

Framework for Countries Evaluating Gas-to-Power Pathways

Goal 3: Achieving Universal Access to Electricity

AARON SAYNE, EMMA DAHMANI, SHARMILA BELLUR AND PHESHEYA NXUMALO

JUNE 2025

Natural Resource Governance Institute

Key messages

- New gas power plants could provide electricity to a subset of people living without power in a relatively small group of countries. But some gas proponents are overselling it as a fuel for achieving universal electricity access.
- Progress toward universal access increasingly depends on further electrification in Africa, where gas power has limited growth potential. Solar and wind power come with their own challenges, but countries should consider renewables as primary solutions for reaching unserved households and businesses.
- Electricity from large on-grid solar and wind farms or off-grid systems like mini-grids and rooftop solar can be expensive for new, lower-income electricity consumers. Yet renewables have potentially growing advantages over gas power when it comes to affordability and reliability.
- The true cost of gas power or renewables is not just financial. Decision-makers should consider the broader social and environmental impacts of building and running new power infrastructure—and the potential benefits for people.
- Before supporting new gas power or renewables, officials and investors should consider everyone's needs, especially the unserved. Responding to these needs fosters social acceptance, supports new technologies, and creates conditions for their growth.
- Countries with electrification challenges need more support from international financial institutions. Current funding is insufficient; these actors must both help to attract private investors and finance essential infrastructure that private funders will not—like batteries and electrical grids.

Cover image: Sunshine Seeds / Shutterstock.com

Overview of this module

Goal 3:

Achieving Universal Access to Electricity

This third part of NRGI's Framework for Countries Evaluating Gas-to-Power Pathways examines the claim that investing more in gas power will allow countries to achieve universal electricity access.

Specifically, we:

- Argue that achieving universal access is a key part of a just transition away from fossil fuels.
- Survey gas power's contributions to electricity access, especially in Africa.
- Offer considerations and questions for assessing when countries should use gas or renewables such as solar or wind to provide power to people living without electricity.

The Framework for Countries Evaluating Gas-to-Power Pathways is a multi-part resource to help non-experts determine whether burning gas for electricity will further their countries' socioeconomic and energy sector goals, both in isolation and compared to renewables.

The intended audience is government officials, NGO staff and activists, researchers and journalists in lower- and middle-income countries with gas reserves. The framework presents the latest thinking about commonly made claims in a balanced way, to aid readers in their own analysis, decision-making and advocacy.

Common claim 3

"Burning more gas for power will allow our country to achieve universal electricity access."

Universal access to electricity should be part of a just transition away from fossil fuels.

The switch to cleaner, more sustainable forms of energy will inevitably create winners and losers, but it will also bring opportunities to address long-standing inequities. To achieve universal electricity access, transition should play out in three ways:

First, the spread of new technologies like solar and wind should help lower-income countries make electricity service available to more people on fairer terms. Research shows that access to electricity can support better, fairer socio-economic outcomes, whether by helping people be more economically productive, or by improving their health and education. (For more on this topic, see NRGI, "The Socioeconomic Benefits of Electricity Access.")

In many lower-income nations with electricity access challenges, however, already-vulnerable groups are often the last to be served: low-earning rural communities, women and girls, and forcibly displaced people, for instance. If new technology like power plants or solar panels mainly serves higher-income urban communities, the developmental benefits of having electricity will not be widely shared and the resulting energy transitions will not be just.

Second, the rise of renewables should reduce, not deepen regional and global inequities around who has access to new power systems. Making electricity access universal depends above all on progress in Africa (see below for an explanation of why), and solar and wind will need to play major roles.

But wealthy nations in North America and Europe also need huge amounts of renewable technology to electrify their economies, especially for the new, energy-intensive industries some are building—artificial intelligence, electric vehicles and hydrogen production, for example. If technology like solar panels and wind turbines become scarce, these wealthier countries will have more capital and geopolitical muscle to buy up what is available.

Third, the energy transition is a chance for governments to find a fairer split of the remaining carbon budget, so that a larger share goes to the places facing the biggest electricity supply gaps. Without more pressures and limits on their behavior, however, some wealthier nations will use the fact of transition as a justification to burn more fossil fuels for electricity.

The U.S., for instance, has plans to build up to 35 new gas power plants—infrastructure touted as a "greener" alternative to coal. This comes as power consumption in the Global North already dwarfs usage elsewhere: per capita, sub-Saharan Africans use 36 times less electricity than Europeans and 72 times less than people in the U.S. In many cases, Africans living without electricity will also bear the worst impacts of climate change despite having done almost nothing to cause it.

New gas power plants could provide electricity to some people living without it in a relatively small group of countries. But pro-gas voices are overselling it as a tool for reaching universal access.

