to buy power for their grids, developers can plan and respond appropriately. Consistent procurement practices thus have the potential to unlock significant renewable energy investment flows in Africa.

Centralized, government-run auctions and tenders for clean power delivery contracts have been held on hundreds of occasions in dozens of nations globally. They have been highly successful in eliciting bids for least-cost renewables, both in wealthy nations and in emerging markets.

Auctions and tenders typically sign long-term power purchase agreements (PPAs) with plants that agree to sell clean power at the lowest cost. These PPAs provide revenue certainty as the developers know how much they will be paid for their power for a fixed number of years into the future. Competitive allocation through auctions has proven to produce tariffs that better reflect ongoing technology cost trends. That said, when auctions are scheduled on an inconsistent or unreliable basis, they can damage investor confidence and result in abrupt declines in investment flows.

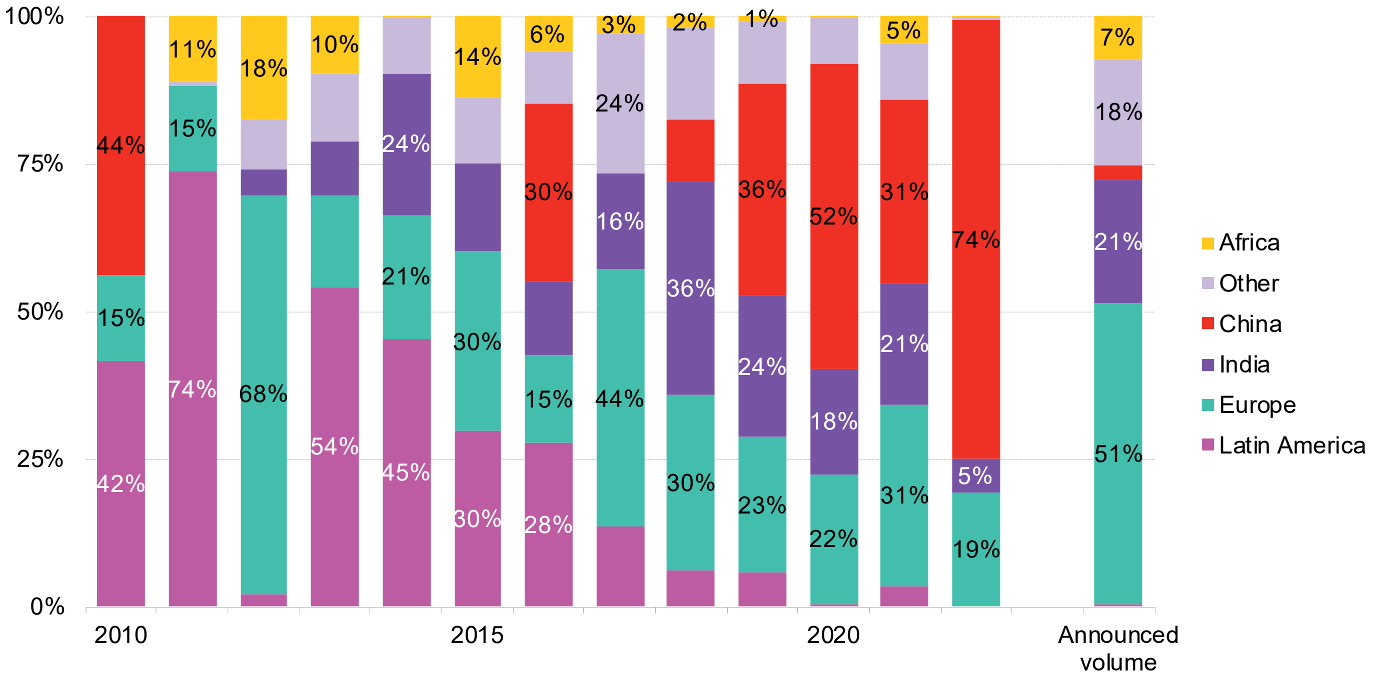
Volumes of clean power pledged via contracts won in auctions have varied by year in Africa, but the general trend has been downward in recent years relative to other regions. Africa was host to 10% of global clean energy auctions by capacity allocated from 2011-2015, but that fell to just 2% for 2016-2020, in part because the global market for auctions grew but Africa did not keep pace. Although Africa auctioned 4% of the global total capacity in 2021 and the pipeline of auctions announced by governments in Africa is 7% of the global total, much of the procurement has occurred on an ad-hoc basis outside of standardized, regular auction programs.

To succeed, procurement programs must be executed effectively from start to finish – all the way through to when projects are completed. Unfortunately, this has not always been the case in Africa or other parts of the world. Meanwhile, the delivery of much of the auction pipeline has been fraught with delays.

In Kenya, for example, lack of auction policy until 2021, poor government communication to stakeholders and excessive bureaucracy have clogged capital deployment for renewables. Kenya has also sought to renegotiate previously agreed PPAs, undermining private sector confidence in the market.

