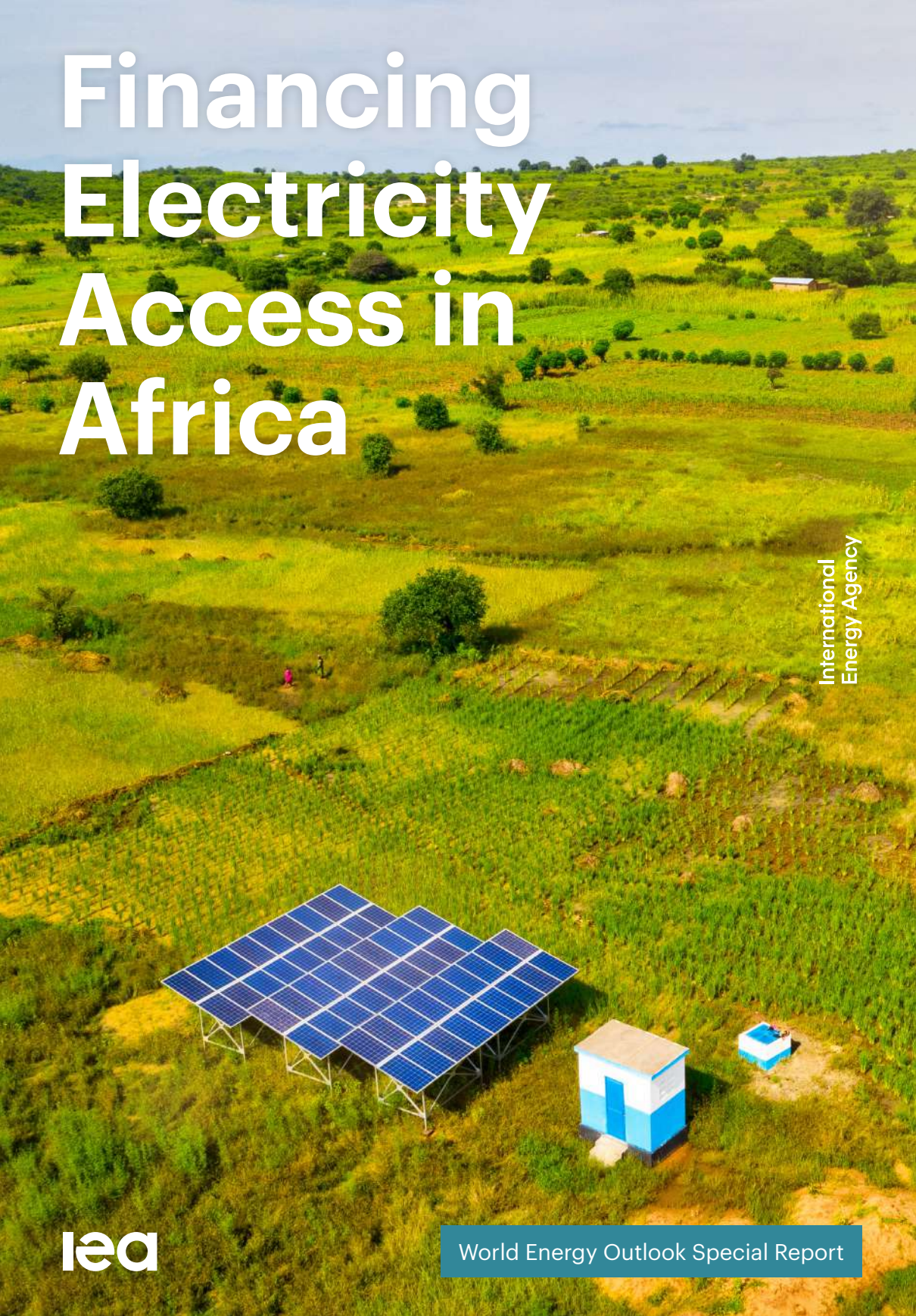
# Financing Electricity Access in Africa



International Energy Agency

World Energy Outlook Special Report

# INTERNATIONAL ENERGY AGENCY

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## *Lack of capital presents a major impediment to universal electricity access*

**Nearly two out of every five people in Africa – around 600 million in total – still live without access to electricity.** Electrification has barely kept pace with population growth, leaving the continent far behind the targets set by African governments and the international community. Progress in reducing the absolute number of people without access has stalled in recent years, with the rate of improvement failing to fully recover to pre-pandemic levels. Fewer than 19 million people gained access in both 2023 and 2024, compared with 23 million in 2019.

**Even when connections are available, high costs often place electricity out of reach for low-income households.** A cost-effective mix of grid expansion and decentralised solutions, such as mini-grids and stand-alone systems, offers a viable pathway to expand electricity accessibility. However, investment and financing remain significant barriers.

## *Finance for electricity access is scarce and relies too much on public sources*

**According to IEA tracking, less than USD 2.5 billion was committed for new electricity access connections in sub-Saharan Africa in 2023.** This includes international public and private spending on a range of solutions, such as market support and ecosystem building. Following a pandemic-related dip in 2020, financial commitments rebounded in 2021, then grew steadily by 5% annually. Total commitments are now around one-quarter higher than they were in 2019. Roughly half of financing is for access via the grid, although decentralised solutions saw a 20% increase in their level of financing between 2019 and 2023. Yet although 80% of the population without access lives in rural areas, financing remains skewed towards urban areas. It is also geographically concentrated, with half of finance flows channelled to only six countries: Angola, Kenya, Mozambique, Nigeria, Senegal, and South Africa.

**Private finance for electricity access accounted for less than 30% of total flows. It reached USD 640 million, compared with USD 1.8 billion in international public finance in 2023.** Electricity access projects face tight profit margins, with limited household budgets preventing many from being commercially viable. As a result, public finance remains the cornerstone of the sector. Around USD 1 billion per year, on average, of this public finance (around 55%) is provided at concessional rates, although there has been a shift away from grants – the most concessional finance option – towards low-cost loans. This poses a challenge to the least-developed countries that struggle to take on more debt. While overall private finance levels remain low, impact investors' interest in mature solar home systems and mini-grid companies contributed to an annual average growth of 16% in private finance flows between 2019 and 2023. However, most capital still comes from international sources, which can put smaller, African-owned companies at a disadvantage.

**Availability of equity capital reached USD 580 million in 2023 but has been limited and highly variable, hindering the development and growth phases for developers.** While equity investments have steadily increased since 2020, growth has been unevenly distributed, favouring mature companies in well-established markets. Smaller companies struggle to access risk-taking capital to fund their development stage, limiting the pipeline of

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bankable projects for debt lenders, who are more likely to finance ventures with reduced risk. This has proved particularly challenging for mini-grid developers, who face the greatest struggles raising debt. Only a few have successfully secured commercial loans or funding from development finance institutions.

**National governments play a crucial role in financing electricity access, with earmarked funds in 23 sub-Saharan African countries accounting for 35% of their energy budgets in 2025.** Public utilities are among the most indebted state-owned enterprises in sub-Saharan Africa, with low profit margins limiting their ability to deliver and sustain loss-making rural electrification programmes. Governments often allocate substantial resources to recapitalise utilities, absorb deficits and provide affordability support to consumers. This funding can be mobilised from a variety of sources, including domestic public revenues and international public finance. Across 23 countries in sub-Saharan Africa, government budget allocations for electricity access were estimated at USD 1.1 billion in 2024, rising to USD 1.9 billion in 2025. This signals the strategic importance of electricity access in national development priorities.

### *Universal access in Africa by 2035 requires USD 15 billion in annual spending*

**Under the Accelerating Clean Cooking and Electricity Services Scenario (ACCESS), nearly USD 150 billion in cumulative investment – USD 15 billion per year – is required to reach universal electricity access by 2035.** This new scenario charts a pathway to achieve universal access to electricity based on the best rates of progress achieved historically. It is grounded in practical constraints and solutions, prioritising cost-effective and proven means to replicate past successes. Under this pathway, just under half of this investment (USD 7 billion annually) targets the expansion of grid networks, with around a third (USD 5 billion annually) going to mini-grids and just over 20% (USD 3 billion annually) to solar home systems.

### *Productive uses and regulatory changes can spur private investment*

**Private investment accounts for slightly more than 45% of spending in the ACCESS pathway, supported by an improved enabling environment.** Momentum is building to attract greater levels of private investment in grids across Africa. Countries such as Kenya, Mozambique, South Africa and Uganda are actively exploring ways to bring private investment into transmission lines. Burundi recently launched the continent's first privately-owned distribution utility in more than a decade. At the same time, more countries are introducing comprehensive mini-grid regulations, as seen in countries with large mini-grid programmes such as Nigeria. These regulations reduce approval times and standardise tariffs, while benefitting from new tools including those developed by the African Forum for Utility Regulators. Meanwhile, VAT and import duty exemptions as well as the introduction of quality standards for solar home systems help developers ensure their solutions remain affordable and reliable for end-users.

**Increased emphasis on productive users as anchor loads, especially for mini-grids, helps expand and stabilise revenue, making projects more commercially viable.** Businesses consume nearly three times more energy per connection than households. Public institutions, such as schools or healthcare centres, can consume six times more – yet they

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represent, respectively, just 30% and 10% of total consumption by mini-grids today. Including demand stimulation programmes in electrification projects brings in productive users such as solar water pumps, cold storage, and small enterprises. Blended finance is already being used to fund these activities as with smallholder farmers in East Africa, CEI Africa's Smart Outcomes Fund and the Zambia Energy Demand Stimulation Incentive programme.

### *A vital role for long-term equity and grants*

**In the ACCESS, equity financing increases roughly ten-fold to USD 5 billion per year, with debt financing seeing a five-fold increase to USD 7 billion annually.** Given the need to scale up investment quickly, often involving high risk business models, equity plays a significant role in electricity access financing over the next decade. Patient equity, often provided by international public finance or philanthropies, is particularly important as providers have longer time-horizons for returns. This type of equity is in short supply, although the launch of the Zafiri fund under Mission 300 is a positive step, with an initial capitalisation of USD 300 million and the ambition to scale to USD 1 billion.

**The rise in debt financing is driven mainly by a growth in private debt provision**. Concessional loans from development finance institutions continue to play an important role, but local commercial banks and pension funds also become increasingly active, as already seen in Kenya, Lesotho and Nigeria. This increased involvement is facilitated by risk-mitigation tools from development partners. These include technical assistance, capacity building and blended finance facilities, such as the new Green for Access First Loss Facility.

**Grants account for around USD 3 billion annually to 2035 to achieve the ACCESS pathway, although improvements to results-based financing are needed to maximise their impact.** International public finance providers have shown a preference for delivering grant capital to developers via results-based financing. However, developers sometimes struggle with this funding since payments are not made upfront. This often forces companies to raise additional financing, and the complexity of application and due diligence processes can be prohibitive for smaller players. To ensure results-based financing continues to play a meaningful role, its design must evolve in collaboration with the private sector.

**New and innovative financial mechanisms are emerging to tap into a broader range of investors for decentralised energy solutions, helping scale up investment.** Mature solar home systems companies have started using securitisation deals to attract private investors while reducing the burden on company balance sheets. An example of this is Sun King's USD 330 million deal in 2022 in Kenya. Meanwhile, innovations to support poorer households include the use of energy-as-a-service models that allow customers to pay for electricity based on availability or usage, rather than buying solar home systems outright. Green bonds are showing promise for mini-grid developers, which have larger upfront capital needs, in countries with clear regulations and deep capital markets, notably Nigeria. Finally, crowdfunding presents an opportunity to tap into the retail investor market, raising more than USD 300 million globally for electricity access since 2016.

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### *Limited concessional funding needs to be used more strategically*

**Concessional resources account for roughly 40% of total investment – the equivalent of USD 6.2 billion each year – between now and 2035.** This represents a nearly six-fold increase from the annual average between 2019 and 2023. Given the current macroeconomic challenges, mounting pressures on domestic budgets in African countries and recently announced cuts in development aid from major donors, it is imperative to adopt a more catalytic and strategic approach to the use of limited concessional funding. This includes focusing highly concessional resources on areas that cannot be serviced by the private sector, such as low-income and vulnerable communities, the early stages of project or company development, and technical assistance and capacity building.

**Concessional funders can also target private sector mobilisation by prioritising higher risk-taking positions, encouraging innovative financing models, and providing risk-mitigation tools.** International public finance providers can unlock private capital within blended finance structures by taking on more subordinated debt positions or contributing equity and grants. Concessional funds are also uniquely positioned to support innovative financing solutions. For example, aggregation could be used to more rapidly scale-up financing for smaller projects, with pilots currently in areas such as pooled procurement approaches and aggregated projects as part of securitisation deals.