A vocal group of political leaders, intergovernmental bodies, international energy companies, think tanks, NGOs, development banks and private foundations have argued that if countries stop extracting and burning gas, millions will go without electricity service. At the same time, officials in some lower- and middle-income countries are making ambitious plans to use more gas for electricity, claiming this is necessary for access to grow.

The push for gas is understandable, given the size of countries' unmet electricity needs, excitement over recent gas discoveries, and popular anger over wealthier nations' hypocrisy and mixed messages about phasing out gas. Yet many public statements in favor of further investment in gas power are broad, rhetorical appeals, unsupported by analysis or examples. Some also reflect more narrow interests and agendas—for instance, those of national oil companies seeking to invest more in gas to diversify their businesses away from oil, or international fossil fuel giants seeking more gas to sell abroad.

Looking ahead, gas power will deliver electricity to a hard-to-predict number of new customers. Ministries and utilities in some countries will choose to connect more households and businesses to gas power plants for technical or commercial reasons, or because gas already dominates their energy mixes. They might also turn to gas power to help stabilize the grid as renewables grow, though this will not be necessary in all cases.

For most countries with large unserved populations, however, gas power is not an option at all. This is usually because they have no exploitable reserves of gas or workable plans for building new gas power plants. Four-fifths of the nations that have made the greatest access gains in recent years have no gas in their electricity mixes.

Progress on universal access increasingly depends on Africa, where gas power has limited potential.

Without urgent action, almost nine out of ten people living without electricity in 2030 will likely be African. Out of this group, most will be from a small group of Sub-Saharan Africa countries. Consumption on the continent is outpacing power generation; research finds that African electricity supply must triple by 2030 to meet fast-growing demand, which is driven partly by huge population growth.

Some Africans did receive electricity service from gas in recent years, though available data does not include an exact number. Over 40 percent of the continent's electricity currently comes from gas power plants, up from 14 percent in 1990. Altogether, 20 African countries are burning gas for power, making it the number one fuel for power generation, followed by coal. Our research finds that a number of gas producers have made large gains on access over the last two decades, and that as a group, African fossil fuel-producing countries have higher electricity access rates than non-producers. In some of these countries—particularly those starting at lower access rates—access rose along with the use of gas for power, suggesting that a significant number of new users owed their service to gas.

Yet despite these accomplishments, power generated from gas simply cannot reach most of the Africans still waiting for electricity. The use of gas for power will remain concentrated in a few, mainly North African countries, most of which already have universal access. Africa has led the world in recent new gas discoveries, but large amounts of these are likely to stay in the ground or be exported, not consumed at home. Gas producers on the continent will also struggle to build new gas power plants, often due to lack of funding. And critically, gas power requires a grid for distribution, yet many countries will not be able to build a grid that reaches everyone. For more on this topic, see NRGI, "Gas Power's Contribution to Electricity Access in Africa."

Given gas power's limitations, authorities in countries with access challenges need to consider renewables as an alternative main power solution.

As technologies for improving electricity access, solar and wind have some clear advantages over gas. In Africa, renewables are likely to grow more quickly than gas-fired generation this decade, and some multi-country studies predict that by 2030, the average costs of solar and wind power in Africa will be lower than electricity generated from gas. At the same time, the rapid scale-up of renewables on the continent remains challenging for a range of reasons.

To keep expanding electricity service in ways that are fast and fair, politicians and development partners should develop a better understanding of which technologies will best meet needs.

The choice between on- and off-grid solutions for expanding access, or between gas and renewables as the fuel, is highly context-specific, requiring ministries, regulators, utilities, investors and NGOs to undertake painstaking consultation, analysis and modeling. At the same time, governments and investors should increase their policy and financial support for access initiatives, making decisions that help newly generated electricity reach the unserved—not just households, businesses and public institutions that already have power. This module offers an overview of key challenges they must confront, with a focus on sub-Saharan Africa as the region with the greatest needs.



Photo by Yuri A / Shutterstock.com

Considerations and questions

To succeed, an electricity access initiative must deliver affordable and reliable service.

To make serious progress on access, authorities must tackle the issue of affordability. To attract investment capital and keep functioning over time, power schemes must be affordable for 1) consumers, 2) the government, and 3) the utilities or other owners of the infrastructure.

For consumers, electricity service is affordable when the consumer can pay their bill without economic hardship. A common metric of affordability is that the service costs no more than five percent of a household's monthly expenditure. Costs can include one-time connection charges, monthly bills, and maintaining and replacing wires, solar panels, or other hardware.

Affordability for government is mainly a question of the types and levels of policy and financial support (e.g., public investments, subsidies) that the government will have to provide for access initiatives to succeed, both short and longer term. Utility companies, for their part, must be able to sell electricity at high-enough prices to justify building and running the infrastructure—i.e., sales must allow them to cover their costs and make reasonable profits.