To address these barriers, Kenya could look to start again with a clean slate. It could establish a clear procurement schedule and communicate it clearly to stakeholders and then honor whatever new PPAs it signs. This has potential to unlock capital flows in the country and increase the number of market participants, ultimately creating a competitive market.

Figure 33: Share of annual contracted volumes through renewable energy auctions and tenders by region



Source: BloombergNEF's Global Clean Energy Auctions Tracker.

The case of Namibia demonstrates how a procurement program that goes off course can get back on track to achieve positive results. The country held its first, pilot auction in 2013 but then made retroactive changes to the bid site capacity, and the process unraveled. This damaged investor confidence and made the clean energy sector in Namibia appear risky. In 2016, however, Namibia re-established competitive tenders. It then held successful auctions in 2017 and 2019 with 90MW of renewables added to the grid thus far from the program, and a total 500MW utility-scale PV expected online by 2025.

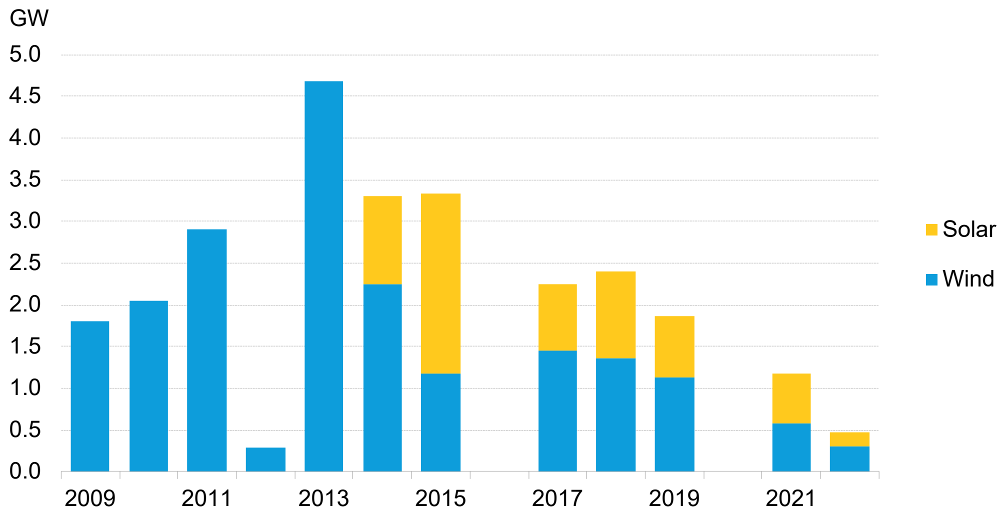
A lack of consistent, predictable procurement processes has contributed to large year-to-year fluctuations in clean energy investment in Africa. Inconsistent procurement has also heightened perceived regulatory risks, raised financing costs and deterred certain investors from participating in African markets. All of these have the potential to increase the total cost of transition and slow clean energy deployed. Clearly outlined plans executed on time can provide developers the clarity they need to make business decisions years in advance. The result: countries will be able to move faster toward expanding their clean energy economies.

Brazil's competitive auctions

Brazil was among the first countries to use competitive auctions to procure clean power at scale, leading to contracts signed with projects representing over 26GW of wind and solar capacity at record-low prices (Figure 34). The country held 37 rounds of tenders between 2009 and October 2022. These helped attract over $85 billion in clean energy project funding including significant volumes of cross-border investment.

Brazil's auctions policy has succeeded by establishing clear rules under which developers operate. It allowed the market to function freely by not setting unreasonable caps on the prices developers could bid to win contracts. The timing of the auctions and the volumes of power it sought to contract has been generally well calibrated to match Brazil's growing demand. Finally and perhaps most importantly, the auctions have been held consistently, regardless of which political party was in charge.

Figure 34: Brazil annual wind and solar capacity contracted via auctions



Source: BloombergNEF

Brazil offers lessons for Africa of what can be achieved when procurement rules are consistently implemented. Brazil was successful in increasing renewable energy capacity because the government remained dedicated to the established auction program. This provided procurement timeline security to investors, encouraging further investment. By establishing annual auctions, African countries could attract consistent renewable energy investment, ultimately increasing renewable energy capacity.

In conjunction with the auctions, Brazil established local-content requirements specifically intended to create local manufacturing bases for wind and solar equipment. These have proven highly successful in building out the country's supply chain for specific technologies. Notably, the local content measures were put in place as incentives not penalties. To receive discounted financing from state-run development bank BNDES, developers who won contracts under state-organized auctions agreed to use certain amounts of locally-sourced equipment. As the clean energy sector in the country grew, the local content requirements became more aggressive, incentivizing developers to source more and more of their equipment locally.