### *Reaping the benefits of access requires an extra effort to ensure affordability*

**Beyond connecting households to electricity, additional finance of at least USD 2 billion per year is necessary to ensure that basic levels of energy service are affordable.** In many of the areas without electricity today, income levels are low, presenting a challenge to both households' ability to benefit from new connection and the commercial viability of access projects. Electricity services are considered affordable if they account for less than 5% of household incomes. Based on new analysis, roughly 220 million people in Africa (40% of those without access) are unlikely to be able to afford the IEA's basic bundle (around 50-75 kWh per household per year). To fill this affordability gap would require additional spending of USD 2 billion per year, rising to USD 10 billion if we consider the higher levels of energy service seen under the essential bundle.

**Providing developers with cheaper capital or additional grants to lower capital costs can improve affordability, but demand-side subsidies remain essential.** The weighted average cost of capital for electricity access projects can be up to four times higher than transmission and distribution projects in advanced economies. This is due to a combination of higher country risk premiums, the smaller project sizes and the high risks associated with the end users. Bringing the cost of capital down to advanced economy levels would reduce project costs by up to 25%, making basic electricity services affordable for 40 million more people.

**Providing grants to mini-grid developers can be an effective way to reduce the cost of electricity to consumers without disincentivising private investment**. Given their capital-intensive nature, this has more of an impact on the affordability of services from mini-grids than on stand-alone systems. If grants were used to subsidise a further 30% of capital

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expenditure for mini-grids, this would make basic electricity services affordable to an additional 60 million people who would gain access via this technology. While these measures bring electricity access more within reach of a significant share of the population, this also highlights that targeted demand-side support remains necessary, particularly for the poorest households.

### *Financing must be carefully designed to reach underserved populations*

**Targeted approaches are needed for communities living in informal settlements, fragile states, humanitarian contexts and Small Island Developing States.** These complex environments account for a significant share of the population without electricity access. Around 60% of households without access are in fragile or conflict prone states, more than half of sub-Saharan Africa's urban population live in informal settlements, and Africa is home to an estimated 40 million people in displacement settings. While the challenges in these settings vary significantly, commonalities include limited infrastructure, weak institutional capacity, and unstable economic conditions. Decentralised solutions often present the most viable pathway to electricity, but the higher risk levels limit investor appetite. Despite this, there are success stories: in refugee camps in Ethiopia and Kenya grants have been used to support private investment in solar home systems and mini-grids respectively. Blended finance has also been used to fund mini-grids in conflict-prone areas of the Democratic Republic of Congo and solar home systems in informal settings in Sierra Leone and Uganda.

**Women play a pivotal role in advancing electricity access, but women-led businesses require tailored solutions to help overcome the additional barriers to accessing finance.** Women-owned businesses can play a key role in the electricity access supply chain but lower engagement with the formal financial sector, lower literacy rates, and limited access to collateral mean they often struggle to raise capital. Further efforts are needed to identify and remove these barriers. Emerging examples that could be replicated include regulatory developments such as the creation of moveable collateral registries, or targeted products for women-owned businesses, such as dedicated funds, new credit assessment tools like cashflow based lending, or interest rate discounts for distributors that meet gender targets.

### *Universal electricity access underpins sustainable economic development*

**Achieving universal electricity access in Africa is an urgent priority requiring coordinated action and sustained investment alongside broader economic development programmes.** While concessional capital is essential for the most underserved and complex environments, the examples outlined in this report show the potential for well-designed financial instruments to catalyse private sector involvement. There are some promising and inspiring initiatives, but progress must accelerate if Africa is to reach universal access by 2035. Financing remains a key enabler in the short to medium term, but it must be deployed in ways that support inclusive growth, local entrepreneurship, and stronger domestic financial markets. Over the longer term, the most sustainable path to universal access lies in increasing demand, making projects more commercially viable and reducing reliance on subsidies, while also supporting inclusive development across Africa.

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# State of play

## Understanding electricity access financing


### SUMMARY

- As of 2024, around 600 million people in sub-Saharan Africa (47% of the population) did not have access to electricity. With electrification barely keeping up with population growth rates, progress remains far off the pace envisaged both by African governments and international organisations. Reaching universal access requires a cost-effective, multi-technology approach, with grid extension, mini-grids and stand-alone systems all playing a role to ensure affordable service provision to unelectrified communities. Notably, financing has been one of the primary impediments to growth.
- For the first time, the IEA has tracked electricity access financing commitments, showing that less than USD 2.5 billion per year is being directed to sub-Saharan Africa. About half of financing (48%) is for access via the grid. However, decentralised solutions – mini-grids and stand-alone systems – have proved essential alternatives and saw a 20% increase in their level of financing between 2019 and 2023.
- Private finance for electricity access remains limited, reaching USD 640 million (or 25% of total commitments) in 2023. The vast majority of this private capital comes from international sources, with impact investors providing over USD 1 billion to decentralised solutions over the five-year period. This reliance on international capital makes it challenging for smaller, often African-owned companies to scale up, illustrating the need to mobilise more financing from local institutions.
- Given the tight profit margins and affordability constraints facing electricity access projects, public finance plays a vital role. Financing from international public providers reached USD 1.8 billion in 2023, primarily in the form of low-cost debt, with a notable shift away from grants in recent years. New initiatives, including the World Bank and African Development Bank's Mission 300, aim to increase the level of public capital for access projects, and are already showing momentum.
- Allocations to electricity access in African governments' national budgets reached USD 1.9 billion in 2025 – around a third of total energy budget allocations. Much of this financing is channelled through government agencies and state-owned utilities. However, utilities across the region face financial pressures due to high operational costs, low tariffs and collection rates, hindering their ability to deliver last-mile programmes and often requiring government budgetary support.
- Current financing trends reveal a major gap in the availability of equity. Equity investment averaged USD 450 million per year during 2019-2023, and while there has been a gradual annual increase since 2020, it has been concentrated in mature companies and markets, preventing early-stage companies from being able to scale up or fund growth into new projects.


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## 1.1 Introduction

Achieving universal access to electricity in Africa is not just an economic development imperative – it is the foundation for poverty reduction, social equity and environmentally sustainable growth across the continent. The availability of ever more innovative, efficient, cheaper, and sustainable solutions has widened the range of options for achieving this goal while improving the quality of life of millions and reducing the impact on the environment. Since the early 2000s, many countries have made rapid progress to extend electricity access, led by developing economies in Asia and parts of Latin America. Other countries, especially in sub-Saharan Africa, have struggled to rapidly extend electricity access.

An increase in financing is vital to enable the expansion of generation capacity, grid networks and decentralised solutions – including both mini-grids and stand-alone systems – across sub-Saharan Africa. Without sustained financing, progress towards universal access risks falling further behind the region's population growth rates. This report seeks to provide further detail on the current state of electricity access financing, outlined in this chapter, followed by a deep dive into how finance evolves to meet the universal access challenge (Chapter 2) and what additional financing considerations are necessary to ensure electricity services are affordable and equitable (Chapter 3).

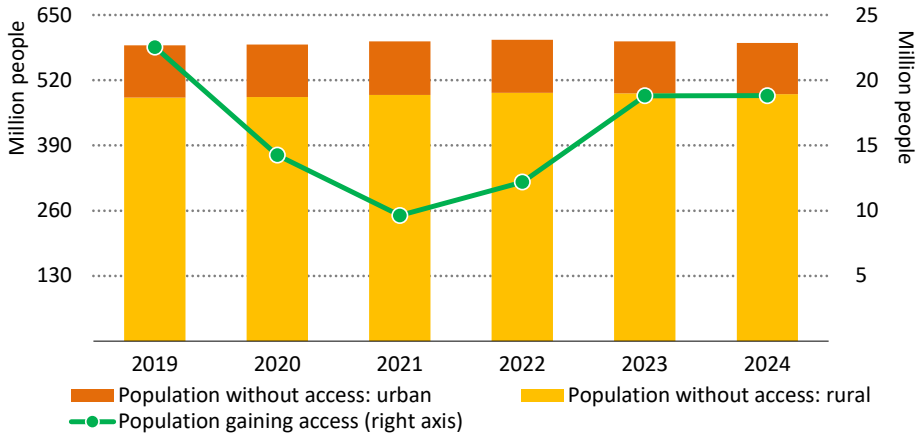
## 1.2 Electricity access rates

As of 2024, 730 million people worldwide still had no electricity access, over 80% of whom lived in rural areas. This represents a decline of only 11 million people from 2023, demonstrating a slower pace than annual progress before the pandemic (IEA, 2025a) . Access rates in sub-Saharan Africa have seen little improvement, with half of the region's population – around 600 million people – still in need of an electricity connection as of 2024. The lingering effects of the pandemic years, combined with political crises and macroeconomic imbalances such as rising debt burdens, inflationary pressures and reliance on foreign currency borrowing, have hindered efforts to accelerate the pace of electrification.

Moreover, in sub-Saharan Africa, these challenges are exacerbated by a rapid rate of population growth – averaging around 2.5% per year. This demographic trend means that the absolute number of people without access has stalled in recent years, with only 16 million people on average per year gaining electricity access between 2019 and 2024 (see Figure 1.1). At this rate, by 2035, around 520 million people in sub-Saharan Africa would still be without access to electricity, when the region's population is projected to reach 1.5 billion. Without a significant acceleration in grid expansion and decentralised solutions, the region risks falling further behind its energy access targets, undermining socio-economic transformation and climate resilience efforts.

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**Figure 1.1 ▷ People without access to electricity in sub-Saharan Africa, 2019-2024**




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*Between 2019 and 2024, the annual number of new connections slowed, barely keeping pace with population growth, leaving around 600 million people without access in 2024*

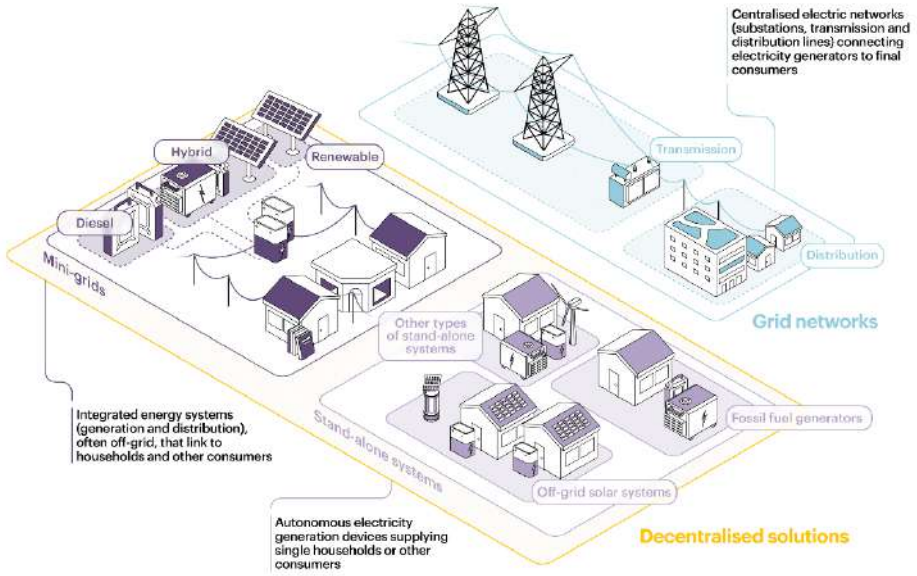
### 1.2.1 Defining electricity access

A household is defined as having electricity access when it benefits from an active connection that provides enough electricity to power at least a minimum level of services and is capable of growing over time. Electricity access can be achieved via the grid or decentralised solutions, such as mini-grids or stand-alone systems (see Figure 1.2). Mini-grids can be either renewables-based, a hybrid system powered by a renewable source with a diesel generator for back-up, or diesel only, although this latter option is becoming less common in new projects. Stand-alone systems represent a broad group of products, primarily solar home systems (SHS), but also solar multi-light systems, solar lanterns, fossil fuel generators and other types of stand-alone systems (such as micro-hydro, wind, rechargeable batteries and hybrid systems).

The minimum required energy service for a household to be considered as having access to electricity differs between institutions. The IEA defines electricity access via a series of **bundles**, based on household consumption levels (IEA, 2023a). The basic bundle, or minimum level of services, includes more than one light point providing task lighting, phone charging and a radio, and is broadly equivalent to a range of around 50-75 kWh per household per year, depending on efficiency levels (see Figure 1.3). The IEA basic bundle represents a critical first step and baseline for access, but a higher level of energy service and efficiency is needed to support productive activities and drive socio-economic development. This need is captured within the IEA's essential bundle of 500 kWh per household per year, and the extended bundle of 1 250 kWh per household per year.

