Natural Resource Governance Institute

Gas Power's Contribution to Electricity Access in Africa

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Module3

This slide deck accompanies the third module of the Natural Resource Governance Institute's (NRGI) Framework for Countries Evaluating Gas-to-Power Pathways. The framework is a resource for government officials, researchers, civil society actors and journalists in lower- and middle-income gas-producing countries. It offers insights, arguments, questions, data points and examples for interrogating common claims around the use of gas for electricity.

In particular, the third module evaluates claims for and against gas power as a vehicle for improving electricity access.

The slides that follow:

↘

Survey the current state of electricity access, with a focus on Africa.

↘

Review gas's past contribution to improving access rates on the continent.

↘

Consider gas's future role as a fuel for expanding African electricity access and use, both in isolation and compared to renewable technologies.

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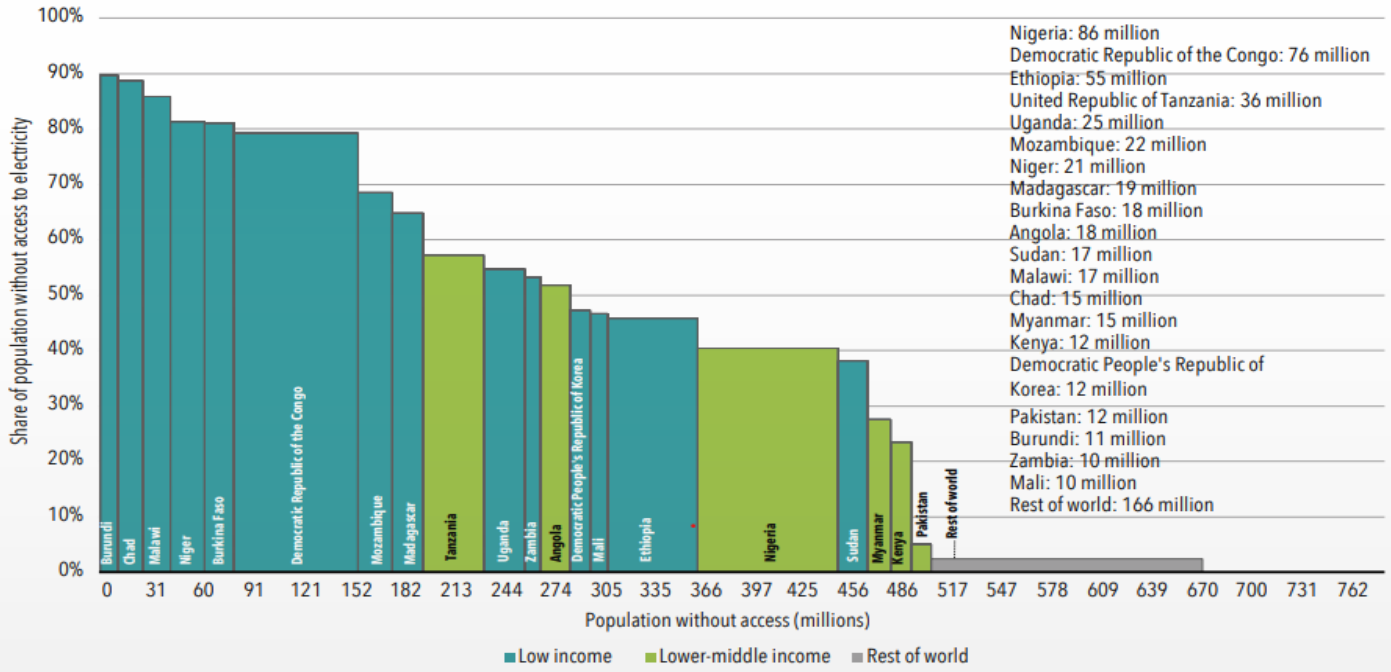
Around 600 million people are still living without electricity, despite big gains.

The drive to make electricity access universal has seen successes in recent years:

- The proportion of the world's population with electricity has risen every year since 2010—from 84 percent to 91 percent in 2021.
- Over this same period, the number of people still living without service dropped by almost half.

People without access are increasingly concentrated in around 20 countries:

Figure 1.14 • Share and absolute size of population without access to electricity in the top 20 access-deficit countries and the rest of the world, 2021



Source: Tracking SDG7: The Energy Progress Report 2023

Nearly 600 million people are still living without electricity, despite big gains.