There have been some bumps along the way in Brazil, with the government having to, at one point, renegotiate previously agreed contracts. Nonetheless, Brazil offers lessons to Africa about what can be achieved when a procurement policy is clearly articulated from the start and then implemented consistently in a relatively transparent manner. It also highlights the economic benefits that can be reaped when rules are in place to incentivize the use of locally-equipment. By establishing annual auctions, African countries have the potential to attract consistent renewable energy investment and ultimately increase renewable energy capacity. By pairing such auctions with local-content rules, they also have the potential to expand local manufacturing and create jobs in the process.

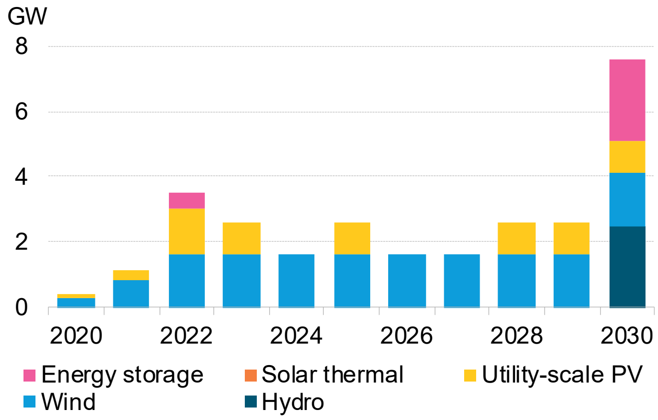
All that said, it should be noted the Brazil had one advantage that African nations generally lack: BNDES, a well-established and well capitalized development bank specifically tasked with furthering local economic growth. Instead, African countries often must look outside their borders for such funding sources. Brazil also had a history with using domestic-content rules effectively in other industries. Few African nations have similar precedents to build on.

South Africa’s Integrated Resource Plan

The government of South Africa updated its Integrated Resource Plan (IRP) in 2019, outlining annual auction and decommissioning plans through 2030. The plan involves installing over 25GW of renewable energy capacity and 3GW of energy storage by that time, procured through regular auctions (Figure 35). The government has already taken steps towards delivering this. In October 2021, it awarded PPAs to 2.6GW of clean energy capacity through its auction program, and in June 2022 it opened bids for 5.2GW of wind and solar projects.

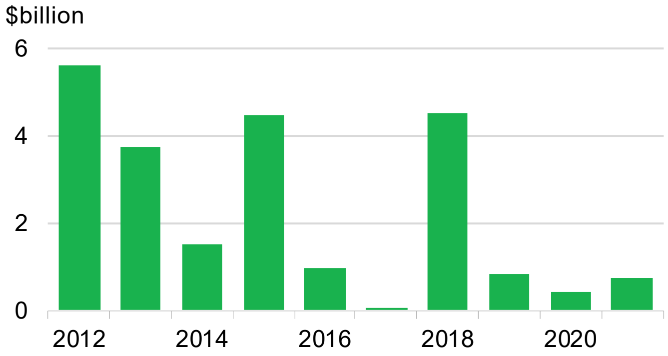
The 2019 IRP raises hopes for a more consistent framework for clean energy procurement in South Africa. Over the last decade, policy instability and lack of consistent procurement have led to highly variable investment flows to projects in the country (Figure 36). For example, the government refused to sign PPAs won under the fourth round of its Renewable Energy Independent Power Producers Program for two years, delaying financing decisions for projects. The South African government also waited four full years after announcing its fifth auction round to actually hold it in 2021.

Figure 35: South Africa 2019 Integrated Resource Plan renewable energy capacity allocation



Source: IRP 2019, BloombergNEF

Figure 36: Annual renewable energy investment, South Africa



Other African countries can learn from South Africa’s successes and challenges over the last decade. Reliable opportunities for investors to support clean energy projects through regular, centralized procurement programs that are open to independent power producers and offer offtake contracts on a competitive basis can be highly effective. Alongside a robust auction contract design, the consistency of procurement mechanisms can help to build and maintain investment confidence in both nascent and mature renewable energy markets.