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**Figure 1.2 ▷ Illustration of technologies providing electricity access**




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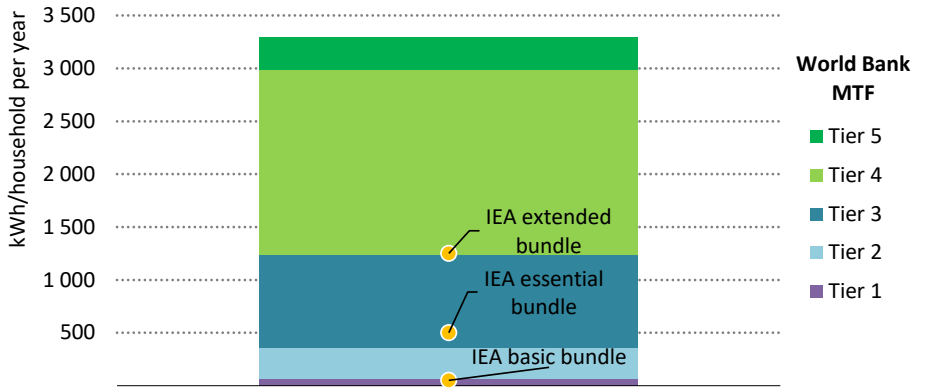
*Access to electricity can happen via the grid or via decentralised solutions, such as mini-grids (supplying multiple consumers) or stand-alone systems (supplying a single consumer)*

Other notable benchmarks used for electricity access include the concept of the **Modern Energy Minimum**, promoted by the Energy for Growth Hub, which sets an energy consumption threshold of 1 000 kWh per person per year (Energy for Growth Hub, 2020). This threshold considers both residential use (250 kWh) and electricity for industry, commerce and agriculture (750 kWh). While this is one-third lower than the average power consumption level in upper middle-income countries (Energy for Growth Hub, 2020), it supports both a higher quality of life and broader economic development.

Another metric commonly used is the World Bank's **Multi-Tier Framework** (MTF), which takes a multidimensional understanding of energy access. The World Bank considers electricity access starting from a small solar multi-light system of 3 Wp, and its MTF establishes six tiers of electricity access, taking into account a combination of energy consumption, reliability and affordability. The lowest tier, Tier 1, is broadly equivalent to 4.5 kWh per household per year.

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**Figure 1.3 ▷ Defining access: Minimum level of energy service thresholds**




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*A minimum level of service of 50-75 kWh/year is needed for a household to have access; but substantially higher levels are needed for broader economic development*

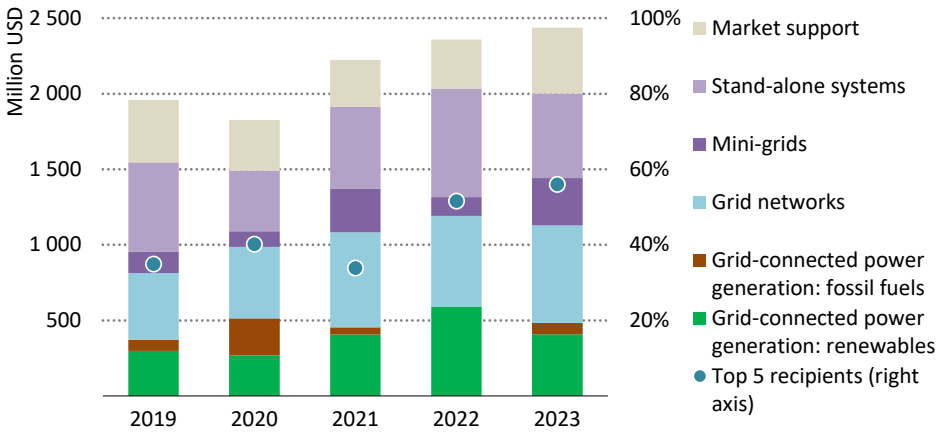
Evidence shows that – in the short to medium term – providing communities access to an electricity connection does not, on its own, drive economic development through, for example, the creation of new businesses or driving higher income streams (Lee, Miguel, & Wolfram, 2020). To achieve this goal, a broad range of economy-wide barriers, such as in education, access to finance and healthcare, to name a few, also need to be addressed. While the primary scope of this report is reaching universal access as defined by the IEA bundles, it is clear this is not the only target for policy makers and financing institutions. Including electricity access in other development programmes that support rural business' development and increased productivity from agriculture, all while maintaining affordability and reliability, is key to maximising the socio-economic gains that can proliferate from these new electricity access connections.

## 1.3 Financing access: Overview by technology

The IEA has, for the first time, tracked financing commitments from public and private providers for electricity access in sub-Saharan Africa (see Box 1.1 for approach). Between 2019 and 2023, an average of USD 2.2 billion was committed annually to financing electricity access in the region (see Figure 1.4). Following a dip in 2020 due to the Covid-19 pandemic, commitments jumped by 22% in 2021, and then maintained a steady increase of around 5% per year to 2023, when they reached almost USD 2.5 billion.

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**Figure 1.4 ▷ Financing commitments for first-time electricity access in sub-Saharan Africa by sector, 2019-2023**




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*Between 2019 and 2023, an annual average of USD 2.2 billion was committed for electricity access in sub-Saharan Africa, demonstrating a rebound and upward trajectory since 2020*

Notes: Market support includes financing for energy sector policy, planning, capacity building, market building and training, among other activities. Stand-alone systems comprise mainly solar home systems. Grid-connected power generation includes battery storage, solar PV, solar CSP, nuclear, marine, geothermal, wind, hydroelectricity, and bioenergy (for renewables) and oil, natural gas, and coal (for fossil fuels). For further detail on methodology, see Annex A.

Sources: IEA analysis based on data from IJGlobal (2025), World Bank (2025a), OECD (2025), AidData (2023), GOGLA (2024a), Cleantech Group (2025), BNEF (2025).

Despite the gradual progress, financing commitments are unevenly distributed both across the region and within countries. Over the five-year period, six countries – South Africa, Mozambique, Kenya, Senegal, Angola and Nigeria – accounted for half of tracked financing. This concentration is even more visible with decentralised solutions, where the top five recipients have accounted on average for 90% of financing. The relatively conducive business environments in these countries and the presence of clear policy and regulatory frameworks or government programmes have helped attract funding. This trend highlights the mismatch between finance flows and the countries with the largest electricity access deficits. This mismatch is also visible within countries, with funding skewed towards urban and peri-urban areas, where higher population density and incomes allowed for more bankable projects, despite the fact that in 2024 80% of the population without access lived in rural areas.

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**Box 1.1 ▷ Tracking electricity access financing commitments**

The IEA has developed a new tracking methodology that relies on a wide variety of data sources to track financing commitments (i.e. capital raised by private companies or committed by international public finance providers) towards electricity access in sub-Saharan Africa. These include financing commitments for grid-connected power generation, grid networks, mini-grids and stand-alone systems; commitments to market support are also tracked. After establishing how much financing has been committed to these sectors, technology-specific ratios are applied to derive the proportion of commitments that are directly targeting new household connections. In practice, this financing will not all be spent or disbursed in the year it is committed. These data should therefore not be considered as equivalent to *spending* on electricity access each year, which is much harder to track and verify given current data limitations.

The data presented are collected from a variety of sources covering international public finance, project and corporate finance, private equity and venture capital, and capital raised by companies active in the off-grid sector. These data are not always comparable, but efforts have been made to harmonise sources and remove double counting. Despite this, gaps are still likely to remain, especially from domestic providers. Spending by African governments has been tracked separately (see Spotlight) and not included alongside other financing commitments because of gaps in the reported data and risks of double counting.

As disbursement rates and costs vary over the years and across technologies, the data are intended to be considered alongside a range of other metrics, such as the number of people gaining access each year.

See Annex A: Methodology for more details, including the full source list.

### *1.3.1 Grids*

Expanding the national grid has been the dominant method of providing electricity access historically. In the past ten years grid investment in sub-Saharan Africa grew by 6% on average. Between 2015 and 2024, cumulative grid investments in sub-Saharan Africa amounted to USD 54 billion, less than half of those in Southeast Asia, where several countries have achieved universal access in the last years.

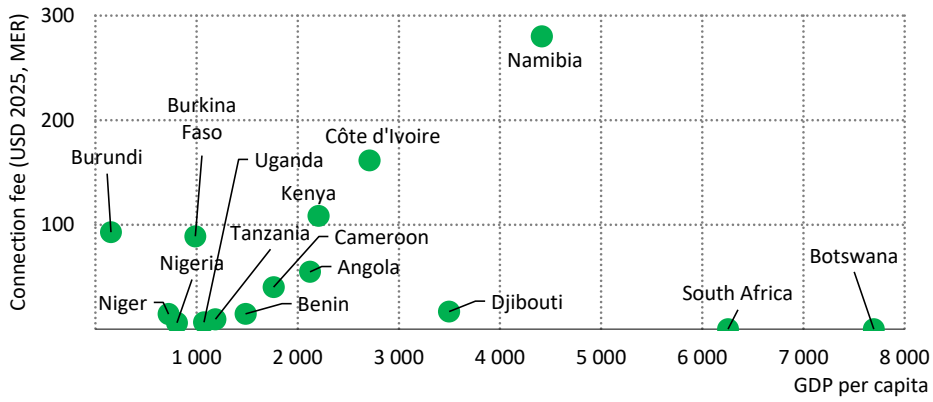
Almost all investment in grid networks in Africa is currently made by national governments, with only eight countries in the region allowing private participation in distribution and only four in transmission as of 2023 (IEA, 2023b). However, rising public debt limits governments' fiscal space and prevents them from being able to fund these projects via state-owned utilities, which frequently face financial challenges. As a result, in recent years, some governments – notably Zambia, Kenya, Tanzania, Senegal, Burundi and South Africa – have begun opening their electricity networks to private sector investment. Regional and

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continent-wide efforts to pool power, including under the African Single Electricity Market, are also being developed to create larger power markets and encourage power trading, which can in turn attract more investment into grid projects.

Investment in grid networks to expand electricity access do not necessarily lead to higher access rates as historically, high up-front connection fees have posed a barrier, often preventing households from connecting to the grid. For instance, evidence from 2014 showed that, despite the substantial investment in expanding the grid, half of households without access in Kenya were located as close as 200 metres from a low-voltage distribution line (Global Infrastructure Hub, 2024). To increase new connections, in 2015 the Kenyan government launched the USD 630 million **Last Mile Connectivity Project** (LMCP), which involves the extension of low-voltage distribution networks, along with a subsidised connection fee of USD 171, reduced from USD 398 (Global Infrastructure Hub, 2024). The project has achieved economies of scale, with costs per connection falling as more households have connected, and has helped improve Kenya's electricity access rate, which increased from 56% in 2016 to 73.4% in 2018 (Global Infrastructure Hub, 2024). Alongside Kenya, in recent years several countries have taken steps to reduce connection charges, acknowledging that such fees can present a significant barrier to achieving universal access. In 2022, the government of Benin approved a policy to reduce connection fees for new customers from CFA francs 20 000 (approximately USD 36) to 10 000, effective from 2025 (La Nouvelle Tribune, 2022). Likewise, in the Gambia, meter fees were reduced significantly – from GMD 8 500 (USD 22) to GMD 500 (USD 7) in 2024 – with the support of international development partners and targeting rural areas specifically (The Standard, 2024).

**Figure 1.5 ▷ Connection fees and GDP per capita in selected countries, 2025**




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***Connection charges vary across the region, with most countries offering subsidised rates; despite this, the average is still over USD 50, which is unaffordable for many households***

Source: IEA analysis based the latest electricity tariffs in 45 countries. GDP per capita is based on World Bank, (2024a).

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Where investments into grid networks are occurring, the vast majority do not involve last-mile connections in rural areas (the expansion of low-voltage distribution lines with the aim of providing first-time access), which are often less commercially viable than urban, peri-urban or industrial areas. Last-mile grid programmes often lead to significant losses for the state utility, as new customers' consumption levels tend to be low. For example, in Kenya the LMCP contributed to a significant drop in residential consumption levels, which fell by 70% between 2009 and 2017 (Taneja, 2018). Low consumption levels make it challenging to offset the high capital costs of extending gridlines to remote areas. Studies in East Africa found the average cost of extending electricity lines to unelectrified rural communities was between USD 2 400 and USD 8 000 per connection (Bos, Chaplin, & Mamun, 2018). This cost cannot be passed through to the consumer entirely, with governments adopting different approaches to setting connection changes. In some countries, like South Africa, Botswana and Benin, connection charges are fully subsidised, while in others, like Côte d'Ivoire, Kenya and Namibia, fees are above USD 100 (see Figure 1.5). The inability of utilities to recoup capital costs through either the connection fee or usage tariffs makes grid expansion projects reliant on public funding. Given the high debt levels already facing many governments in the region, the design of future grid financing must be sensitive to debt sustainability and is likely to rely on support from international public finance providers.

### *1.3.2 Decentralised solutions*

Decentralised solutions – i.e. both mini-grids and stand-alone systems – are now recognised as a cost-effective way to expand electricity access, especially in rural areas where grid extension would be too time-consuming and costly. Financing committed to decentralised solutions in sub-Saharan Africa reached USD 870 million in 2023, a 20% increase compared to 2019 levels (see Figure 1.4). Nevertheless, in several of the region's countries, policy frameworks still do not integrate decentralised solutions into national electrification strategies, treating them as transitional or complementary, and companies in the space continue to face numerous barriers to accessing finance that hinder their ability to scale up. For instance, SHS companies are seen as high risk due to concerns over the ability of consumers to pay, and many newer companies do not have the necessary collateral or credit history to raise capital, let alone at affordable rates. Meanwhile, mini-grid developers – with larger capital expenditure requirements – often struggle with regulatory uncertainty, particularly around tariffs, which creates high market entry risks and can make it challenging to attract commercial investors.