People without access are increasingly concentrated in around 20 countries:



Source: Tracking SDG7: The Energy Progress Report 2023

Making electricity access universal increasingly depends on progress in Africa, where needs are growing quickly.

Electricity demand in many African countries is rising faster than supply.

Supply on the continent needs to triple by 2030 to meet fast-growing demand.

Rising demand is driven partly by huge population growth.

- Over half of world population growth through 2050 will be in Africa.
- Four of the top 10 countries with the largest projected population growth this century are African gas producers:
  - Nigeria (+527 million people by 2100), Tanzania (+226 million), Angola (+155 million), Egypt (+122 million)

Fast population growth also makes it harder to reduce the numbers of people living without power.

- 2010–2020: Africa's electricity access rate increased by 8 percent, but population growth left 5 million more people without electricity.
- Estimate: By 2030, almost nine out of every 10 people living without electricity could be African.



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A range of voices are promoting gas as a necessary fuel to bring electricity to Africans.

The common claim:

If African countries stop extracting and burning gas, millions of people will go without electricity service.

This appears in statements by political leaders, position papers from intergovernmental bodies, op-eds and other media from international energy companies, research by think tanks and NGOs, and publications of development banks and private foundations. **Typical supporting arguments:**

- Gas can provide Africans with low-cost, reliable electricity.
- African countries need to burn gas for power because renewables cannot meet all their electricity needs. Those opposed to gas rely on pie-in-the-sky assumptions that greatly underestimate the challenges of building and operating all-renewable power systems, even in wealthier countries.
- Concerns like the above, in turn, feed arguments that:
  - Gas should be a "transition fuel" for Africa.
  - Africa cannot "leapfrog" gas power to renewables.
  - Gas power plants will be an important "backstop," "complement" or "partner" for renewables, a source of "stable" baseload power.
- Abandoning gas now would threaten African countries' energy security.
- Supporting Africa to keep extracting and burning gas longer than other, wealthier regions is fair and just, because middle- and high-income countries relied on gas, so why not Africa, especially when African countries are not the ones responsible for the climate crisis?
- Africa's use of gas for electricity isn't against climate goals because:
  - Gas is a "green" fuel, especially compared to other fuels like oil or coal. (Note: This is not necessarily correct.)
  - Even if African countries dramatically increased their use of gas for power, the impact on global emissions would be small.

The push to link African gas to electricity access is understandable.



Arguments about using gas for power generation come at a time when unmet energy needs on the continent are huge.

Excitement over recent gas discoveries remains high.

Some Africans are angry about wealthy nations' hypocrisy and mixed messages about the need to move away from gas, especially after Russia's full-scale invasion of Ukraine.

Other, wealthier nations have already built robust, high-emitting economies and energy systems using gas.

Scaling up renewables is still challenging in most African countries, for a range of reasons.

Nonetheless, gas's true promise for delivering electricity to unserved people needs careful interrogation.

Many public statements in favor are broad, rhetorical appeals, unsupported by analysis or examples.

Building lots of new African gas power plants and related infrastructure would be difficult (see slide 18 for some reasons why).

Arguments in favor of developing African gas may reflect other interests and agendas—for instance, those of:

- National oil companies (NOCs): In an NRGI survey, many NOCs said they want to invest more in gas to "diversify" away from oil, in part to ensure their own survival.
- International oil and gas companies: Some are focusing more on African gas as "peak oil" approaches, but mainly to sell the gas to wealthier nations.

Companies headquartered in Europe own the majority of new gas reserves in Africa. Do their priorities match those of Africans?

The slides that follow ask: How much has gas power contributed to the electrification of Africa, and what might its future role be?

Example–Eni:

- Says it wants gas to be 90 percent of its fossil fuel output by 2050, up from 46 percent in 2022.
- Is extracting and exploring for gas all over the world, including in 10 African nations.
- Has supplied at least some gas for power generation in Angola, Ghana, Nigeria and Republic of the Congo (Congo-Brazzaville).
- Is mainly increasing its strategic focus on gas, it says, to hold onto its "leading position in the European gas market," providing "secure supplies" of gas to Europe over the coming decades.
- Mainly sells its gas to Europe. In 2023, 96 percent of all Eni's gas sold went to buyers in Europe; its sales to countries beyond Europe have been falling for years.
- Is investing mainly in new African gas reserves and projects (in Angola, Congo-Brazzaville, Côte d'Ivoire, Mozambique) to produce gas for export to Europe or Asia, not for domestic use.