3.2 Planning grid expansion and electricity access

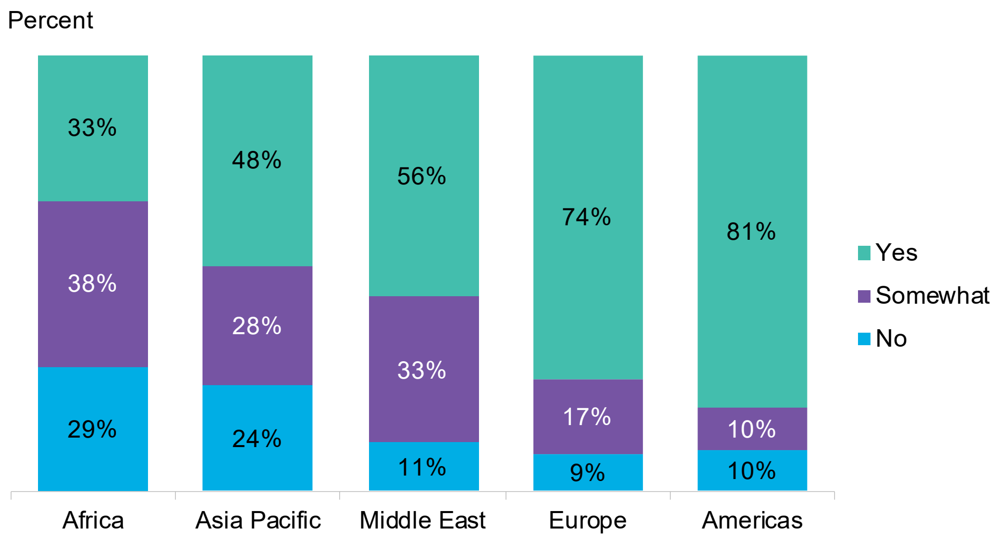
Proper planning and development of a country's power grid can ensure that electricity moves efficiently from where it is generated to where it is needed. Improving grid infrastructure across Africa will be critical to delivering reliable, cost-effective, low-carbon electricity to consumers. Strong grid infrastructure is also vital to meeting Africa's massive energy access challenge and integrating new renewable energy capacity.

As African countries aim to expand access to electricity to more of their citizens and connect renewable-resource rich regions to population hubs, there is a massive opportunity for new investment in grid infrastructure. The private sector can underwrite this build-out if governments lay out adequate plans. This involves transparent planning processes, clearly articulated policies, and demonstrable opportunities for investors to earn sufficient returns on investment. Such plans should also seek to provide opportunities to developers of utility-scale projects and those seeking to build out distributed generation.

Transmission planning involves a clear outline on how the government or system operator intends to develop the grid. Ideally, these plans incorporate delivery timelines to help investors identify opportunities for both grid infrastructure projects and generating capacity expansion. A lack of available plans can make it difficult for investors to create timelines around grid investment.

Of the 42 African countries tracked by BloombergNEF's Climatescope, just a third have transparent grid extension plans in force (Figure 37). By comparison, 56% of the countries BNEF surveyed in the Middle East and more than 74% in Europe have grid extension strategies.

Figure 37: Availability of transparent grid extension plans by region, 2021



Source: BloombergNEF. Note: Based on Climatescope survey indicator 'Transparent grid extension plan'. Climatescope covers 132 countries globally including 42 countries in Africa. For more details and full country list see www.global-climatescope.org

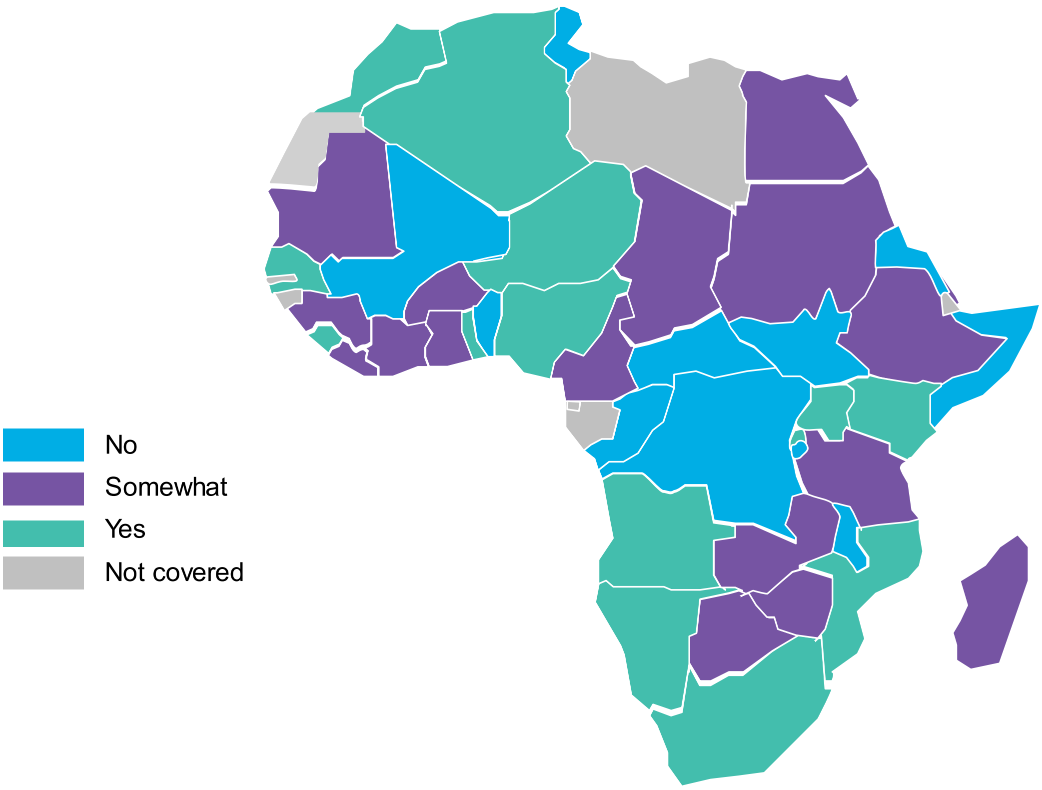
Rwanda, Uganda, Nigeria and Kenya have each developed and made public grid extension plans. Kenya developed its grid plan after struggling to bring to fruition a wind farm that first won a power-delivery contract a decade ago. In 2012, the country launched a tender for a 310MW wind project, which was won by developer Vestas Wind Systems. Vestas commissioned the project in