Electricity service is reliable when users do not experience unexpected power outages or other chronic service problems like sudden voltage fluctuations that can damage appliances. Consumers have shown themselves less willing to pay for faulty service, which can also be more expensive. In the past, governments measured electricity access in one way: is a house or business connected by a wire to the grid? Many households and businesses did not use their new connections, however, partly due to reliability problems.

Now energy sector officials, donors and others involved in electrification think of access as a quality-of-service continuum, along which consumers can move over time—for instance, as they acquire new appliances, or as their businesses grow.

Authorities seeking to expand access must first choose between on- and off-grid power infrastructure—before considering whether to use gas or renewable fuel.

Gas power is grid power, whereas solar and wind can be on-grid (large solar or wind farms) or off-grid (mainly mini-grids and rooftop solar). The choice between these depends partly on the type of consumer needing service. Decades of work on electricity access have produced some broad trends or rules of thumb:

On-grid power suits:	Off-grid power suits:
• urban, more densely populated areas • higher tiers of service (i.e., consumers that use more/more sophisticated appliances, with higher voltage levels)	• remote, sparsely populated towns, villages, settlements • lower tiers of service

The stage of a country's electrification journey can also make a difference. In the earlier stages, grid power often serves more people more efficiently—especially if they live and work close to one another.

Contrast this with "last-mile electrification," where countries increasingly use a mix of on- and off-grid solutions to reach their remaining unserved areas, many of which have poor, vulnerable, isolated populations that need only small amounts of electricity. In Africa, these last-mile challenges have impeded achievement of universal access.

Some analysts looking across countries have favored off-grid systems—predicting, for instance, that half of all new grid connections worldwide would be unaffordable for consumers, or that electricity from off-grid systems will be more affordable for over half of all unserved households.

This doesn't mean, however, that off-grid power is within everyone's reach. In Nigeria, for instance, researchers found that 92 percent of people without power could not afford solar home systems, while 53 percent could not afford electricity from a mini-grid. And unfortunately for many countries, the price for delivering electricity service tends to rise as more people are served. One recent multi-country study in Africa found that, on average, the cost of reaching the last 10-50 percent of unserved consumers would cost five to twenty times more compared to earlier efforts—even though the last people served are often those least able to pay.

Low customer ability to pay, in turn, can increase costs to the government and infrastructure owners. For on-grid power, this can mean high upfront payments to extend the grid and a commitment to long-term public subsidies. Past studies found that to make new connections affordable for users, governments had to cover an average of 87 percent of grid connection costs, and set customer tariffs more than 50 percent below the cost of the service. Relatedly, many countries have overestimated demand for new grid connections, partly by overestimating what people could pay.

Governments can look to outside investors to share the costs, but private investors especially tend to shy away from grid infrastructure, fearing such investments will not return a profit. In recent years, new investments in grid infrastructure have averaged about a tenth of what is needed to achieve universal access by 2030.

Private sector and donor investment in lower-income country mini-grids and rooftop solar has been more dynamic in recent years, thanks in part to the falling costs of components and more supportive government policies. New investment in access-deficient countries remains far below needs, however, and is often concentrated in more affluent, already served areas.



Photo by Tolu Owoeye / Shutterstock.com

Here is a non-exhaustive list of risk factors that can affect the affordability of on- and off-grid power:

Factor	Effects on affordability
Low incomes/high poverty in the unserved area	Makes it harder for consumers to afford up-front infrastructure costs, utility bills and/or electrical appliances
Low customer demand for service	Makes it harder for utility owners to generate and sell enough electricity to turn a profit
High costs of building and maintaining infrastructure (e.g., power plants, solar panels, grid extensions, batteries)	Drives up customer utility bills and/or up-front costs to infrastructure owners
Distance between unserved customers and the grid	Requires more new transmission and distribution infrastructure, which increases costs to government and utilities, since consumers often cannot absorb them
Poor infrastructure performance (e.g., due to faulty management and maintenance of the grid, solar panels)	Reduces the amount of electricity that utilities can sell or off-grid installations can generate, increasing costs and reducing returns to the owners
Political instability/physical insecurity/violent conflict	Causes damage that infrastructure operators/ owners must repair; raises the costs that third-party investors charge to finance new infrastructure like power plants, solar panels
Scarcity of financing for infrastructure (donor grants) and repaying debt, such as pre-paid meters and pay-as-you-go plans	Makes infrastructure too expensive or impossible to build upfront
Inefficient government incentives/subsidies (e.g., that do not effectively target the poorest consumers)	Raises the government's costs of electrification while failing to make service affordable for consumers
Limited consumer knowledge of available incentives/subsidies (interest free loans, donor grants, subsidized tariffs)	Keeps consumers from seeking support that could make service affordable

And in many lower-income countries, off-grid solar developers struggle to find business models that work without outside financial support. Operators of mini-grids, for instance, often rely on government- or donor-funded grants for over half of their infrastructure costs, partly because they cannot pass on the costs to the low-earning customers they serve.