In 2023, financing commitments to stand-alone systems for new electricity access connections reached USD 560 million in the region. Within stand-alone systems, the primary technology households use to gain access is via SHS. Sales of SHS units above 10 Wp in sub-Saharan Africa reached an all-time high of almost 5.5 million units in 2023, accounting for 1.3 million new connections in the region (a third of total new connections). This comes after a period of uncertainty for the SHS sector and represents exponential growth compared to the almost negligible levels of the early 2010s (IEA, 2024). The sector boomed in the mid to

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late 2010s following the development of pay-as-you-go (PAYG) business models that allowed the cost of SHS kits to be spread out over longer periods of time, rendering them affordable to a much larger customer base. However, private sector interest declined after several high-profile bankruptcies in 2019. This was worsened by the Covid-19 pandemic and Russia's full-scale invasion of Ukraine, which led to rising food and fuel prices, putting significant pressure on household spending; during this period several SHS companies required loan write-offs, lowering investor confidence in the sector. Over the past two years the sector has matured, with significant consolidation in the market. While this has allowed the larger players to access a broader pool of investors including commercial banks, smaller SHS companies, many of which are African-owned, still struggle to access sufficient affordable finance to develop bankable projects.

Finance flows towards mini-grids have more than doubled over the period analysed, from USD 140 million in 2019 to over USD 300 million in 2023. This increase has been driven by a combination of national electrification programmes including a role for mini-grids, and the expansion of productive uses of energy (PUE), which makes mini-grid projects more commercially viable. Clear legal frameworks and government support have been key drivers to attract financing into the sector. For example, Nigeria attracted over 20% of the region's mini-grid financing between 2019 and 2023, driven by the **Nigeria Electrification Programme** (NEP), a federal government initiative that has received financing from the **World Bank** and the **African Development Bank** (AfDB). The existence of mini-grid regulations, as well as sound programmes and international support, are key to the creation of an enabling environment for private project financing. This is instrumental in scaling up mini-grid deployment. Nigeria provides a clear example: in 2022, **CrossBoundary Energy Access** and **ENGIE Energy Access** signed a USD 60 million transaction with the aim of connecting 150 000 people in Nigeria via mini-grids, an investment that would not have been possible in the absence of the country's clear policy framework.

The commercial appeal of mini-grid projects has also been improving thanks to the possibility of including PUE in project design, although this has yet to be proven at scale. By increasing the level of electricity demand, the investment in PUE – such as solar-powered irrigation, flour-milling machines or electric mobility – stabilises revenue streams for the operator and improves the tight profit margins typical of the mini-grid sector while also addressing technical risks, such as frequency and voltage fluctuations. Despite this growth in financing, the sector is still relatively nascent and includes a broad base of companies ready for scale-up. These companies require financing at ticket sizes that are generally too small to appeal to development finance institutions (DFIs), but equally they struggle to attract commercial funding without concessional finance providers absorbing some of the risk.

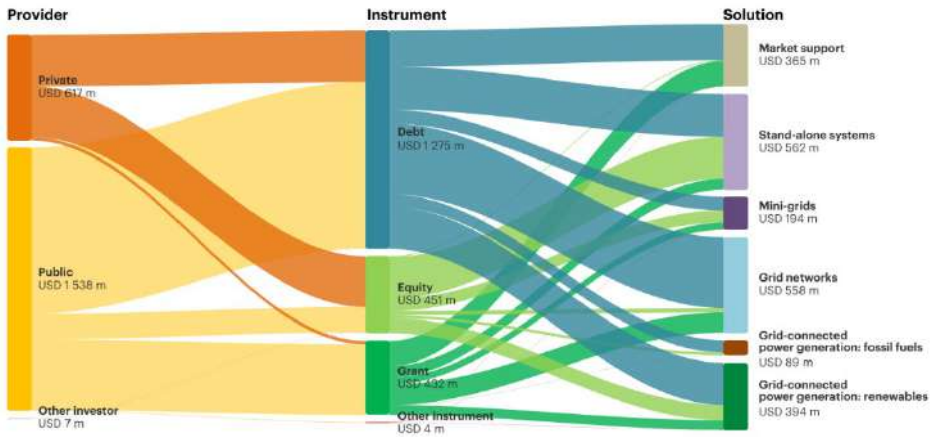
## 1.4 Financing access: Overview by provider

Access-focused financing from private capital providers has remained limited, with financing commitments totalling USD 3 billion over the 2019-2023 period. This represented just 29%

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of overall financing commitments. Despite growing investor interest, international private financing remains particularly limited in the context of decentralised solutions compared to grid-connected power. This is primarily due to concerns around revenue and the level of offtake for mini-grids or in the case of SHS, the length of payback periods. At the same time, financing from domestic private capital providers has yet to achieve scale, and local currency financing – which is particularly needed for African-owned enterprises that face high exposure to exchange rate volatility – is costly and characterised by high collateral requirements that most SHS companies struggle to meet.

**Figure 1.6 ▷ Annual average financing commitments for electricity access in sub-Saharan Africa, 2019-2023**




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*Electricity access is primarily financed by DFIs via debt; equity and grants play a key role in the financing of off-grid solutions, which have received 35% of the financing for access*

Notes: Public comprises development finance institutions, multilateral climate funds and other international public finance providers (mainly donor governments). It does not include domestic government spending (see Spotlight). Other investor and Other instrument include projects with uncategorised investors or instruments from the data provider. Stand-alone systems comprises mainly solar home systems, plus other off-grid projects. Grid-connected power generation includes battery storage, solar PV, solar CSP, nuclear, marine, geothermal, wind, hydroelectricity, and bioenergy (for renewables) and oil, natural gas, and coal (for fossil fuels). Market support includes financing for energy sector policy, planning, capacity building, market building and training, among other activities. For further detail on methodology, see Annex A.

Sources: IEA analysis based on data from IJGlobal (2025), World Bank (2025a), OECD (2025), AidData (2023), GOGLA (2024a), Cleantech Group (2025), BNEF (2025).

Public finance has therefore proved essential, particularly concessional financing in the form of low-cost debt and grants, and targeted instruments such as blended finance structures and guarantees. International public capital providers tracked by the IEA include a range of organisations. DFIs – a group that includes international financial institutions, multilateral banks, and national, regional and local development banks, as well as other entities with a

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mandate to finance public policy on behalf of the state – are the largest contributors, with financing commitments averaging USD 1 billion a year. Notable commitments are also made by multilateral climate funds (MCFs) and other international public finance providers such as governments (ministries, government agencies and funds), UN bodies and export-credit agencies.

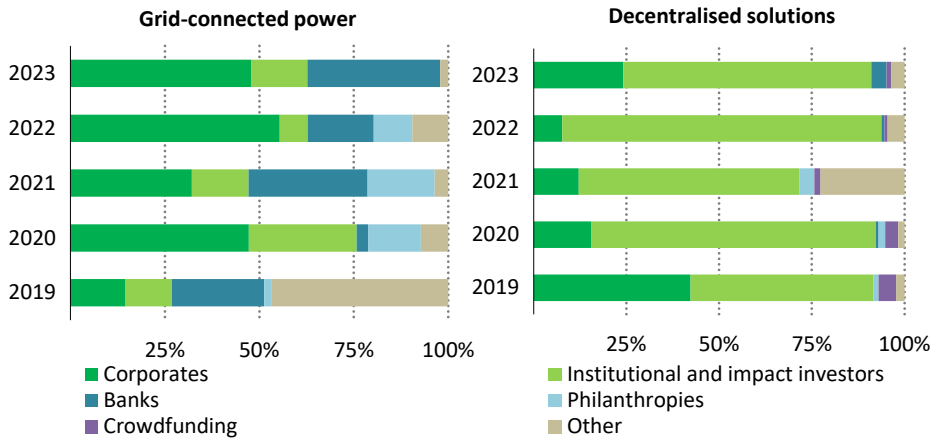
Additionally, an important financing contribution comes from African governments, whose budget allocations to electricity access are tracked separately (see Spotlight).

### *1.4.1 Private finance*

Private sector financing of electricity access in sub-Saharan Africa has been growing at an average annual rate of 16%, from USD 450 million in 2019 to USD 640 million in 2023. However, despite their critical role in achieving universal electricity access, decentralised solutions and low-voltage distribution lines represent only a modest share of total financing from the private sector, with its financing commitments being mainly directed at large-scale generation and transmission projects. While generation projects support energy security goals, their impact on electricity access can be minimal without suitable investment in the expansion and improvement of distribution networks and the existence of targeted programmes for last-mile connectivity, particularly in rural areas. One example of a grid-based generation project that targets electricity access is the AfDB's **Desert to Power initiative**, which aims to increase the solar power generation capacity of 11 Sahel countries by 10 GW and provide electricity access to 90 million people (AfDB, 2018). However, there are several examples from across the continent that also highlight the risk that delays in the construction of the necessary supporting grid infrastructure can prevent utility-scale power generation projects from reaching new electricity connections, for instance the **Lake Turkana** wind project in Kenya.

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**Figure 1.7 ▷ Private financing by provider in grid-connected and decentralised solution access projects, 2019-2023**




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*Decentralised solutions attract a much less diversified pool of private investors than grid-connected generation, with 70% of financing commitments coming from impact investors*

Note: Institutional and impact investors includes debt and equity funds (including those with an impact mandate), private equity and venture capital, pension funds, and other institutional investors. Philanthropies includes foundations and family offices. Other includes angel investors, utilities, accelerators and incubators, and investors not categorised by the data provider.

Sources: IEA analysis based on data from IJGlobal (2025), World Bank (2025a), OECD (2025), AidData (2023), GOGLA (2024a), Cleantech Group (2025), BNEF (2025).

The financing of decentralised solutions is dominated by impact investors, whose financing commitments increased by 70% between 2019 and 2023. This increase has partly been driven by several major deals, such as large capital raising transactions of USD 330 million by **Sun King** in 2022 (Sun King, 2022), USD 490 million by **d.light** between 2020 and 2023 (Fintech Finance News, 2023), and **Husk Power Systems** who secured over USD 40 million from private capital providers through its series D funding in 2023, which was further leveraged to raise an additional USD 60 million in debt from international financial institutions (Husk Power, 2023). While impact investors are categorised as private, many of the funds investing in electricity access are either exclusively or primarily capitalised by development finance, although recent capital raising by these funds has seen more interest from private institutional investors and domestic pension funds. Larger companies, such as **Sun King**, have also been able to raise funds from global private equity firms, such as **General Atlantic** (USD 260 million in 2022) and **LeapFrog** (USD 70 million in 2022) (LeapFrog Investments, 2022) (General Atlantic, 2022). However, this also reveals the different equity raising environments for maturer companies compared to those in the earlier stages. In 2024 over 75% of capital issuances concerned companies already in the scale-up phase, demonstrating a clear gap for start-ups, for whom equity capital is essential (GOGLA, 2025a).

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International banks and large corporates participation in access-focused projects remains limited, constrained by the small ticket sizes and concerns around bankability given the tight profit margins and challenges in assessing the credit risk of end consumers. However, in 2024 a joint investment of USD 500 million from **BP**, **Equinor**, **Shell** and **TotalEnergies** to increase energy access in sub-Saharan Africa and in South and Southeast Asia through investment in SHS and mini-grids (among other solutions) is signalling growing interest from corporates in decentralised solutions (Shell, 2024).

### *Domestic commercial banks*

Local banks in sub-Saharan Africa remain marginal players in electricity access financing and are often unable to offer electricity access developers a financial product aligned with their needs. The majority of domestic commercial bank lending is unaffordable due to high national interest rates, and banks have strict collateral and long credit history requirements that developers are unable to meet. Nearly 70% of African-owned decentralised solution companies have cited insufficient collateral as a key barrier – with most banks requiring immovable property, such as physical property or corporate assets, as collateral (Energy4Impact, 2020). Most banks also lack the technical capacity to assess these projects, which are often seen as high risk.