October 2017, but transmission lines connecting the project to the grid were unavailable at the time.

The contract Vestas signed with Ketraco was "take or pay" meaning the state-run utility was obligated to pay for the power the wind farm was producing despite the power not being exported to the grid or ultimately consumed by anybody. Ketraco completed the transmission lines and connected the project to the grid in September 2018 but the utility's lack of foresight amounted to an estimated 1,300GWh of lost generation over 11 months.[3] The country has received about 150GWh of wind generation monthly from the project ever since.

Countries that BNEF identifies as having 'somewhat' readily available grid extension plans need to ensure clear mechanisms for their delivery. For example, Sudan has grid legislation that mentions a transmission framework, but it has not yet developed this framework in practice. Therefore, grid extension plans must also include deliverables, be enforceable, and impact wider policy, regulatory and revenue frameworks, to be effective.

Figure 38: Availability of transparent grid extension plans in Africa by country, 2021



Source: BloombergNEF. Note: Based on Climatescope survey indicator 'Transparent grid extension plan'. Climatescope covers 42 countries in Africa. For more details and full country list see www.global-climatescope.org

Expanding energy access means extending transmission lines, of course, but it also means exploiting off-grid solutions. This is particularly true for rural areas which are hard to reach with the typical hub-and-spoke transmission architecture given the high costs of building across certain

[3] Estimated based on the increase in generation seen at the transmission inception time. For more, see Leading Economic Indicators December 2018.

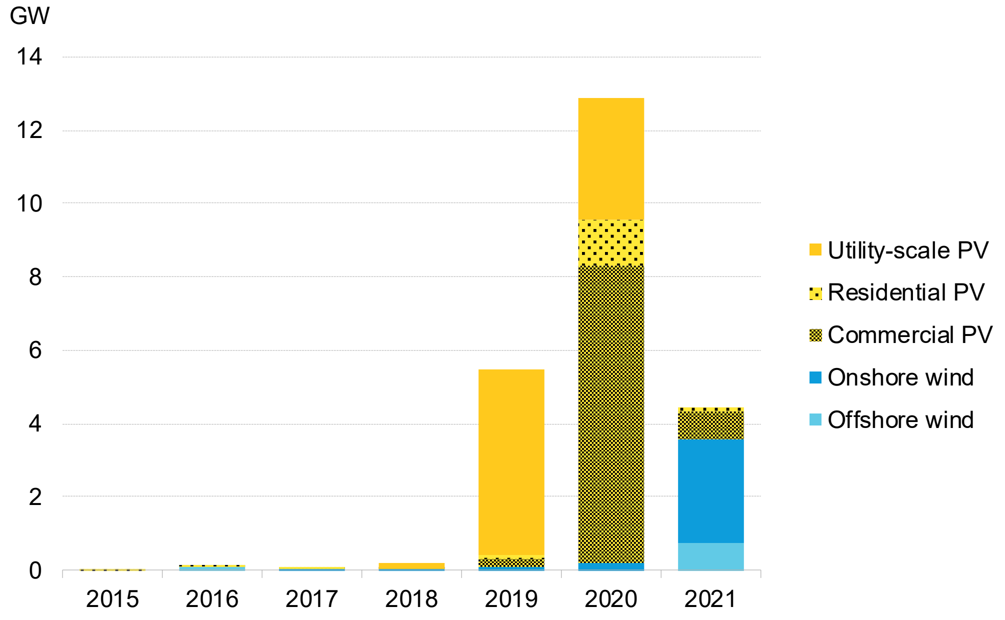
types of terrain. For this reason, off-grid solutions such as mini-grids and solar home systems can provide alternative, lower cost routes to electrification.

In some African nations, the culture of citizens in rural areas is generally incompatible with conventional transmission set-ups. Mauritania, for instance, is home to large, rural nomadic populations. Such groups pose stranded asset risk to transmission infrastructure if they decide to relocate. For them, off-grid solutions may well be preferable. African policy makers would be wise to take off-grid solutions such as mini-grids and solar home systems (SHS) into account when formulating national plans.