The reliability of on-grid versus off-grid power depends just as much on context. Key questions to ask include, but are not limited to:

- Will the owner of the infrastructure have the resources, systems and know-how to manage and maintain it over time?
- Is the infrastructure of good technical quality?
- Can the infrastructure withstand climate change-related extreme weather events such as storms, heat, fires or floods?

For either on- or off-grid, if the answer to one or more of these questions is no, the chances of system breakdowns and service interruptions rise. Poor infrastructure performance, in turn, raises red flags for affordability, for instance through higher maintenance costs. In the worst cases, countries with chronically unstable grids may struggle to deliver reliable service at all, or to attract investment for repairs and service upgrades. About a quarter of Africa's existing on-grid generation capacity is routinely unavailable due to aging infrastructure and poor maintenance.

Power from on-grid solar and wind farms can be expensive for new, lower-income electricity consumers. But renewables have potentially growing advantages over gas power when it comes to affordability.

If a government decides that on-grid power will reach more consumers more effectively, the choice of fuel for the additional power generation should be officials' next consideration. The answer is not always "either-or": some countries may need a mix of on-grid renewable and gas power to reach everyone.

Again, the challenge is finding which technologies will best serve particular communities, businesses and public institutions that need service.

Several multi-country studies have concluded that for now, gas is the lower-cost option in at least some access-deficient parts of Africa, Asia and Latin America. Yet as solar and wind get cheaper, gas power will increasingly struggle to compete. Worldwide over the last decade, the average levelized costs of electricity (LCOEs) for solar, onshore wind and offshore wind dropped by 90, 67 and 60 percent, respectively. (LCOE is a measure of the average net present cost of electricity generation for a power generation system over its lifetime. Analysts often use it to compare the costs of different technologies, though this has limitations.)

The IEA projects that by 2030, average LCOEs for on-grid solar and wind in Africa will be lower than gas. Here are some of possible reasons why, broken down by cost component:

- **Falling costs for power generation components.** One of the main drivers of reduced renewable electricity LCOEs over the last decade was the falling costs of components like solar panels and wind turbines. Research has found that prices for solar panels and wind turbines fell by a combined average of 58 percent over the 2010s while the costs of components for gas power plants did not notably change. Looking ahead, some studies predict that by 2030, prices could decrease again by half for solar and a quarter for wind. No comparable drops are predicted for gas.

- **No need to build fuel supply infrastructure.** The farther a power plant is from existing supplies of gas, the more new pipeline will be needed to supply the plant. Some gas-to-power projects may also need facilities to process the gas into a form the plant can burn. How investors recoup the costs of building all of this infrastructure varies by project. Nonetheless, at least some of the costs likely will be added to the sale price of the gas, which usually translates to higher prices for any electricity generated from the gas.

- **Zero fuel costs.** For new electricity consumers to afford service, the fuel used for power generation must not be too expensive. Overall, fuel cost is the number-one variable that affects how much users of gas-fired electricity will pay. In situations where a power plant owner can buy gas at relatively low, stable prices under contracts lasting many years, this becomes less of a worry. But where such deals aren't available, the cost of gas can make or break affordability. Problems could especially arise when power plants are forced to buy gas from a new, more expensive source; when new climate-related policies (e.g., carbon taxes and penalties) increase the costs of producing or selling gas; or when plants must burn imported gas with high, volatile prices.

  Once gas prices rise, the available options for keeping gas-fired electricity service affordable can be painful for everyone:

Options for consumers
Reduce electricity consumption
Reduce or shut down work
Choose between paying for electricity and other needs
Options for governments
Raise consumer tariffs
Increase subsidies
Curb electricity supply and demand (e.g., by imposing efficiency measures or rationing power supply through the grid)
Suspend gas purchases
Take on new sovereign debt to help pay for gas
Options for utility companies
Petition the government for bailouts
Defer payments to creditors (if possible)
Shut down or reduce plant output
Generate more power with other, dirtier fuels like coal or oil (if plant technology allows)

  (For more on the potentially high and far-reaching socio-economic impacts of relying on gas for power when prices rise or fluctuate, see NRGI's Framework for Countries Evaluating Gas-to-Power Pathways Module 2.)

  Choosing solar or wind over gas power takes the issue of fuel cost out of the equation, since the fuel for both is free and available on site. This is a huge potential advantage for electricity access initiatives, where consumers often cannot weather big price changes.