Several examples of domestic commercial bank lending to decentralised solutions show that lending has often been supported by either credit guarantees or technical assistance from international public finance:

- In 2025, **Stanbic IBTC Bank** and the **IFC** closed an USD 80 million, Naira-denominated debt facility with Sun King to expand solar energy access across Nigeria (IFC, 2025). This public-private partnership allows Sun King to borrow in local currency, removing foreign exchange risk.
- In Nigeria, **First City Monument Bank** (FCMB) in partnership with the **Rural Electrification Agency** (REA) approved the roll-out of NGN 100 billion (USD 65 million) for credit-enhanced loans to support decentralised renewable energy projects in rural and underserved areas. Under this facility, FCMB extends loans of up to NGN 1 billion (approximately USD 650 000) per eligible mini-grid developer, covering up to 70% of approved project costs over a two-year period, with potential to scale up. The remaining costs are covered by performance-based grants that are managed by REA and serve as credit enhancements by reducing FCMB's exposure to risk (The Electricity Hub, 2025).
- In Ghana, **Ecobank** has started a USD 31.6 million initiative to offer concessional loans under the **Accelerating Solar Action Programme** (ASAP), backed by the **Green Climate Fund** (GCF), to finance distributed solar and mini-grids for SMEs and households. The facility leveraged a USD 15 million concessional loan and USD 1 million grant from the GCF, matched by USD 15 million in commercial co-financing from Ecobank. By extending loan tenors to up to seven years – more than double the market norm –

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and by offering below-market interest rates, the programme addresses a key financing barrier in Ghana, where commercial lending rates averaged around 38% (CrediRates, 2025) (Green Climate Fund, 2024).



While these examples demonstrate the potential for greater involvement among domestic commercial banks, it is often the case that even when credit lines are extended, banks struggle to find projects to lend to. Banks are not well-suited to lending to early-stage ventures since they often require a credit history or cash-flow data to make a credit assessment, and are therefore best positioned to support more established companies.

### *1.4.2 Public finance*

Public finance providers are uniquely positioned to fund electricity access projects that are not commercially viable, including in nascent markets or hard-to-reach areas. As well as direct funding, they provide essential de-risking capital in blended finance instruments aimed at crowding-in private capital. This support ranges from grants – which have proved necessary in the mini-grid sector, especially in the presence of subsidised electricity tariffs on the national grid – to guarantee schemes and other credit enhancement mechanisms to address offtaker risk. Additionally, international public finance providers have provided significant levels of market support to help countries overcome key barriers within their policy and regulatory environments and to strengthen institutional capacity in both government and domestic financial institutions.

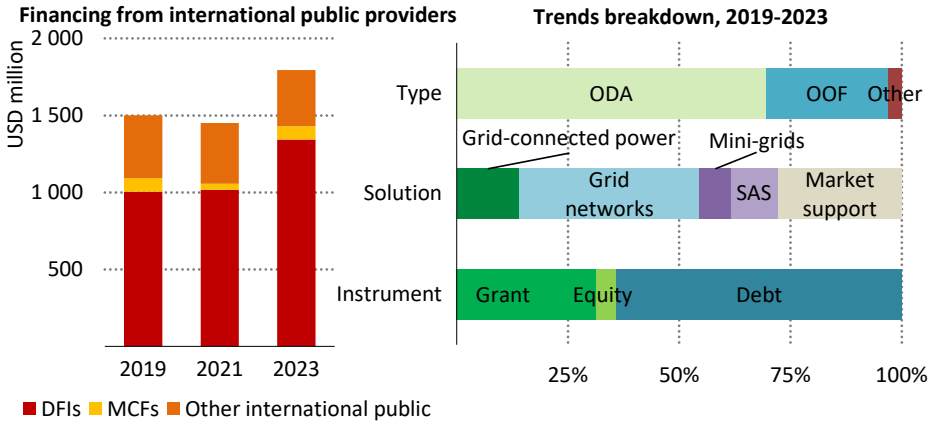
The majority of public capital for electricity access comes either from DFIs, donor government agencies or domestic governments (tracked separately due to data limitations; see Spotlight). Each of these providers has differing priorities and approaches. DFIs portfolios are dominated by sovereign lending (i.e. loans or grants made directly to governments) or by projects backed by government guarantees as governments are considered to be reliable borrowers, especially where local capital markets are shallow, private investment is seen as too risky, or where DFIs benefit from preferred creditor status, which reduces their risk of default. This means they tend to fund national electrification programmes or grid networks, which between 2019 and 2023 attracted 40% of DFI capital. Non-sovereign lending – lending not backed by a government guarantee – can take the form of either direct lending to a project developer, partial credit guarantees, or, as more commonly seen in decentralised solutions, indirect investments through local financial institutions or funds for on-lending to final borrowers. Non-sovereign operations remain relatively small. For example, the **AfDB**'s approved lending for non-sovereign operations was approximately USD 1.7 billion in 2023, while that of the **International Finance Corporation** (IFC) in Africa was USD 14.2 billion in 2024 – accounting for 20-30% of IFC's total lending in the region (AfDB, 2024; IFC, 2024).

Meanwhile, other international public donors and multilateral climate funds are the primary suppliers of grants and highly concessional capital in lower-income countries, with funds such as the **GCF** and the **Global Environment Facility** (GEF) often providing first-loss capital and long-tenor loans. Funding directly from donor government agencies or departments remain the dominant source of funding for residential and off-grid access, especially in fragile and

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remote markets where commercial capital is scarce. Given their different roles, ensuring co-ordination among international public finance providers is key to increasing efficiency and streamlining processes.

**Figure 1.8 ▷ International public finance commitments to electricity access in sub-Saharan Africa, 2019-2023**




*International public finance commitments have been increasing over time, driven by DFIs, and have predominantly been in the form of debt, with a shift from ODA grants to loans*

Notes: DFIs = development finance institutions; MCFs= multilateral climate funds; Other international public = mainly governments, UN bodies, export credit agencies, and projects with uncategorised investors from the data provider. ODA = official development assistance; OOF = other official flows that do not meet ODA criteria, excluding export credits. Other = Private development finance, private-sector instruments, equity instruments. SAS = stand-alone systems, and comprises mainly solar home systems, plus other off-grid projects. Market support includes financing for energy sector policy, planning, capacity building, market building and training, among other activities. For further detail on methodology, see Annex A.

Sources: IEA analysis based on data from IJGlobal (2025), World Bank (2025a), OECD (2025), AidData (2023), GOGLA (2024a), Cleantech Group (2025), BNEF (2025).

Between 2019 and 2023, international public finance actors provided over USD 7.5 billion for electricity access across sub-Saharan Africa, with a 20% growth in the same timeframe (see Figure 1.7). While DFIs have registered the most significant growth, providing USD 1.3 billion in financing to access projects in 2023 alone, finance from MCFs and other international public sources decreased by 10% over the five years analysed. At the same time, DFIs have become increasingly more risk-averse, acting as senior lenders and reducing their financing of stand-alone systems, which in turn negatively affects their ability to mobilise additional private capital into the sector. Official development assistance (ODA) – which by definition has to include a grant-like element – has averaged USD 1 billion per year, representing 70% of financing commitments for energy access by international public financiers between 2019 and 2023. However, there has been a shift in its composition from grants to loans. In 2019, the ratio of grants to loans in ODA flows for electricity access projects was 0.91:1; this had

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fallen by 60% by 2023 to 0.39:1. Financing for policy design support, capacity building for local financial institutions and technical assistance to regulators has been roughly stable at over USD 350 million per year.



Nevertheless, recent financing commitments offer renewed optimism. The **World Bank** and **AfDB's Mission 300** (M300) initiative – with support from partners such as **SEforALL**, **GEAPP** and the **Rockefeller Foundation** – was launched in 2024 with the aim of connecting 300 million people in Africa by 2030. This initiative aims to increase funding for electricity access – a particularly timely ambition in light of several high-profile international development budget cuts from major donors – and has also emphasised the need for a broad range of instruments beyond debt products. For example, a new equity fund has been announced – the **Zafiri Fund** – that will offer patient and concessional equity to energy projects, demonstrating a commitment to take on more risk-taking positions (discussed further in Chapter 2). Existing initiatives by the AfDB, such as the **Sustainable Energy Fund for Africa** (SEFA) and the **Facility for Energy Inclusion** (FEI), are also expected to be further utilised for equity investment in early-stage developers and mini-grid operators, which is not commonly available from international public finance providers.

S P O T L I G H T

## Domestic government financing for electricity access

Domestic public spending is key to accelerating efforts towards universal electricity access in sub-Saharan Africa, particularly for grid networks, rural electrification and creating an attractive regulatory environment for private investment. Despite limited fiscal space and competing priorities for government budgets, public financing for electricity access is gaining momentum, reflecting its growing strategic relevance in national development agendas and fiscal priorities. 70% of African governments have integrated electricity access targets for 2030 into their national development plans. Moreover, momentum for greater electricity access financing is building under M300. As of September 2025, 29 countries published National Energy Compacts that lay out the investment needs to reach universal access.

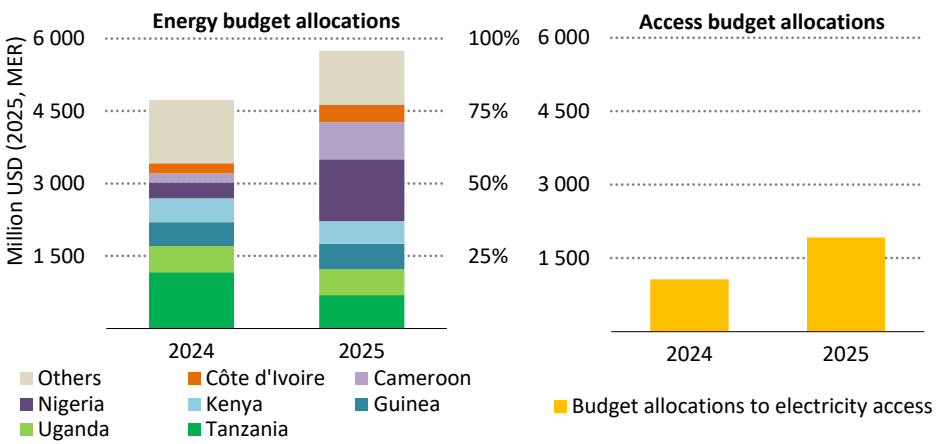
The IEA has analysed the national budgets of 23 African countries and collected data on energy and electricity access budget allocations. This represents earmarked spending, as opposed to disbursements, and includes both domestic public revenues (e.g. taxpayers contributions) and international financial support, making it complex to accurately combine with the tracked finance outlined in this chapter. Budget allocations to energy exceeded USD 4.7 billion in 2024, increasing by 20% to reach USD 5.7 billion in 2025. Of this, USD 1.1 billion was allocated to electricity access in 2024, rising by 80% to USD 1.9 billion in 2025. This represents not only an increase in absolute value, but also as a share of total energy allocations, accounting for 23% in 2024 and 33% in 2025.

The growth in electricity access allocations has been driven by a handful of countries. In 2025, the electricity access budget allocations of seven countries – Côte d'Ivoire,

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Cameroon, Nigeria, Kenya, Guinea, Uganda and Tanzania – accounted for 80% of the total. In many of these countries, financing is allocated to dedicated agencies focused on rural electrification programmes, highlighting their role in last-mile distribution efforts. For instance, Nigeria's Rural Electrification Agency and Tanzania's Rural Energy Agency are central in the countries' efforts to extend electricity to unserved and underserved communities.

**Figure 1.9 ▷ National budget allocations on energy and electricity access in selected countries in sub-Saharan Africa, 2024-2025**




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*National budget support to electricity access reached USD 1.9 billion in 2025, an 80% increase since 2024, driven by growth from Kenya, Nigeria and Cameroon*

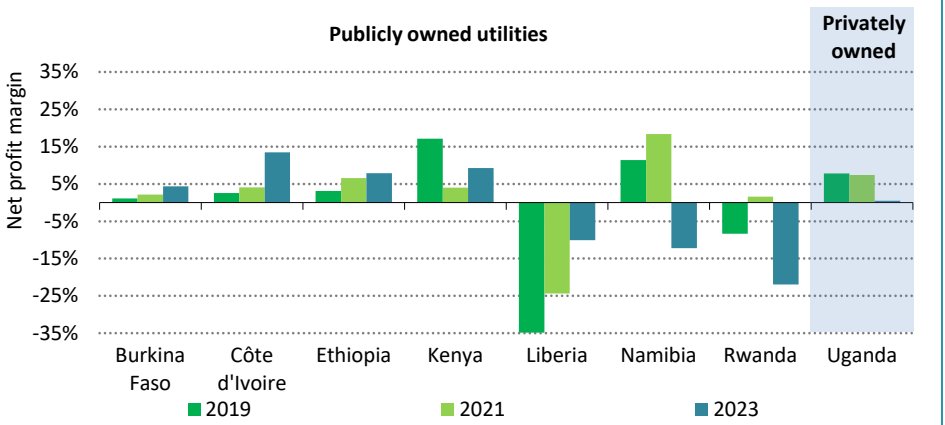
Notes: The analysis covers the following countries: Benin, Burundi, Cameroon, Central African Republic, Chad, Côte d'Ivoire, Eswatini, Gambia, Ghana, Guinea, Kenya, Liberia, Mali, Mauritania, Namibia, Niger, Nigeria, Sierra Leone, Somalia, Tanzania, Togo, Uganda and Zambia.