Vietnam seeks grid expansion to match its solar boom

The country of Vietnam offers a somewhat cautionary example of why grid planning should occur alongside, not after, strong policy support is offered to renewables. In May 2020, policy makers there stepped up efforts to attract private financing for a build-out of Vietnam's transmission network. The move came in response to a surprisingly strong boom in renewables capacity addition in the country. From 2019-2021, solar and wind installed capacity grew by a remarkable 23GW (Figure 39). The sudden burst in PV deployment, in particular, created congestion on Vietnam's grid, which policy makers are now scrambling to address.[4]

Figure 39: Vietnam solar/wind capacity additions



Source: BloombergNEF

Vietnam's feed-in tariff scheme, which drove the boom, did not incorporate grid considerations such as location-based quotas. Most assets were built in one region due to resource availability with limited planning to connect this new generation to demand centers.

Vietnam laid out in its power development plans a grid expansion strategy outlining growth targets for line and substation growth to 2030 (Table 1).[5] The current draft power development plan VIII

[4] For more, see *Vietnam Prioritizes Grid and Renewable Energy over Coal* (web | terminal).

[5] For more, see 'EVN Annual Report 2021' (link).

aims to balance demand and supply across regions based on their resources to reduce extensive inter-regional grid infrastructure requirements. Specifically, most solar generation exists in the sunny southern parts of the country while the northern region has ample thermal coal resources.

Table 1: Vietnam power transmission system expansion plan

Initiative	Unit	2016-2020	2021-2025	2026-2030
500kV lines	km	2,746	3,592	3,714
220kV lines	km	7,488	4,076	3,435
500kV substations	MVA	26,700	26,400	23,550
220kV substations	MVA	34,966	33,888	32,750

Source: BloombergNEF, Vietnam Electricity (EVN). Note: MVA = Mega Volt Ampere.

To reduce the financial burden on public resources of connecting new capacity, the government is proposing to open investment to the private sector – specifically to build 220kV and 110kV lines that connect new supply to the main grid. State-owned enterprises in Vietnam currently invest about $478 million annually to construct lower-voltage lines.

To date, the government has approved just one private grid infrastructure development. Trungnam Group built the 450MW Thuan Nam solar power plant and a 220/500kV gridline connecting the Phuoc Minh commune to the Vinh Tan commune. This line aims to improve transmission capacity in the area and reduce the risk of curtailment to the solar plant.

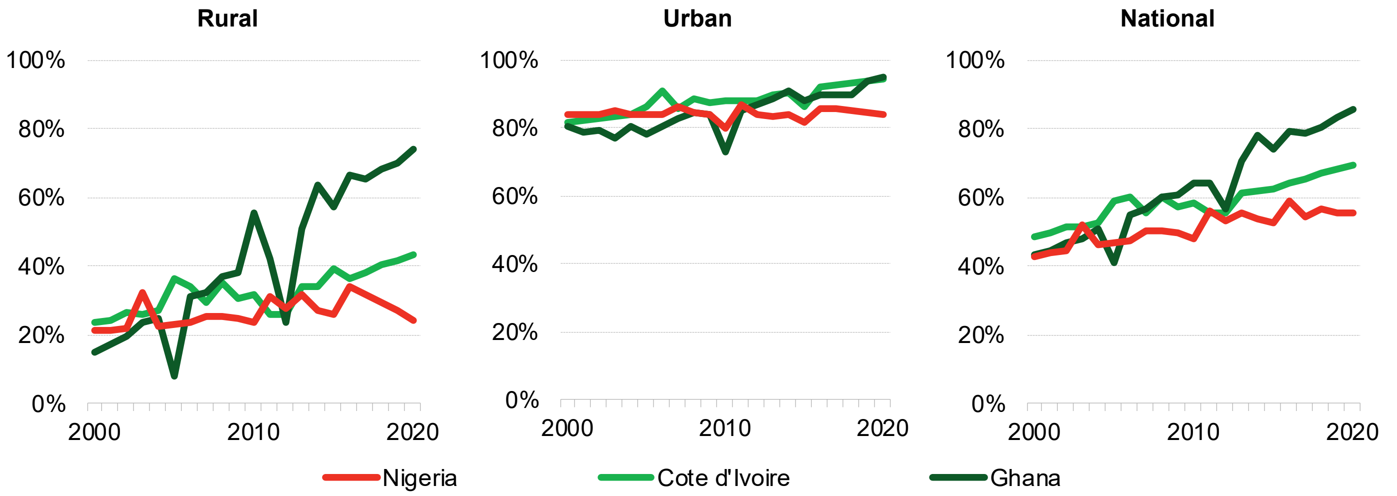
There are challenges, however, to opening grid infrastructure to private investment. For example, the government wants state utility Vietnam Electricity (EVN) to manage and operate all lines, and has not yet determined which party would be responsible for maintenance costs or how revenue mechanisms to recover capital expenditure would work for private entities. EVN was already hesitant to take on the management of Trungnam Group's transmission line, even at no cost, because of the maintenance cost risk.