Is meanwhile exiting its Nigerian gas fields that supply gas to local power plants.

Africa has used more of its gas for electricity in recent years.

Over 40 percent of Africa's electricity currently comes from gas, up from 14 percent in 1990. Gas is the number one fuel for power generation on the continent, followed by coal (less than 30 percent). Today, 20 African countries burn gas for electricity. All but two (Benin and Togo) have existing gas production.

Table source:
Author calculations based on IEA data

African countries using gas versus other fuels in their electricity mix (% of total electricity, 2021)

Country	Gas	Coal	Oil	Hydro	Wind	Solar PV	Other sources
Algeria	94%		5%	1%			
Angola	10%		15%	75%			
Benin	76%		24%			1%	
Cameroon	30%		10%	60%			
Congo-Brazzaville	72%		5%	23%			
Côte d'Ivoire	69%			30%			1%
Egypt	84%		4%	8%	2%	2%	
Equatorial Guinea	66%		1%	33%			
Gabon	49%		10%	41%			
Ghana	59%		4%	37%			
Libya	73%		27%				
Morocco	9%	68%	2%	3%	11%	1%	6%
Mozambique	16%		1%	83%			1%
Niger	7%	27%	63%			3%	
Nigeria	76%			24%			
Rwanda	23%	4%	15%	56%		2%	
Senegal	1%	3%	83%		4%	7%	3%
Tanzania	42%		17%	39%		1%	1%
Togo	66%		8%	19%		7%	
Tunisia	95%				2%	2%	1%

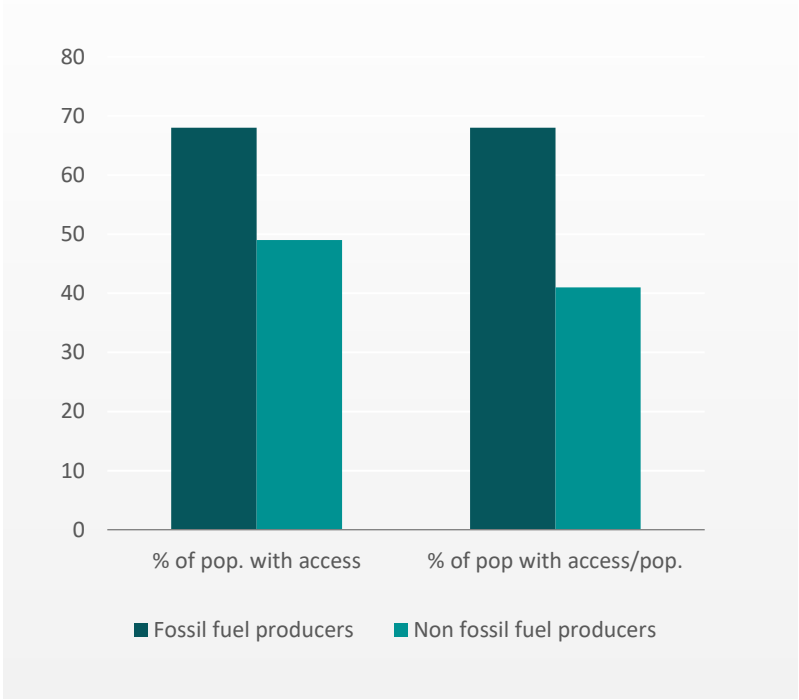
Gas power has made meaningful contributions to electricity access in some African countries.

As a group, African fossil-fuel-producing countries have higher electricity access rates than non-producers (left graphic).

Some gas producers have made large gains in access over the last two decades (right graphic).