Government spending on energy is often channelled through public utilities, which have struggled to develop cost-reflective business models while also supporting electricity access goals. This has primarily been due to the combination of low consumption rates from newly connected customers and low collection rates due to customers' inability to pay. In Nigeria, for example, some distribution companies reported recovering less than 60% of their costs in 2025 (The Guardian Nigeria, 2025). This results in losses for utilities or low profit margins, often below 5% (see Figure 1.9). Governments often absorb public utility deficits through subsidies or guarantees, adding to already high national debt levels, and in extreme cases, triggering debt restructuring. For example, ahead of the IMF restructuring in 2022, Zambia's vertically integrated state-owned utility Zesco held the largest foreign debt of all state-owned enterprises in the country (Sinyangwe, 2022). The growth in public spending from African governments has contributed to rising debt

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servicing costs, which accounted for a median of over 12% of revenues across the region in 2024, more than double the levels of a decade ago (IMF, 2024) (IMF, 2019)

**Figure 1.10 ▷ Financial health of electricity utilities in selected countries, 2019-2023**




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*Most of the public utilities in sub-Saharan Africa register net profit margins below 5% due to difficulties with cost recovery and low collection rates*

Notes: The utilities included in the analysis are vertically integrated unless stated otherwise. Kenya refers to the generation utility, Kenya Electricity Generation Company; Ethiopia refers to the Ethiopian Electric Utility; Uganda refers to the private distribution company Umeme.

Source: IEA analysis based on World Bank (2025b).

However, utilities remain necessary participants in delivering electricity access due to their role managing grid networks and their ability to use their diverse customer base – including commercial and industrial users – to cross-subsidise tariffs for poorer households. One option to improve the financial health of utilities and reduce the burden on government debt levels is via the creation of privately operated utilities and distribution companies. These are not widely present on the African continent today and, where they exist, they are often involved in more commercially viable areas, which can skew any comparison against state-owned utilities. However, experience from other regions indicates that private involvement in the sector can support stronger financial performance.

## 1.5 Financing access: Overview by instrument

Effective, affordable and sustainable electricity access requires the right finance at the right time. Companies and developers need to be able to access a range of different financing

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instruments, which can broadly be categorised into (a) corporate debt and equity (i.e. capital raised by companies backed by their overall balance sheet) and (b) project debt and equity (i.e. capital raised for a single project, based on that project's cashflow). The importance of these different finance types varies by technology. For example, grid networks in sub-Saharan Africa are funded almost exclusively via corporate debt based on utility balance sheets, while on-grid generation projects have seen an increase in project finance as a means to attract more private investment (IEA, 2025b). Meanwhile, decentralised solutions have not had equal access to corporate and project finance. Mini-grid developers have found it more challenging to raise corporate finance due to risk perceptions around their business model. This forces developers to over-rely on project finance, which can stymie company growth by making it more challenging to scale up to new sites and raising the potential of working capital shortages.

Alongside the question of whether capital is raised at the corporate or project level, sector development requires equal access to both debt and equity instruments. Equity is particularly important in the early stages of company or project development, where flexibility and risk tolerance are essential. Equity investors are willing to absorb higher levels of uncertainty and focus on long-term value creation, with expectations of high returns linked to growth potential. Debt, given the lower risk exposure and cost, becomes more important as companies and projects seek to scale up and can present predictable revenue streams that can be used to make loan repayments. The different roles of debt and equity also mean that debt providers and equity investors have different concerns when assessing a company or project. Equity investors focus on upside growth and their ability to exit the investment at a profit; debt providers meanwhile are primarily concerned with creditworthiness and downside risk that could impact the long-term revenue flow. Understanding these different perspectives is crucial to designing blended finance solutions that can effectively target the relevant capital providers.

Given that the involvement of the private sector continues to be limited, grants, guarantees and other credit enhancement instruments play critical roles, helping to de-risk early-stage or low-margin projects, improve bankability and crowd-in private capital. Grants – either directly to companies or via technical assistance programmes – can fund capacity building and the pre-development stage or support viability gap funding, while guarantees reduce perceived risks for lenders by covering political, credit or currency-related exposures. Together, these instruments play a catalytic role in expanding access to clean energy, especially where commercial finance alone is insufficient.

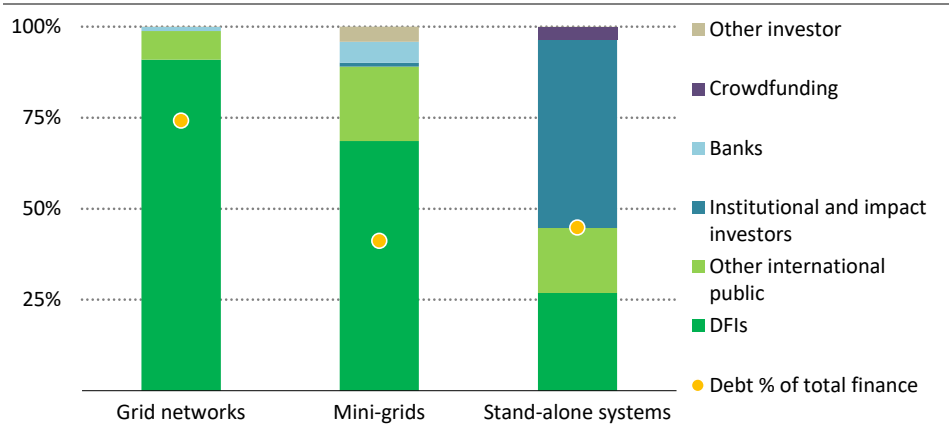
### *1.5.1 Debt*

Debt is central to grid infrastructure financing due to the high upfront capital costs and long payback periods. As a result, debt represented nearly three-quarters of financing commitments for grids made between 2019-2023, totalling USD 2.1 billion. Almost all of this debt has been provided by public actors, particularly DFIs (which alone provided USD 1.9 billion) due to the poor financial health of utilities and regulatory environments that do not

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allow significant private investment in grid infrastructure (see Figure 1.11). For instance, in 2016, the World Bank's **International Development Association** (IDA) committed USD 550 million in debt financing to the **Tanzania Rural Electrification Expansion Program** to scale up grid extension and grid densification, with over 1.5 million connections being achieved in rural areas (World Bank, 2024b). Moreover, the **AfDB** – alongside other partners – has invested UA 128 million (approximately USD 175 million) supporting Kenya's **Last Mile Connectivity Project** (LMCP), with the aim of providing electricity access to 2.5 million people (Kenya Power, n.d.).

**Figure 1.11 ▷ Breakdown of debt financing by provider in sub-Saharan Africa, 2019-2023**




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*DFIs have been the main providers of debt in the grid and mini-grid sector, primarily a function of the larger ticket size of projects and the role of sovereign entities as partners*

Note: Other investor includes philanthropies, corporates and other investors not categorised by the data provider; Institutional and impact investors include impact funds, venture capital, private equity and other institutional investors.

Sources: IEA analysis based on data from IJGlobal (2025), World Bank (2025a), OECD (2025), AidData (2023), GOGLA (2024a), Cleantech Group (2025), BNEF (2025).

Grid projects are well-suited to the financing approach of DFIs: they are large-scale projects developed by a sovereign entity – either the government or the state-owned utility. However, new models to increase the role of the private sector in last-mile distribution grids are also emerging. For instance, a partnership between the **government of Burundi**, **Anzana Electric Group** (a portfolio company of Gridworks) and the **IFC** in 2024 led to the establishment of **Weza Power**, a private sector, national-scale distribution utility in Burundi, which attracted a USD 600 000 grant from the **AfDB** and a USD 3.1 million grant from the **US International Development Finance Corporation** (Gridworks, 2025). The grants are enabling Weza Power to fast-track a two-year pilot project to connect over 40 000 new homes and businesses to the grid in Burundi.

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Compared with grids, decentralised solution financing relies less heavily on debt, but it still accounts for around 45% of total financing. Stand-alone systems companies have been increasingly able to raise debt, reaching USD 260 million in 2023. The majority of debt raised by SHS companies comes from impact investors, with the role of commercial banks still very limited, often deterred by unfamiliarity with the business models and preference to lend to sectors characterised by more predictable or secure cashflows. Efforts to aggregate projects creating larger deals have helped to bring in more commercial banks, although these deals are almost exclusively for larger developers in the sector, with smaller African-owned companies still facing limited debt raising options (see Chapter 2).

On the contrary, only a limited number of mini-grid projects in sub-Saharan Africa have successfully raised debt. Where mini-grid developers were able to raise debt, DFIs were the largest providers, accounting for USD 275 million (or over 65%) of mini-grid debt investment between 2019 and 2023. Given the lower risk appetite of debt providers, debt transactions have focused on well-established companies, in countries with strong policy frameworks, generally through blended finance transactions. In June 2023, **ENGIE** secured a USD 7.5 million senior debt facility from the **Facility for Energy Inclusion**, managed by **Cygnum Capital** and with technical support from **TTA**, to finance the construction of 60 mini-grids in Zambia. The project, which is expected to connect over 40 000 people, builds on earlier support from a EUR 6 million EU grant under the **Increased Access to Electricity and Renewable Energy Production** (IAEREP), part of the **Global Gateway initiative** (PV Magazine, 2023). This series of transactions demonstrates the crucial role donor grants can play to help de-risk projects enough to attract private debt providers.

### *1.5.2 Equity*

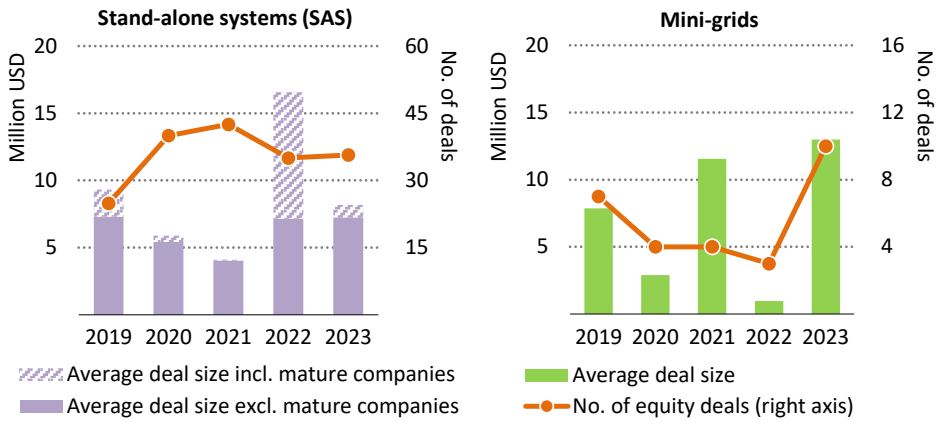
Equity investments in Africa are generally made either by DFIs or via private markets – such as private equity and venture capital investors – given the limited depth of stock markets, which reduces the possibility of equity investments through public capital markets. Much of this investment is made via dedicated funds, including blended finance funds such as the **Emerging Africa & Asia Infrastructure Fund**, or specialised fund managers such as **African Infrastructure Investment Managers**, **ARM-Harith** or **Metier**.

Since the early 2010s, there has been an uptick in private market activity in infrastructure in Africa, with the annual average number of deals rising from 43 in 2012-2015 to 101 in 2020-2023. However, overall deal value declined over the same period, driven by a drop in transactions exceeding USD 500 million and a rise in smaller deals under USD 50 million – 41% of which have been concentrated in the energy sector (AVCA, 2025a). After a peak in dealmaking in 2022, private market activity slowed amid rising interest rates and heightened macroeconomic uncertainty. This made fundraising for equity funds in Africa more challenging, with the total value of fund closures – referring to the moment private market funds reach final close on capital commitments – falling by over 40% from USD 6.8 billion in 2021 to USD 3.9 billion in 2022 (AVCA, 2025b).

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The fundraising slowdown has also been reflected in the off-grid solar sector, with equity investment declining sharply between 2022 and 2024, falling 85% from approximately USD 395 million to USD 63 million (GOGLA, 2025a). This downturn disproportionately affected early-stage companies targeting rural and low-income communities, with start-up capital dropping by 30% over the same period (GOGLA, 2025a). As a result, many early-stage companies and smaller players have been unable to raise equity for initial operations, such as the business plan development or proof of concept, with some being forced to exit the market entirely. Average equity ticket sizes for early and growth stage companies remain modest, at around USD 6.5 million. However, this is often too large a ticket size for African-owned companies, who face even larger challenges in equity raising due to their limited access to international markets. Meanwhile, mature players continue to attract equity, including to help fund consolidation and expand activities to new markets; for example, **Ignite Energy Access** (formerly **Ignite Power**) acquired **Mwezi** and **Pawame** in 2023, **Oolu** in 2024, and recently acquired **ENGIE Energy Access**, strengthening its presence in Kenya, West Africa and Cameroon (ESMAP, 2024) (Ignite Energy Access, 2025). Large equity raising transactions by mature companies – notably **Sun King**'s USD 330 million in 2022 –tend to skew equity investment figures.