- **Potentially lower finance costs.** Most owners of large on-grid power generation facilities, whether gas-fired or renewable, cannot pay the full up-front costs of building them and so must look for third-party financing, often in the form of loans. To recoup the costs of repaying this debt, the owner will want to factor them into the prices it charges for electricity. Third-party debt from energy projects can be expensive, especially in Africa, where foreign lenders can charge creditors up to seven times more than similar borrowers in Europe or North America.

  Investors are not very transparent about what they charge the owners of African electricity projects, which makes it difficult to draw conclusions about the relative costs of capital for gas and renewable power on the continent. Some recent studies also found that public research and modeling on the topic have underestimated the costs of capital for lower-income country renewables projects.

  At the same time, solar and wind have the advantage that more development finance institutions like multilateral development banks or export credit agencies appear willing to support them with concessionary loans and guarantees. This support can lower the total costs of borrowing for renewables projects, both directly, through lower interest rates and fees, and indirectly, by encouraging private investors to charge less for the capital they provide.

The true cost of gas power and renewables is not just financial. Decision-makers should not overlook broader social and environmental costs—and potential benefits.

Bringing electricity infrastructure to an underserved area doesn't guarantee positive outcomes. Gas and renewable power plants touch the lives of the people around them in many ways. Past experiences show that without careful, ethical planning, outreach and collaboration, the negative can dominate.

Problems often start when companies don't meaningfully consider the needs, strengths, rights and vulnerabilities of host communities (those who live where gas plants or renewable installations are built)—ignoring good practices around free prior and informed consent, for instance, or refusing to share information about their plans. Some even try to muzzle questions and opposition, through tactics like corruption, threats and attacks on local leaders and human rights defenders, threatening use of police or other security forces, and aggressive use of the legal system.

Then, once construction starts, some firms resort to land grabbing, whether through forced displacement or abusive leasing. They might also mismanage or pollute local water resources.

The long-term socioeconomic costs of such behavior can be high. People can lose their livelihoods, especially in agriculture, fishing, livestock or other trades that depend on land and water access. Trouble finding enough clean water can also weaken people's health and businesses. When controversies around a new power plant arise, new social divisions and violent conflicts can break out over, e.g., property rights, broken promises or unmet expectations. Unrest gets can keep the power plant closed, whether through lawsuits, protests, violent or property crime. Events like these, in turn, make residents feel less safe and even less accepting of their corporate neighbors. Many of these harms also fall disproportionately on already vulnerable groups like women, racial and ethnic minorities and indigenous populations.

Nothing suggests that either gas or renewable power is more prone to such poor outcomes, or that gas or renewable power companies, as a group, have worse track records. Studies and investigations by government agencies, NGOs and media across a range of countries have found serious lapses and abuses in both industries.



Photo by Alejandro_Molina / Shutterstock.com



Photo by Only Live Once / Shutterstock.com

One area where solar and wind can have clear advantages over gas power, however, is local environment impacts. Gas is often touted as a "green" substitute for polluting fuels like oil or coal—which, in terms of its contribution to national or global emissions, is (sometimes) true. But gas wells, power plants and pipelines still emit dangerous pollutants that solar and wind farms do not, especially nitrogen oxides, which have proven health risks for those living nearby. If a gas-to-power project flares gas, the documented risks compound, to include additional types of respiratory and skin disease, mental and sleep disorders, and cancers.

Looking beyond air quality, both gas and renewable plants can cause differing amounts of deforestation, loss of vegetation and water pollution, depending on how their owners build and run them. Renewables can have their own unique impacts, such as when wind turbines create noise pollution or disrupt the movements of fish and marine mammals. Large solar farms often require more land than gas plants to generate an equal amount of electricity.

New power infrastructure can bring tangible benefits to host communities, yet these do not flow automatically. Multi-country research has found that investing in renewables creates more jobs on average than fossil fuel power, and can do more to boost local skills.

But in lower-income countries, the number of permanent local jobs from new gas and renewable power plants is often small, consisting of mostly lower-paying positions in security and maintenance. Moreover, the mere act of building a power plant does not, by itself, support new or existing industries in the area, or contribute positively to rural development. Studies in lower-income countries have found weak linkages between such facilities and the surrounding economies, and few pathways for local wealth creation.

This is especially true with larger utility-scale power plants, which are often owned by foreign actors who rely on expatriate or city-based labor and prefer to export their profits, in arrangements that can seem neocolonial.

In terms of wider infrastructure, plant owners don't consistently build roads, water or IT systems that meet both their own and residents' needs. Nor do many new power plants improve their host communities' access to cheaper, more reliable electricity. In some cases, 100 percent of their electricity goes to other, more affluent customers living far away—although power plant owners, it should be noted, tend to have limited say over who receives their output. Control over that rests more with the government, particularly in countries where the state owns transmission and distribution networks. For more on options to share the benefits of power projects more equitably, see below.