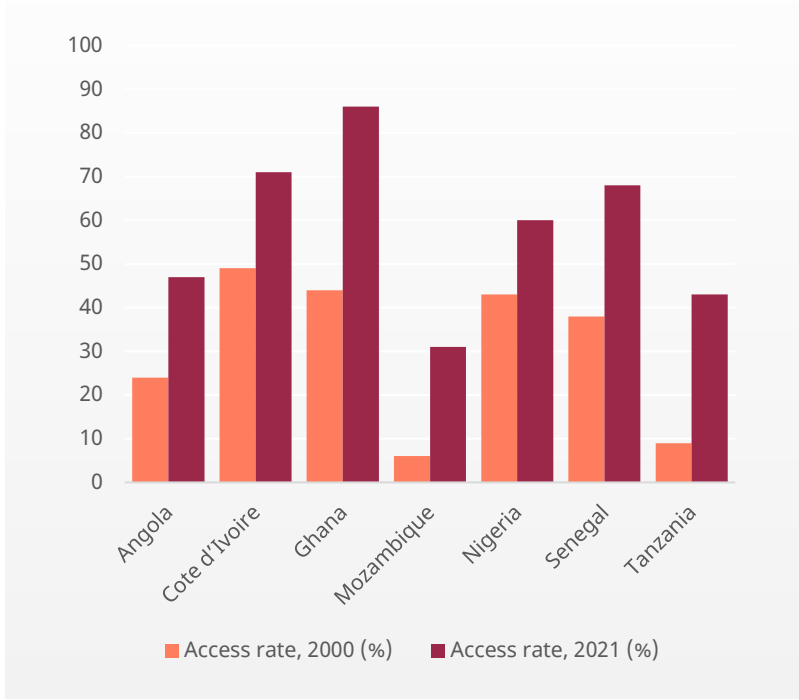
During the 2000s and 2010s, the electricity production of African countries that burned gas for power grew more quickly on average than for countries that did not use gas.

Electricity access–fossil fuel producers v. non-producers (2020)



Source: Author calculations based on ESMAP data

Changes in electricity access in selected African gas-producing countries (2000-21)



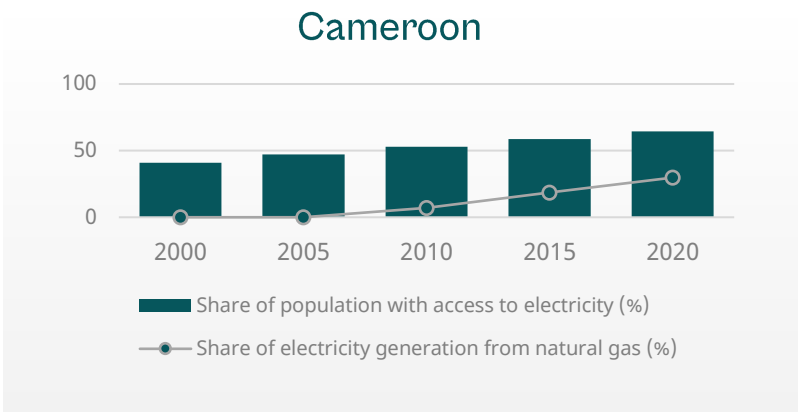
Source: Author calculations based on ESMAP data

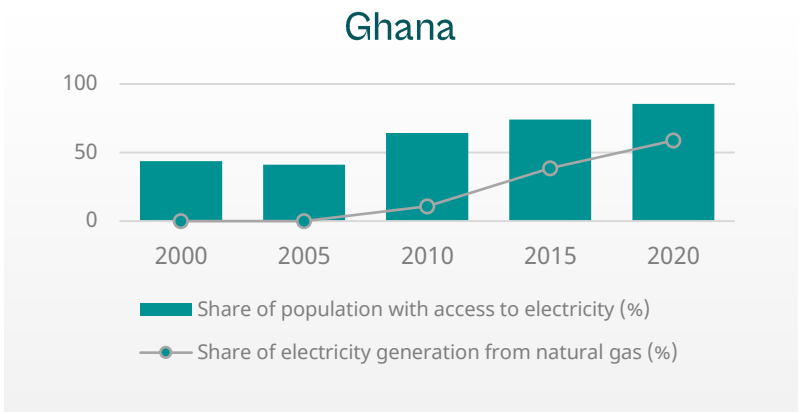
Gas power has made meaningful contributions to electricity access in some African countries.

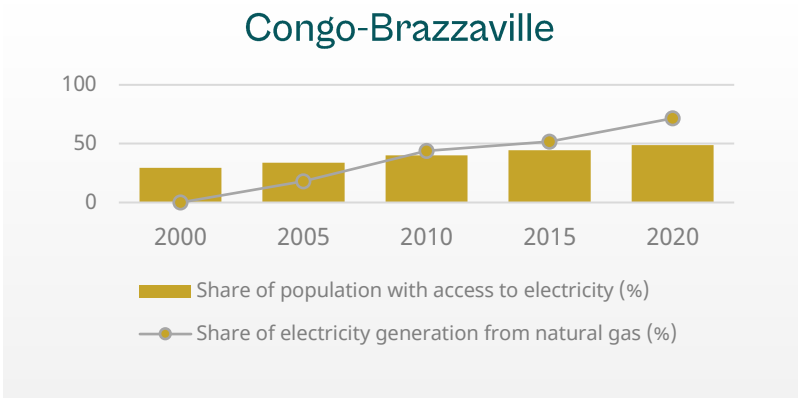
The available data does not show how many new electricity users received service from gas power compared to other technologies like solar, wind or hydro.