**Figure 1.12 ▷ Average equity deal size and number of equity deals, stand-alone systems and mini-grids, 2019-2023**




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***Individual deals by mature companies distort equity trends for both SAS and mini-grids, but average ticket size remains small, averaging USD 6.5 million for early and growth-stage SAS***

Sources: IEA analysis based on data from OECD (2025), GOGLA (2024a), Cleantech Group (2025).

Meanwhile, in the mini-grid sector, the lack of growth-stage equity has proved particularly problematic. While early-stage capital can be sourced from local investors or angel networks and larger private equity funds may target high-value deals, mid-sized equity – essential for

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scaling up – is scarce. As a result of this lack of equity, many mini-grid developers rely on a combination of debt and results-based finance (RBF) facilities to transition from pilot projects to scalable operations (see Section 1.5.3). However, these instruments are not well adapted to this stage of development, introducing complexity and delays that hinder company operations.

Despite these challenges, there have been some notable recent equity issuances, including **Husk Power System**'s USD 43 million series D equity raising in 2023 (Husk Power, 2023) – the largest mini-grid equity issuance to date – and **Nuru Energy**'s series B USD 40 million deal in the same year to scale its metro-grid project in DRC (GEAPP, 2023). However, these individual deals distort overall trends. The average mini-grid equity deal size remains modest, at around USD 7 million, and the number of equity deals remains limited, with an average of less than six transactions per year between 2019 and 2023. While impact investors and specialised infrastructure funds are beginning to play a larger role, DFIs, such as **Norfund**, and public sector-backed platforms, such as the **Renewable Energy Performance Platform** (REPP) and **InfraCo Africa**, can also act as key equity providers given the long timeframe often associated with recovering investors' initial investments and the sector's history of low profitability.

### *1.5.3 Risk-mitigation instruments*

Equity and debt alone remain insufficient to meet the capital needs of last-mile energy access, particularly in remote and underserved markets. Risk mitigation instruments, such as grants and guarantees or first-loss facilities, are essential to unlock investment at the base of the pyramid. Such instruments, which are often provided as part of a blended finance structure, improve project bankability and reduce exposure to early-stage or market risks (see Table 1.1). However, most blended finance deals in the off-grid solar sector, for instance, remain small and bespoke, with a median commercial-to-concessional ratio of just 1.9:1 across 51 recent transactions, a modest leverage when compared to the significantly higher ratios achievable. For instance, **Nithio**'s **Facility for Adaptation, Inclusion, and Resilience** (FAIR) was characterised by a notable 7:1 leverage. The untapped potential of blended finance instruments in the off-grid solar sector is due to the modest returns and scarce involvement of private investors in blended finance deals – which provide on average less than 40% of commercial capital in such transactions (GOGLA, 2025b). Scaling up these instruments will require greater commitment from public providers, standardisation, stronger public-private co-ordination, and targeted deployment in markets where commercial capital alone cannot deliver universal access (see Chapter 3).

#### *Guarantees and risk insurance*

Guarantees and insurance transfer risk from the project developer to an external third party, increasing the affordability and availability of financing in the market. Guarantees provide a financial backstop in case of project default, non-performance, non-payment or other breaches of contractual obligations, thus reducing financial risk for investors and lenders. Guarantees have also been used to enhance the credit standing of small-scale energy

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projects to facilitate aggregation and securitisation (see Chapter 2 for more detail). Risk insurance products complement guarantees by protecting against unexpected losses stemming from political, macroeconomic or climate shocks.



### *Grants*

RBF has become a widely used instrument to unlock private investment in decentralised solutions, particularly for companies operating in more challenging, and thus underserved, environments. Under RBF frameworks, disbursements from public funders are contingent upon the independent verification of the achievement of predefined outputs. RBF can be structured as a supply-side subsidy to offset the high upfront costs and operational risks associated with market expansion, or as an end-user subsidy to improve affordability for low-income consumers and stimulate demand. Initial RBF schemes in the off-grid sector largely targeted small-scale solar kits, such as multi-light systems, but are now more common in higher-capacity SHS and mini-grids. RBF instruments have been a key part of financing in markets that have seen rapid growth. For example, in Nigeria, between 2018 and 2022, RBF helped scale up the SHS sector, with SHS and multi-light system sales growing at a compound annual rate of 75% during the period, adding 1.5 million units (GOGLA, 2024b).

However, the RBF approach is not without its challenges and limitations. Most RBF schemes disburse funds only after results are verified, limiting their effectiveness in addressing the lack of upfront capital that developers face – particularly in capital-intensive mini-grid projects (CCA, 2022). Additionally, companies have reported delays in the disbursement process of up to a year, which risks causing capital shortages and poses an additional challenge to firms' financial planning. In order to tackle these challenges, new models of RBF are being developed. They include hybrid RBFs that disburse funds at earlier project stages based on the achievement of predetermined outputs, such as in the **Mwinda** programme in DRC. The **Clean Energy and Energy Inclusion for Africa** (CEI Africa) foundation has also addressed this time-lag in RBF disbursements by offering forgivable loans, which are instruments where both the principal and accrued interest are converted into non-repayable grants upon achievement of predefined results, effectively providing liquidity to companies during project implementation and before the RBF is released. Further improvements to RBF programmes could be to ensure that they do not exclude key actors like productive use equipment providers and ensuring that RBF design does not prioritise short-term metrics, such as connection numbers, over long-term sustainability.

### *Technical assistance*

At the pre-development stage, many projects struggle with inadequate feasibility studies, unclear permitting processes, a lack of standardised documentation and insufficient risk mitigation tools. Moreover, project developers often lack the technical expertise and financial resources to structure deals in ways that align with investor expectations around risk mitigation, return expectations and scalability. To overcome these barriers and support a pipeline of bankable projects, concessional capital providers have been providing targeted technical assistance to support capacity building and investor facilitation.

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**Table 1.1 ▷ Notable examples of de-risking support**

| Category | Objective | Examples |
|---|---|---|
| **Guarantees and risk insurance** | Covering the risk of breach of contract | **MIGA**: guarantee to Anzana Electric Group for distribution grid expansion in Burundi |
| | De-risking projects to attract new investor classes | **InfraCredit** and the **Climate Finance Blending Facility**: local currency guarantee to allow Nigerian pension funds to invest in mini-grid developer Darway Coast |
| **Grants** | Supporting early-stage decentralised companies | **Energy Catalyst**: grant funding for projects involving technical and business model innovations in the energy access sector, with funding reaching GBP 160 million for over 300 projects |
| | Supporting off-grid solar companies operating in challenging environments | **Regional Off-Grid Electricity Access Project**: grant funding for stand-alone solar businesses totalling almost USD 270 million to ensure equitable geographical reach |
| | Facilitating the preparation of bankable projects | **Sustainable Energy Fund for Africa (SEFA)**: a multi-donor facility with a cumulative funding of USD 577 million, providing grants and catalytic finance to unlock private sector investment in renewable energy and energy efficiency, including support for feasibility studies and environmental assessments |
| | Providing results-based financing for developers in underserved communities | **Clean Energy and Energy Inclusion for Africa (CEI Africa)**: offers two funding windows, an RBF component and a Smart Outcomes component to support mini-grid development and Productive Use of Renewable Energy (PURE), with a particular focus on women |
| **Technical assistance** | Providing support for financial management and project monitoring | **Green Mini-Grid Electrification Project in Mauritania (RIMDIR)**: EUR 5.6 million from the AfDB's SEFA, World Bank and AFD for assistance in financial management and project monitoring for the electrification of 58 localities in Mauritania |
| | Offering tailored support to businesses seeking grant funding | **Transforming Energy Access Technical Assistance Facility**: a programme funded by the UK Foreign, Commonwealth and Development Office offering support for business model design, KPI development and proposal drafting |
| | Providing business development support to build investment readiness | **GET.invest Finance Readiness Support:** provides business development advice and coaching for local, earlier stage companies to access finance |
| | Supporting policy regulation and standards for governments | **GET.transform Pro Mini Grids**: supports the development of regulatory frameworks and technical standards for mini-grid electrification in Uganda |
| | Creating a needs-based ecosystem for electricity access | **EnDev**: capacity building for businesses, regulatory support for governments, and building of demand for modern energy services |
| | Providing targeted support to governments to advance power sector reforms | **Africa Energy Sector Technical Assistance Program (AESTAP)**: an AfDB-led initiative focusing on strengthening regulatory frameworks, improving utility performance, and creating enabling conditions for private sector participation in energy infrastructure |

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# Pathway to universal access

## Mobilising the necessary investment


### SUMMARY

- Under the new **Accelerating Clean Cooking and Electricity Services Scenario (ACCESS)**, investment of nearly USD 150 billion is needed to achieve universal electricity access in sub-Saharan Africa by 2035. This represents a six-fold increase in annual spending from today's levels, facilitated by improvements to the regulatory environment, strengthened risk management by developers and risk-mitigation tools to support more private investment, and a more targeted use of concessional funds.
- Around 45% of households currently without access are connected via the grid under the ACCESS, with financial support for households to reduce connection fees and increased community engagement to improve take-up rates once the grid arrives. However, decentralised solutions remain essential, especially for rural areas. Integrated energy planning and improved tendering approaches can help design impactful interventions, streamline processes, and thus unlock further capital.
- Private finance accounts for roughly 45% of spending under the ACCESS, making up over half of spending in decentralised solutions but a slightly lower share in grids. The private sector already plays a key role in solar home systems (SHS) but faces obstacles in other sectors: many countries do not allow private investment in grids, and mini-grid regulations are often unclear on areas such as tariff design. Improving project bankability, including by raising demand for electricity, and tapping into domestic capital markets, can unlock further private capital.
- Concessional finance is essential for derisking private investment and directing capital to underserved markets. Universal access by 2035 will require USD 6.2 billion per year, a significant jump from an average of USD 1 billion per year in 2019-2023. The World Bank and African Development Bank's Mission 300 – with the target of electrifying 300 million people by 2030 – can help drive up concessional funding levels, which have otherwise been relatively static.
- The limited supply of equity remains one of the biggest obstacles to scaling electricity access spending. Without equity, companies are forced to find less well-adapted financing solutions, relying on results-based finance or debt financing. This inhibits the creation of a pipeline of bankable projects and prevents companies from being able to scale up. Increasing patient equity, primarily from concessional finance providers, will be crucial.
- To support the private financing of decentralised solutions, new solutions are emerging in recent years and include off-balance sheet financing via securitisation, the development of energy-as-a-service models for households with low incomes, the use of green bonds for mini-grids and crowdfunding.


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## 2.1 Introduction

As discussed in Chapter 1, financing for electricity access in sub-Saharan Africa has remained relatively static in recent years, falling well below the levels necessary to achieve universal access. A step change in electricity access financing is required, calling for a significant increase in both public and private capital and an evolution of the financial instruments used. This chapter looks in more detail at the investment needs to reach universal access, breaking down the role of grid and off-grid solutions, and the financing challenges for each technology. It also discusses how financing evolves to meet investment needs, for example how private sector involvement can be incentivised. The chapter ends by outlining innovative financing instruments that have shown promise to attract investment to decentralised solutions.

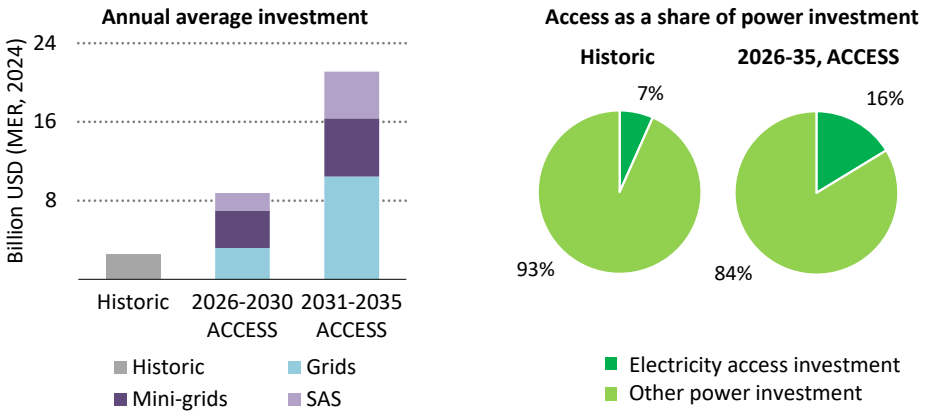
## 2.2 Investment need for universal access

Achieving universal access to electricity in Africa requires nearly USD 150 billion under the IEA's new **Accelerating Clean Cooking and Electricity Services Scenario (ACCESS)**, where universal access is reached in 2035. This new scenario charts a pathway to achieve universal access to energy based on the best rates of progress achieved historically. The scenario is grounded in practical constraints and solutions, prioritising cost-effective and proven means to replicate past successes. Grids remain the most affordable option to connect roughly 45% of the households without access, including in urban areas where densification programmes can improve network coverage. The rest of the population without access is connected via mini-grids or solar home systems (SHS), which provide the most cost-effective solutions in areas further from existing grid networks.