Stakeholders should compare lead time for gas versus renewable power projects.

No new power generation capacity can be built without capital. For gas power plants, finding willing investors is becoming ever more challenging. African governments are planning $62 billion worth of new gas-fired generation, but they haven't secured funding for $52 billion (or 84 percent) of that. Worldwide, Africa received just 5 percent of all funding for gas power in 2022 (down from 12 percent in 2015). The reluctance of DFIs to fund new projects is an especially serious problem since private investors often wait for DFIs to go first and take on the biggest risks. For more on the challenges of financing gas power, see NRGI's Framework for Countries Evaluating Gas-to-Power Pathways Module 4 (forthcoming).

The investment prospects for African solar and wind farms seem at least somewhat brighter, though hurdles remain. Flows of capital going to African renewables quadrupled over the past decade; they also surpassed new investments in gas power.

At the same time, the entire continent gets just three percent of all funding for renewables, and a handful of countries receive most of that. Most of these countries (Ethiopia, Kenya, Morocco and Senegal), moreover, have already achieved universal or near-universal electricity access. For more on what governments and DFIs could do to help steer more funding to access-deficient countries, see the last sections of this module.

Securing sufficient capital allows a utility company to start building a new plant or farm—yet that can take years. Solar and wind have some possible advantages here. On average, on-grid solar and wind installations are quicker to build, often taking less than two years compared to an average four years for gas power plants. There is also no need to build new fuel supply infrastructure like pipelines since wind and sunshine are free and available on site. Constructing a new supply pipeline can add years to a gas-to-power project, along with an increased risk of delays. One reason for this is that gas pipelines are becoming increasingly hard to finance: out of the $89 billion worth of new pipelines that African governments want to build, authorities have found only $4 billion in funds to start construction.

Once a new power generation facility is built, the task shifts to keeping it running. Both gas and renewable power can have issues with fuel supply. How well a country manages these affects the reliability of each technology.

Unlike gas reservoirs, the sun and wind are not exhaustible, fast-depleting resources. But power output from renewables is intermittent and variable since solar irradiation and wind speeds fluctuate. This can be a serious challenge for a range of reasons, and different countries will need differing approaches to it.

Ideally, new solar and wind farms in Africa would include battery banks to store power for periods when sunshine and wind ebb. This is not commonplace yet, though, and even though the costs of battery storage are falling, nine-tenths of new investments in storage are happening in high-income countries. Some African nations may need some back-up gas power to help them manage intermittency, at least for a while, though they may also have cheaper, more sustainable options. For an overview of these, see NRGI's Framework for Countries Evaluating Gas-to-Power Pathways Module 1.

The main challenge for gas power plants, by contrast, is ensuring sufficient long-term supplies of gas. Output from gas power plants isn't affected by the weather and can be ramped up or down within minutes to respond to shifts in demand. But gas-fired plants will struggle to generate electricity for new consumers if their host countries cannot reliably produce or import enough gas to supply them. A new thermal plant will need steady supplies of gas for its entire operating life (at least 20-30 years). Some countries will struggle to deliver this, whether because of declining investment in gas extraction, increased competition over imported gas during global or regional shortages, or the tendency of production from new gas fields to fall rapidly. For more on these risks, see NRGI's Framework for Countries Evaluating Gas-to-Power Pathways Module 2.

Before they back a particular technology, officials and investors working to improve access must listen to everyone with an interest in the work, starting with the unserved.

Taking time to understand the electricity needs of individual unserved groups doesn't just increase the odds of finding the best solutions for them. It can help promote social acceptance and understanding of new power plants and other technology like solar panels, and create conditions for them to be sustained and grow with time.

Officials and investors should follow emerging good practices around stakeholder consultation:

- Engage in the early stages of project development and keep engaging throughout. One-off, perfunctory outreach can create perceptions of box-ticking. It also is unlikely to capture the full range of local knowledge, perspectives and capabilities.
- Use different platforms (town halls, small-group workshops and dialogues, household surveys).
- Provide clear, accessible information about proposed plans, with regular updates.
- Be inclusive, reaching out to a diverse range of groups including community members, local businesses and government officials, NGOs and experts.
- Understand the divisions and tensions within groups and avoid replicating or exacerbating them in the consultation process.
- Offer stakeholder education about the benefits of access and the available types of service and financial support.
- Engage on a range of topics. Don't ask only about electricity needs and use patterns. Also explore:
  - Existing local skills and capacities for maintaining infrastructure.
  - The best mechanisms for distributing the socioeconomic benefits of the electricity project under consideration—e.g., community benefit agreements, trusts; profit-sharing and reinvestment; free or below-cost electricity service; local content; financial support for local businesses; donations of smaller energy systems and appliances such as rooftop solar panels, streetlights or solar lanterns.
  - Options for local ownership of project infrastructure—e.g., through co-operatives, non-profits, local development corporations, energy communities.