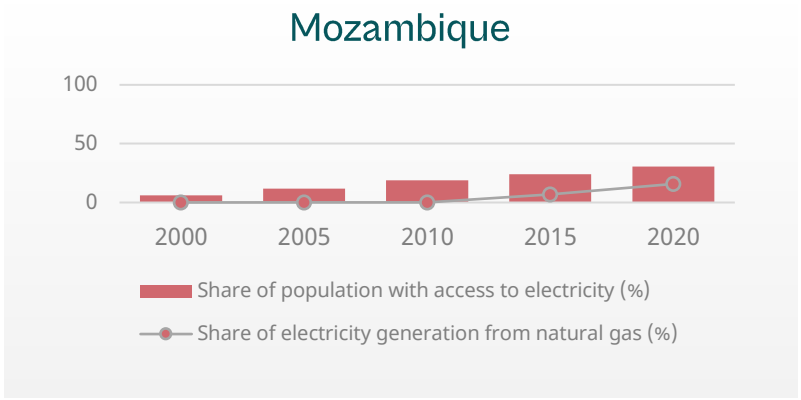
But in some countries—particularly those starting at lower access rates—access rose together with the use of gas for power, suggesting that at least some new users owed their service to gas.

Sources: IEA, Tracking SDG7







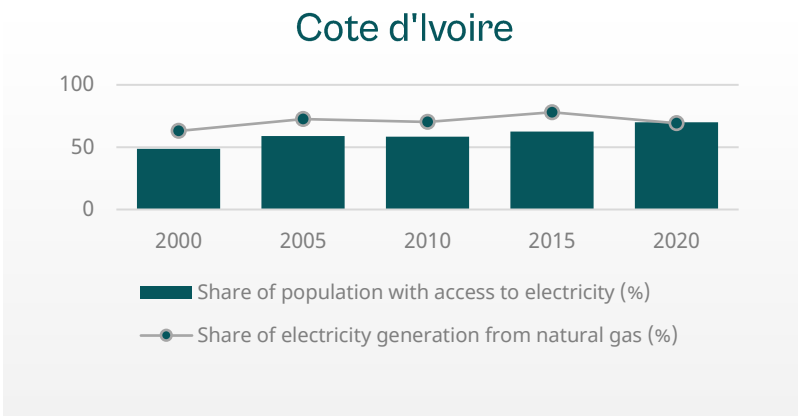


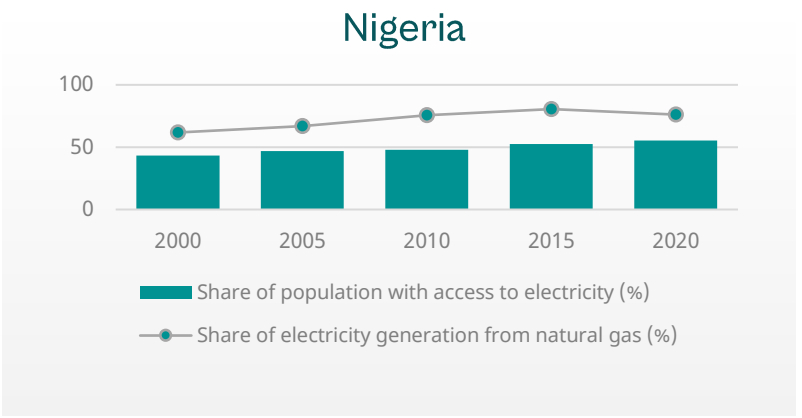
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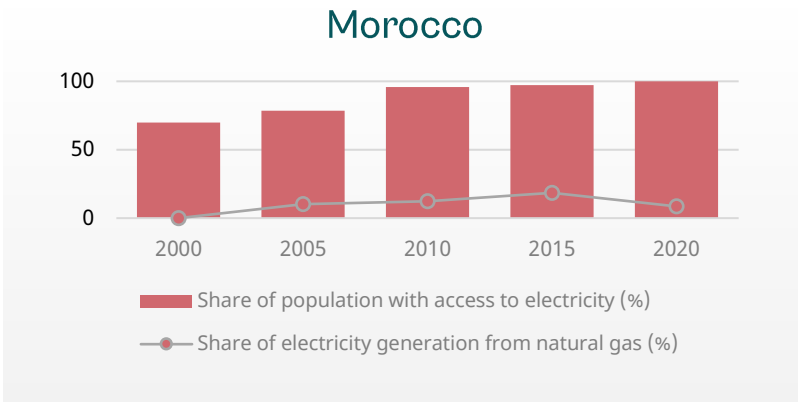
In other countries, this correlation was observed less clearly, or not at all.