While the Vietnam experience is exceptional, given the size of the country's clean energy boom, it does offer potential lessons for nations in Africa. Though no African country has seen the type of explosive growth in solar capacity that Vietnam has, Vietnam highlights the importance of grid planning when supporting renewables. Such planning should welcome private investment by offering clear remuneration mechanisms to compensate the up-front capital required. It should also consider how to cover the operation and maintenance costs associated with the assets.

Nigeria's results-based blended finance for mini-grids

Nigeria is demonstrating how blended finance incentives can potentially boost investment for off-grid solutions. Electrification rates have been almost flat for a decade in Nigeria (Figure 40). To improve rural electricity access, the World Bank, African Development Bank, and Nigerian Rural Electrification Agency in 2018 launched the Performance-Based Grant program, which can be paired with private capital to support the deployment of solar-hybrid mini grids. It offers grants to mini-grid developers of $600/connection on a first-come, first-served basis, with a minimum total grant request of $10,000 per mini grid and a total concessional program budget of $48 million.

Figure 40: Electrification rates by country



Source: World Bank, BloombergNEF

The program appears to be building momentum for investment. The grants are being used to support 14 mini-grid developments that look to be completed by late 2023. In October 2022, Engie Energy Access and CrossBoundary Energy Access announced a joint agreement to finance a $60 million portfolio of mini grids in Nigeria – the largest mini-grid project finance transaction in Africa to date – using a blended finance approach to bring electricity access to 150,000 people by 2026.

The results-based design of the program compensates developers once the mini-grid is complete and meets reliability criteria. Developers can access 40% of the grant when materials arrive at the construction site, 40% on commissioning the mini grid, and 20% when the project provides reliable electricity to consumers for 90 days. This means developers must raise the rest of the upfront capital on their own, usually from local banks.

Nigeria had previously attempted to incentivize renewable energy mini grids using upfront grants, but developers often failed to deliver projects in a timely manner. Results-based incentives should however be carefully designed to minimize administrative burdens on developers. For example, Nigeria has a digital platform to allow mini grids to be remotely metered to prove their reliability, rather than relying on manual verification from independent agents.

Similar programs could be implemented in other African countries where main-grid expansion is less economic than off-grid solutions. This could include countries with sizeable rural communities, such as Burundi and Uganda. Five other countries in Sub-Saharan Africa have already implemented similar funding schemes for mini-grids, namely Ethiopia, Burkina Faso, Togo, and Mali.[6]

3.3 Activating domestic clean energy investors

Africa-based lenders and investors can have a fundamental role to play in scaling on-grid and off-grid renewables deployment. National commercial and development banks, for example, can offer in-depth knowledge of local clean energy sectors that foreign investors may lack. Such institutions

6 For more, see: *State of the Global Mini-Grids Market Report 2020 (web | terminal).*

have unique connections to local communities. Domestic financiers can also serve as intermediaries between international sources of capital and local projects or communities. Countries with domestic financial institutions active in clean energy have benefitted from higher investment flows. That said, there is plenty of room for improvement as not all local funders are aware of the opportunities renewables offer. Others may have the knowledge but have limited capital to deploy for green initiatives.

In Africa, domestic investors have provided just 23% of the combined debt and equity deployed for utility-scale renewable energy project development in the past five years (Figure 41). With over $2.4 billion from local investors, South Africa accounts for over half of all domestic finance in the region and is the only country where investment from local players significantly exceeds that of foreign investors. Morocco, Kenya, Egypt and Zimbabwe are the four other countries where domestic capital has most often been deployed (Figure 42).

Figure 41: Renewable energy asset finance for renewable energy projects in Africa by investor type

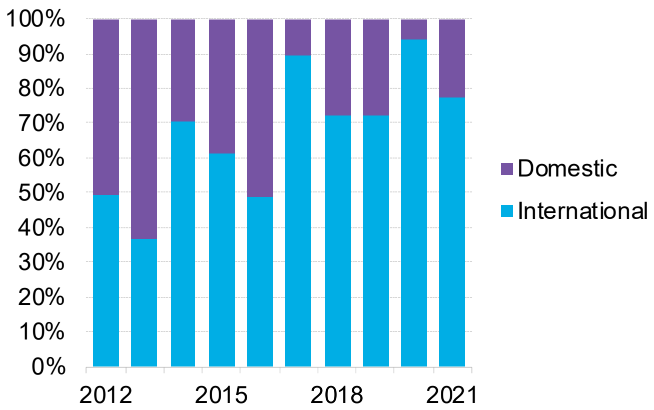
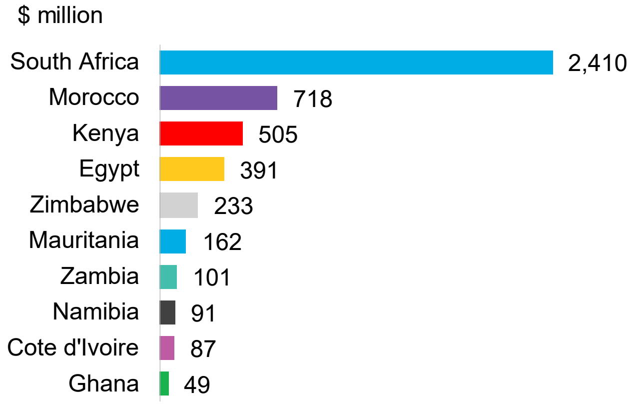