Photo by TLF Images / Shutterstock.com

Energy sector officials should ground electricity access efforts in granular, evidence-based planning.

How government officials think and talk about electrification affects how many—and how much—consumers will benefit from access. Rigorous, well-informed planning is foundational for this. Sound electricity access plans are those that:

- Include both on- and off-grid solutions. Plans should identify least-cost technology options and present clear sequences, timelines, and funding requirements for both grid and off-grid electrification.
- Are up to date. Electrification plans should account for shifting development goals, economic and energy use trends, population growth, technical advancements with gas power or renewables, and financing opportunities, among other things. While there is no set timeframe for revising plans, every three to five years is common practice.
- Target specific populations that need service—for instance, by setting minimum service levels for different customers, or by tailoring solutions to vulnerable groups such as female-led or lower-income households.
- Link electrification plans to broader development goals and planning. Electrification is part of a larger process of socioeconomic change, not just a technocratic exercise. Good planning is not solely cost-driven and technical; it also considers a wide range of timeliness, policy, political, social, and regional equity factors. The overall focus should be on providing levels of energy that can create thriving, healthy local economies and people.
- Make use of helpful planning tools such as geospatial mapping, which identifies particular unserved populations, and the World Bank Multi-Tier Framework (MTF), which helps planners build in the upward mobility of users to higher access tiers.
- Account for the wider environmental and social costs of electrification. Depending on the context, important steps could include conducting life cycle assessments and social and environmental impact assessments.
- Base the technical and economic aspects of plans on granular, up-to-date analyses. These could include:
  - energy needs assessment to understand the current and future energy needs of regions, communities, etc.
  - energy resource assessment that evaluates the availability and tradeoffs of different fuels and technologies for generation.
  - economic viability analysis that reviews the costs, potential revenues and expected returns on investment from the different types of technology.
  - electricity market analysis that assesses market dynamics for energy services and helps identify opportunities and measures for creating a stronger enabling environment for private sector participation and competition.
  - institutional and legal assessments used to identify gaps, conflicts or other issues in the governance of electricity access initiatives, and to zero in on needed reforms—e.g., the creation of a dedicated rural electrification agency or helpful changes to permitting processes.
  - capacity building needs assessment and plan. Building local capacity is vital, encompassing technical skills and institutional capabilities. Training and developing a local workforce to operate, maintain, and expand the electricity infrastructure are critical for long-term success.
  - a financing and funding analysis, identifying existing public and private funding opportunities for electrification and what policy and financial support is needed to access them.



Photo by PradeepGaurs / Shutterstock.com

Governments should create stronger enabling environments for investment in access projects.

Countries that have not achieved universal access will struggle to cover the full costs themselves. Their governments and local business communities likely cannot afford all the necessary equipment—millions of solar panels and meters, for instance. Likewise, few of the people living without electricity have the means to pay the high upfront costs of off-grid solar systems and appliances. For many of these same countries, the challenge isn't so much to transition away from fossil fuels as to build entirely new domestic energy systems while the rest of the world migrates toward clean technology.

Different estimates have found that achieving universal electricity access by 2030 would cost between $25 billion to $53 billion per year, but actual spending rarely reaches even $5 billion. Work on access, moreover, is only one part of the energy transition bill lower-income nations are facing: one study projected that African countries need $277 billion per year this decade to implement their nationally determined contributions under the Paris Agreement.

Faced with numbers like these, governments need to create conditions that can attract more foreign investment in access initiatives. Globally, over four-fifths of all clean energy funding comes from the private sector. Yet despite strong promise and upsides, many private companies and financial institutions still shy away from electricity projects in the countries with the biggest unserved populations. Reasons include weak, confusing regulatory environments; unaffordable tariffs; critical infrastructure gaps; lack of tested, working business models and markets; and problematic macroeconomic policies or conditions.

Many governments could do more to address these investment barriers. The affordability and reliability of different electricity systems is not a *fait accompli* or entirely outside a country's control.

Governments can tip the scales to make on- or off-grid, or gas or renewables, more affordable and reliable through the types of policy and financial support they provide. And in rolling out support, officials should look for options that ensure that newly generated electricity will reach the unserved, not just households, businesses and public institutions that already have service.