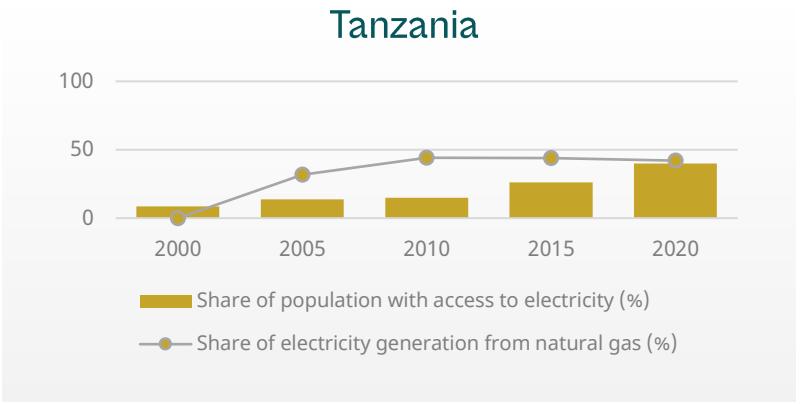
Greater reliance on gas for power generation, therefore, does not automatically lead to progress on access. Other factors and choices can be seen as more important.

Sources: IEA, Tracking SDG7









Almost none of the countries where access improved the most relied on gas power.

From 2010 to 2021, only three of the 20 countries worldwide with the largest gains in electricity access were African nations with gas power plants: Rwanda, Tanzania and Togo.

Four-fifths of the biggest success stories had no gas in their electricity mix at all. And none of the three African gas users are obvious demonstration cases of how gas power can grow to serve large numbers of people.

- Rwanda and Togo are both small, low-population countries, each with a single gas power plant. Contrast this with the countries with the largest unserved populations (see slide 3), many of which must reach tens of millions of people living in remote rural areas, far from the electricity grid and in difficult terrains. Both Rwanda and Togo are prioritizing off-grid solar to serve rural people.
- The way these two countries procure gas is also unusual. Togo imports 100 percent of its gas (and over half its electricity) from neighbors. Rwanda extracts methane from the waters of Lake Kivu.

Country	Annualized increase, 2010 to 2021 (percentage points)	% gas in power mix, actual generation, 2021
Timor-Leste	5.6	0
Kenya	5.2	0
Afghanistan	5	0
Cambodia	4.7	0
Bangladesh	4	73
Solomon Islands	3.7	0
Rwanda	3.5	**23**
Eswatini	3.4	0
Lesotho	3	0
Uganda	3	0
Lao Republic	2.7	0
Guinea-Bissau	2.7	0
Kiribati	2.7	0
Ethiopia	2.6	0
Tanzania	2.5	**42**
Bhutan	2.4	0
Mali	2.4	0
Vanuatu	2.4	0
Sudan	2.3	0
Togo	2.3	**66**

Sources: World Bank and IEA data

The reality: Gas power has mainly been an option for wealthier countries that already have universal access.

Around a dozen high- or high-middle-income nations dominate both gas power generation and new investments in gas power plants:

Rank	Top 10 producers of gas power, 2022	Amount of gas power generated, 2022 (% of global total)	Top 10 countries that added the most gas power to their grid, 2013–22	Amount of gas power added, 2013–22 (GW)
1	US	28	US	93
2	Mainland China	8	Mainland China	81
3	Russia	8	Egypt	39
4	Japan	5	Russia	20
5	Mexico	4	South Korea	19
6	Saudi Arabia	4	Saudi Arabia	17
7	Egypt	3	Iraq	17
8	South Korea	3	Japan	14
9	Italy	2	Mexico	13
10	UK	2	Thailand	12
	TOTAL, top 10	**67**	**TOTAL, top 10**	**325**
	Cf. Sub-Saharan Africa	**1**	**Cf. Sub-Saharan Africa**	**7**

Table source:
Author calculations based on BloombergNEF, Ember and IEA data.