Figure 42: Domestic capital supplied in support of renewables, 2017-2021



Source: BloombergNEF

South Africa's successes reflect largely the country's mature financial sector and multiple types of financiers that have backed clean power in South Africa. While banks and corporations have been most active, asset owners such as pension funds and asset managers have also participated. This has helped encourage collaboration with and investment from international players.

Morocco ranks second for domestic finance as measured in dollar terms. But the $718 million deployed from local sources represents less than a quarter of Morocco's total 2017-2021 clean energy investment. Most domestic investors are state-owned organizations, such as the Moroccan Agency for Sustainable Energy (Masen). Truly private investment of any kind for clean energy has been limited in Morocco with international development finance institutions such as KFW, the European Investment Bank, and the World Bank providing most funding to date.

The limited participation from local financial institutions to date highlights the need for greater education on the opportunities (and risks) clean energy offers for capital deployment. International development finance institutions, philanthropic organizations and foreign commercial banks, among others, all have the potential to provide technical assistance to local banks on the sector's opportunities.

The role of national development banks in Mexico

Mexico's case demonstrates the importance of local finance institutions in accelerating deployment of utility-scale projects in nascent markets. Following capacity building activities from multilateral development organizations, including the World Bank's Climate Investment Funds, Mexico's development bank Nacional Financiera (Nafin) was invited to participate as a co-lender in financing the 250MW Eurus wind farm in 2009-2010. Other debt providers included the International Finance Cooperation (IFC) and the Inter-American Development Bank (IDB). Eurus was one of the first private wind farms in the country and the largest project in Latin America at the time. It was, therefore an important project to demonstrate feasibility and profitability of wind in the country.

The success of the collaboration led Nafin to become a key player in Mexico's renewable energy sector. It channeled investment from multilateral development banks to several projects, including concessional finance from the Climate Investment Funds (CIF). Since Eurus, Nafin alone has allocated over $475 million to the sector, helping finance more than 2.4GW of wind and solar projects combined. By channeling concessional finance from CIF, Nafin also helped mitigate project-specific risks in an incipient sector, lowered cost of capital and therefore made projects more attractive for market entrants, driving new investors to the country. The state-owned development bank Banobras played a similar pivotal role, providing $470 million to help finance 14 wind and solar projects in the country.

It is important to note, however, that an abrupt government change with the victory of the leftist Andres Manuel Lopez Obrador in 2018, has reduced clean energy opportunities in Mexico and shifted the focus of government agencies, including development banks, away from renewable energy. Still, the developments over the past decade helped the country reach over 18.5GW of wind and solar capacity in 2021, or 19% of the country's power matrix.

Educating India's lenders on small-scale solar

Training and upskilling can support the development of a domestic financing ecosystem for small-scale renewable energy adoption. In India, for instance, the Bharatiya Vikas Trust educates businesses in rural areas on how to deploy and use renewable energy technologies. It also teaches the financial institutions that can back clean ventures. The Trust specifically trains bankers, micro-finance institutions, and government departments on financing small-scale solar projects.

Loans for small-scale renewables in India are often inaccessible to local business owners because banks are uncomfortable funding what they regard as unfamiliar technologies. Banks can also resist lending to small businesses of any kind given the informal nature of much of India's economy. The growth in alternative financing options, such as micro-finance loans, is helping to improve accessibility, but many institutions still lack familiarity with clean energy specifically.

Educating a full range of institutions can be particularly useful in developing countries as often smaller institutions such as microfinance organizations rely directly on regional, rural banks for support. Those institutions, in turn, can rely on even larger, either national or multinational sources of funding. So upskilling institutions all along the financial value chain can pay significant dividends.

About us

Contact details

Client enquiries:

- Bloomberg Terminal: press <Help> key twice
- Email: support.bnef@bloomberg.net

Chasity McFadden	Analyst, Energy Transitions
Luiza Demôro	Head of Energy Transitions
Ethan Zindler	Head of Americas
Emma Champion	Head of Regional Energy Transitions
Caroline Chua	Senior Associate, Southeast Asia
Antione Vagneur-Jones	Head of Trade and Supply Chains
Laura Foroni	Analyst, Energy Transitions

Copyright

Disclaimer