There are few one-size-fits-all answers, as different countries are at very different stages of electrification. Nonetheless, here are some commonly recommended options:

- Clarify and streamline governance of the electricity sector, possibly by creating an independent regulator and filling gaps in the regulatory framework.
- Liberalize and restructure markets, for instance by passing new rules for infrastructure access, grid connection, thresholds for private generation or state-owned enterprise participation.
- Roll out incentives that encourage more renewable power generation. Common options include net metering rules and subsidies, feed-in tariffs, cost-reflective tariff reviews, lower import duties and carbon taxes.
- Consider options for reducing currency risk for investors, such as rules for funds repatriation and conversion of local currency to foreign exchange.
- Hold or announce more auctions and licensing for renewable power, as an alternative to more opaque direct negotiations with individual investors.
- Collect and publish data that investors can use of due diligence on companies, customers and projects. Examples include household-level income and energy use, local bank lending and loan performance histories, databanks for existing and planned renewables projects, and a range of climate risk disclosures.
- Fast-track other reforms that improve the business environment, such as anticorruption programming, improvement to the rule of law, tax collection and port efficiency measures.

As they take steps to woo investors, governments must also consider the wider socio-economic implications of backing different types of energy systems. Large on-grid power plants, for instance, are more likely to be owned by foreigners, and as such may offer fewer opportunities for domestic entrepreneurship and wealth creation. The need for foreign capital will limit what countries can build. But the future does not have to be wholly dictated by the wants of investors, whose interests won't always align with those of consumers.

Development finance institutions must step up support for electricity access.

The remaining countries with serious electrification challenges likely won't meet their access-related goals without more support from DFIs. First, DFIs must do more to attract wary private investors to support work on electricity access. They can play this role in several ways—for instance, they can:

- Offer more comprehensive risk mitigation products such as more flexible loan guarantees and insurance covering currency risk.
- Structure their loans to energy projects and companies in ways that make local financial institutions more willing and able to invest a larger share of the capital needed over time. Options here include loan syndication, on-lending, b-loans and portfolio guarantees.
- Help to attract funding from institutional investors such as pension funds, insurance companies and endowments—for instance, through financial and technical support to a new yieldco, purchasing and advising on local currency green bonds, or support for entities that guarantee local corporate bonds
- Find innovative ways to package smaller projects and other funding opportunities to reduce transaction costs, spread risk and attract larger investors.
- Provide more direct support to promising new players—e.g., by taking equity in local off-grid developers, providing low-cost funds to subnational governments that are active on electrification.
- Encourage private investors to support work on electricity access through their participation in country platforms like Just Energy Transition Partnerships (JETPs).
- Share more of the non-public studies and data they fund, to help fill data gaps for private investors.

Second, DFIs should fund parts of electricity access work that the private sector is unlikely to touch. For many foreign energy companies, private banks or equity investors, selling power—or power generation systems—to low-income people in difficult terrains looks like bad business. Until perceptions like these change, development banks, state finance corporations and bilateral aid agencies will sometimes be the funders of last resort. To increase the impact of their interventions, they can:

- Look beyond financial support for new generation capacity, to invest more in critical but hard-to-fund infrastructure like grid extensions, battery storage or household meters and connections.
- Diversify their portfolios beyond loans and guarantees. In particular, DFIs need to offer more, larger and longer-lasting grants that cover a wider range of expenses, not just early-stage studies or design work.
- Support public grantmaking, lending and investment bodies in countries with access challenges. This could include grants for government entities (national development banks, banks of industry, rural electrification agencies) that finance renewables or related infrastructure, support to sovereign wealth funds that invest in renewables, or backing for a government-run currency risk guarantee fund.
- Pay for granular, evidence-based consultation, data collection and analysis that will help identify the needs, opportunities and best solutions for individual unserved groups.



Photo by Alucardion / Shutterstock.com

About the authors

Aaron Sayne is lead, domestic energy transitions at NRGI. Sharmila Bellur is a consultant specializing in sustainable development for developing economies. Phesheya Nxumalo is a research associate at Chatham House.

Acknowledgements

The authors would like to thank the following NRGI colleagues for their feedback on and support to this module: Ahmad Abdulsamad, Lee Bailey, Tengi George-Ikoli, Ana Carolina Gonzales Espinosa, Laury Haytayan, Alex Malmqvist. Valuable information, perspective and advice also came from Lamine Cisse, Sahele Fekede and Zira Quaghe of the African Climate Foundation; Lanre Babalola; and Pedro Sanchez of the World Bank. David Tennant-Eyles designed the module. Thanks also to the authors of all the works cited for the rich learning they provided.

About NRGI

The Natural Resource Governance Institute is an independent, non-profit organization that supports informed, inclusive decision-making about natural resources and the energy transition. We partner with reformers in government and civil society to design and implement just policies based on evidence and the priorities of citizens in resource-rich developing countries. Learn more at **www.resourcegovernance.org**



Natural Resource Governance Institute