Looking ahead, gas probably will deliver electricity to at least some additional unserved people.

Some countries will connect more households and businesses to gas power for technical or commercial reasons, or because gas already dominates their domestic energy mixes.

- Some will need at least some gas power to stabilize the grid as renewables grow—though this may not be true in all cases.
- Some have already signed fuel or power purchase agreements that lock them into consuming gas for years to come.

Some countries also have large gas reserves.

- Over 40 percent of all new gas discoveries in the 2010s were in Africa.

Some geographically smaller countries could extend their grids to connect more consumers to gas-fired thermal power (e.g., Ghana and Senegal).



Photo Dennis Diatel Photography for iStock

But the use of gas for electricity will remain concentrated in a few African countries, most of which have already achieved universal access.

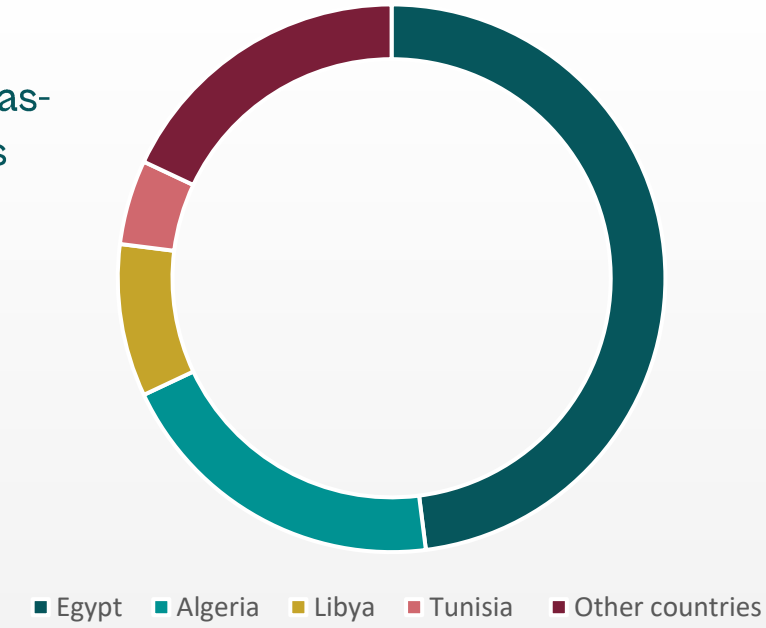
Gas power's role in the electricity mix varies considerably by country and region.

The largest growth of gas-fired power has been in North Africa, in countries that already had universal access to electricity.

Today, four-fifths of all African gas generation capacity is located in four North African countries (see chart).

Likewise, just four countries—Algeria, Egypt, Libya and Nigeria—account for over four-fifths of all gas production and consumption on the continent.

African countries with the largest gas-fired power fleets



Source: GEM Global Oil and Gas Plant Tracker

For most countries with the largest unserved populations, gas power is simply not an option.

Consider the **top 20 countries with the most unserved people**. Together, they are home to three-quarters of all people without electricity. Yet out of these 20:

- **Fourteen produce no gas**. Either they also have no reserves of gas, or their reserves are unlikely to be developed (because of size, cost, location, lack of investment, etc.). As a group, these 14 nations account for 318 million—or nearly half—of all unserved people.
- **Thirteen have no working gas power plants**. Instead, they rely on other fuels like hydro, coal, oil, solar or wind for electricity.
- **Only three (Mozambique, Myanmar and Nigeria) are building at least one new gas power plant right now.**
- **Only four (Angola, Mozambique, Myanmar and Nigeria) have advanced stage plans to build at least one additional plant.** How many of these projects will ultimately succeed is hard to predict.

	Country	Unserved people (million)	Produces gas	Burns gas for at least a quarter of power generation	Has at least 1 working gas power plant	Currently building at least 1 new gas power plant	Has advanced stage plans to build at least 1 new plant
1	Nigeria	86	✓	✓	✓	✓	✓
2	Dem. Rep. Congo	76					
3	Ethiopia	55					
4	Tanzania	36	✓	✓	✓		
5	Uganda	25					
6	Mozambique	22	✓		✓	✓	✓
7	Niger	21			✓		
8	Madagascar	19					
9	Angola	18	✓		✓		✓
10	Burkina Faso	18					
11	Malawi	17					
12	Sudan	17					
13	Chad	15					
14	Myanmar	15	✓	✓	✓	✓	✓
15	Kenya	12					
16	North Korea	12					
17	Pakistan	12	✓	✓	✓		
18	Burundi	11					
19	Mali	10					
20	Zambia	10					

Sources: IEA, World Bank and Global Energy Monitor data

Ultimately, gas has limited growth potential as a fuel for Africa's unmet electricity needs.

Lack of fuel

Large amounts of Africa's known gas reserves are likely to stay in the ground or be exported, not used for power generation at home.

- Four-fifths of all new gas discoveries in Africa are in countries that don't produce gas yet, or produce only small amounts (Ethiopia, Mauritania, Morocco, Mozambique, Senegal, South Africa and Tanzania).
- Although at least two countries (Mozambique and Senegal) may be close to becoming major producers, for many others (e.g., Ethiopia and Tanzania) the chances seem more remote.
- Most new or planned gas extraction projects in these same countries are mainly for export, not for domestic use.
- Extraction projects meant to serve domestic energy markets face long approval times, delays and risks of cancellation.

Lack of finance

Countries will struggle to build new gas power plants, often due to lack of funding.

- African governments are planning USD 62 billion worth of new gas-fired generation but have not secured funding for $52 billion (84 percent).
- Worldwide, Africa received just 5 percent of all funding for gas power in 2022 (down from 12 percent in 2015).
- Development finance institutions are also holding back from or refusing to fund gas projects.
- For more on the challenges of financing gas power (and renewables) in Africa, see NRGI Gas-to-Power Framework Module 4 (forthcoming).

Lack of grid infrastructure

Gas power is also grid power. The grid cannot reach everyone.

- Connecting new consumers to the grid tends to be easier in urban, densely populated areas. Extending grid service to more remote towns and villages can be too expensive and hard to finance.
- Of the 600 million people at risk of not receiving electricity by 2030, more than 80 percent live in rural areas.
- Countries in the "last mile" of their electrification efforts often need a mix of on- and off-grid solutions to reach their remaining unserved populations.
- Multi-country studies suggest off-grid technology like rooftop solar and mini-grids could be more affordable than gas-fired electricity for over half of Africans without electricity.

Given gas power's limitations, alternatives like solar and wind power need full consideration.

As technologies for improving electricity access, solar and wind have some clear advantages over gas power.

- The success of solar and wind doesn't depend on a country being able to produce or buy sufficient volumes of gas. The fuel is free and available on-site.
- Solar and wind can reach consumers that gas power cannot, especially in areas that are far from the grid or from an available source of gas.
- They can also be built incrementally, in phases, to better serve areas where electricity demand is low but growing.

In Africa, renewables are also widely expected to grow more quickly than gas power this decade. For example, the IEA's Sustainable Africa Scenario predicts that:

- Most new electricity generation capacity between 2020 and 2030 will come from low-cost solar PV and other non-hydro renewables.
- Continent-wide, solar and wind will account for 27 percent of power generation by 2030, eight times more than in 2020.
- Solar in sub-Saharan Africa will reach 20 percent of electricity generation by 2030, up from almost zero in 2020.
- The main reasons for growth will be falling technology costs, favorable policies and rising foreign investment.

Some multi-country studies also predict that, by 2030, the average costs of solar PV and wind power in Africa will be lower than the cost of gas-fired electricity.

The rapid scale-up of renewables in Africa remains challenging, however. Roadblocks include insufficient and expensive financing that flows to a limited number of places; low access to quality technology; confusing and inefficient regulatory and institutional frameworks; limited consumer knowledge about the available options and their benefits; and difficulties in managing the intermittent output of solar and wind installations.

Governments and development partners need to do more to address these challenges. They also need to make policy and investment decisions that help the new technologies reach unserved electricity consumers, not just households, businesses and public institutions that already have access.

Conclusion

More nuanced, country-specific data and analysis are needed to know when gas or renewables will be the better option for reaching particular unserved populations.

For more on the topic, see NRGI's Gas-to-Power Framework Module 3.

Analysis should focus on which technology will be more affordable and reliable. Research has shown that lower-income customers are often unable or unwilling to pay for more expensive, unreliable electricity service.

The affordability and reliability of gas versus renewables in a particular country are not a fait accompli. Governments and investors can tip the scales through:

- how they talk about and plan for future energy supply
- the policy and financial support they provide
- the types of infrastructure they invest in
- how they communicate with and involve unserved electricity consumers