Under the ACCESS, total spending in electricity access roughly triples in the next five years, with a further tripling between 2031 to 2035. This spending covers the necessary capital expenditure, including the cost of installing grid or mini-grid lines and the equipment costs for decentralised solutions, including distribution. Grids account for roughly USD 3 billion per year in spending between now and 2030, rising to USD 10 billion per year from 2030 to 2035 as grid expansion projects gain pace. Decentralised solutions see some of the largest spending increases, with annual spending growing nearly five-fold over the next decade. By 2035, investment in mini-grids is roughly 6 billion per year and USD 5 billion per year in SHS. Under this scenario, access spending accounts for 16% of total power spending and 10% of total energy investment in sub-Saharan Africa, compared to 7% and 2% today, respectively.

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**Figure 2.1 ▷ Investment need in ACCESS by technology, sub-Saharan Africa, 2019-2035**




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*Achieving universal electricity access in Africa requires nearly USD 150 billion between now and 2035, accounting for 16% of all power sector spending in Africa*

Note: SAS = Stand-alone systems

**Box 2.1 ▷ Operation and maintenance costs**

While much attention is paid to capital expenditure (CAPEX) in rural electrification programmes, operational expenditure (OPEX) remains a critical yet under-addressed component. Rural energy systems, particularly mini-grids, are often designed and tendered with an emphasis on initial service delivery without clear provisions for long-term sustainability. This is further highlighted by the benchmarking system that is often used by developers and operators, which is based on capital cost per connection instead of a more comprehensive metric such as levelised cost of energy (USD/kWh) or levelised cost of access (USD/month, see Chapter 3 for further information).

Under-addressing OPEX costs can create a major gap in programme effectiveness, with maintenance, management and customer engagement all presenting a potential financial burden for the operator or the local stakeholder. In quantitative terms, OPEX can account for up to 35% of the cost of electricity in solar-hybrid mini-grids, spiking to up to 80% in diesel-based mini-grids (MGF, 2024). Operation and maintenance alone comprise an estimated 13% of total ongoing costs (PowerForAll, 2019), although personnel costs dominate OPEX at 37%, followed by logistics and component replacements (SEforAll, 2024).

Digitalisation offers a promising pathway to reduce OPEX and improve system reliability. Remote monitoring, smart metering and predictive maintenance tools can facilitate efficient management, especially in the most remote places, cutting operation and

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maintenance costs for electricity access projects by up to 15%, especially by reducing site visits and extending equipment lifespans (MGP, 2024) (Pittalis, Sancho, Szabó, Lazopolou, & Moner-Girona, 2023). However, the lack of internet connectivity in remote areas could remain a barrier to deploying digital solutions at scale. Alongside installation, planning for long-term operations, investing in digital infrastructure and designing policies that reward continued performance are crucial for the sustainability of off-grid systems over time.

Increased community engagement has also been shown to play a key role in reducing OPEX and improving maintenance practices, while also creating jobs locally (Eales, 2024). Numerous initiatives focused on training community members in the maintenance of decentralised energy solutions have reported notable improvements in the longevity of products. For example, the Rocky Mountain Institute's Africa Energy Program supports the development of community-led mini-grids through community engagement and a community-centred design process (RMI, 2019). Various organisations, such as Solar Sister, also focus on training local communities to work in electricity access-related jobs: Solar Sister has trained over 12 000 female entrepreneurs in the past decade, and recently launched a new programme to encourage female students to pursue careers in science, technology, engineering and mathematics (ThisDay Live, 2025).

### 2.2.1 Grids

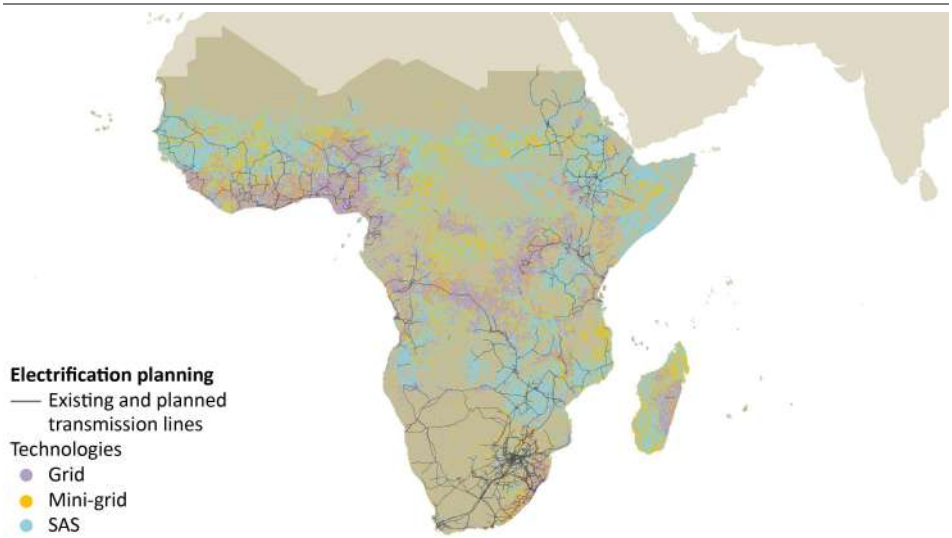
Investing in power grid infrastructure, including power generation as well as transmission and distribution, is essential to ensure reliable, secure and affordable electricity, particularly in densely populated areas located near existing transmission networks (see Figure 2.2). Although investment in grid networks in Africa has been relatively static in recent years (IEA, 2025a), grid extension remains a cornerstone of electricity access strategies, system reliability objectives and the development plans laid out by both African governments and regional bodies such as the African Union. The vision of an interconnected continental system under the **African Continental Master Plan** aims to increase reliability, reduce costs, and allow for the further integration of decentralised solutions. This integrated approach is seen as pivotal to achieving universal access, underpinned by higher consumption levels, improvements in affordability and greater community engagement.

One of the major challenges hindering grid network investment focused on providing access to new connections has been that consumption levels rarely provide returns that render the investment profitable. Energy planning and modelling efforts often rely on projections of rising future energy demand, driven by expectations of local economic development, increases in household income and policy for energy demand stimulation. These assumptions typically underpin national electrification strategies and infrastructure investment. However, historical data and evidence suggest that forecasted growth in energy consumption does not always take place as expected. Instead, household consumption can remain stagnant or even decline over time. For example, Rwanda experienced rapid growth

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in its electricity access rate, from 6% in 2009 to 54% in 2023. Data showed that in the 10-year period after grid arrival, 51% of households in the village in question were connected to the grid, but electricity consumption remained constant and low, at around 8.1 kWh per month, or the equivalent of around one-fifth of the IEA essential bundle (IGC, 2024a). This trend can be attributed to a range of factors, such as limited affordability, underutilisation of appliances, unreliable service quality, or lack of maintenance of electrical infrastructure. In some cases, households revert to traditional energy sources due to inconsistent grid supply or the inability to sustain electricity-related expenses.

**Figure 2.2** ▷ **Least-cost electrification planning for universal access, sub-Saharan Africa**




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*While the national grid remains a cornerstone of energy access strategies, alone it cannot achieve universal access – SAS and mini-grids will play an increasingly important role*

Note: IEA and KTH Royal Institute of Technology analysis based on the OnSSET model developed by KTH Royal Institute of Technology. SAS = Stand-alone system

Source: IEA analysis based on Absolute Wealth Index ONSSET results KTH (2025).

Integrated energy planning and a holistic cross-sectoral assessment of energy demand and supply are essential to underpin decision making for electricity solutions. This is particularly critical for capital-intensive investment like new grid lines, which may struggle to recoup costs without demand stimulation. Different programmes and measures can be used to stimulate demand, such as e-cooking and so-called productive uses of energy (PUE), referring to projects that use energy to generate income or improve economic productivity. Under the ACCESS, e-cooking demand in 2040 increases fivefold, reaching 65 TWh per year, around 12% of current total electricity demand in sub-Saharan Africa (IEA, 2025b). This can be built into

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grid network planning, as seen in Kenya, where in the third phase of the **Last Mile Electricity Connectivity Project**, clean cooking and demand stimulation for e-cooking are strategic focuses to advance policies and attract further investment.

Rapid scale-up of grid investment in the ACCESS follows improved context-specific planning and local information. Countries have experimented with more localised approaches to foster community involvement, aiming to build trust and promote a sense of ownership. One of the most successful examples is Ghana's **Self-Help Electrification Programme** (SHEP), which places a strong emphasis on community engagement. Under SHEP, the prioritisation of communities for grid extension was based on specific criteria: communities had to be within 20 km of the existing national grid and capable of connecting at least one-third of their population. A key feature of the programme was its focus on communities that demonstrated readiness and capacity to take responsibility for certain aspects of the infrastructure – particularly the installation of low-voltage distribution lines and the erection of distribution poles. Despite the complexity of the process, SHEP proved highly effective. Between 1990 and 2004, over 3 000 communities were electrified, with around 60% participating through the SHEP model. Finding options to recreate this level of community engagement in other countries' electrification plans can not only help speed up extension plans, but also increase consumption levels once the grid arrives.

Affordability of grid access remains a significant challenge due to the often-overlooked costs of installing and maintaining low-voltage distribution lines, especially in last-mile electrification, and the high cost of internal household wiring. Household wiring plays a crucial role in enabling the use of higher-voltage devices and supporting increased levels of energy consumption, especially for commercial activities. Even when grid infrastructure is deployed, the absence of commercial activity or other anchor loads in some areas means that cost burdens are not shared widely, often leading to a low proportion of household connections (IGC, 2024b). Reaching universal access requires an increase in targeted interventions to tackle high connection fees and electricity tariffs, such as via subsidies or microfinance programmes for internal wiring, as well as capitalising on technological advancements such as the distribution of ready boards (pre-wired distribution panels that remove the need for a property to be fully wired) in electrification programmes. These ensure that grid investment can remain as cost-effective as possible, while continuing to offer a viable service to new connections.

### *2.2.2 Decentralised solutions*

The majority of households without access to electricity today live either in communities that are more than 30 km from the grid, with distances exceeding 100 km, or in rural areas with low population density. Decentralised solutions are best suited to these environments, with around 55% of the population gaining access by 2035 in the ACCESS doing so via decentralised solutions. While historically these solutions were seen as separate from national grid extension planning, many African governments now include decentralised systems as key element of universal electricity access planning, such as Burkina Faso,

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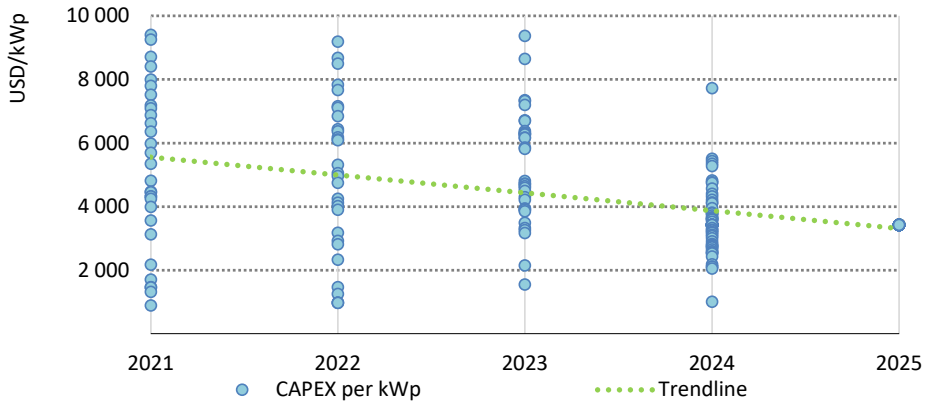
Ethiopia, Ghana, Madagascar and Mauritania (AMP, 2024). With governments proving more open to decentralised solutions, multiple design evolutions have taken place. In particular, mini-grids are now often designed with grid-readiness in mind, and in some urban and peri-urban areas are already being used in conjunction with national grids to support "grid densification" programmes, as seen in the interconnected mini-grid project in Nigeria funded and supported by **Global Energy Alliance for People and Planet** (GEAPP) and **RMI** (RMI & GEAPP, 2025). Under the ACCESS, decentralised solutions are integrated with grid networks where necessary to support a more rapid, flexible and reliable electricity provision, mirroring the shift in regions like Europe, where energy systems are moving from centralised to decentralised models to enhance resilience, sustainability and consumer empowerment.

Attracting capital to meet the high initial investment needs of decentralised solutions is one of the main obstacles to their rapid scale-up. In some cases, over 75% of total CAPEX in mini-grid projects can be attributed to land acquisition and generation assets – such as PV modules, batteries, inverters and other electromechanical components. Distribution infrastructure, including end-user meters and customer connections, accounts for around 20%, while the remaining 5% covers general management, insurance and other overheads (SEforAll, 2024). These proportions may shift significantly over the coming years, as the cost of generation equipment – especially PV modules, batteries and inverters – continues to decline, whereas cable prices have surged by approximately 50% according to the latest IEA estimates (IEA, 2025a).

Over the past five years, the capital cost of new mini-grid systems per kWp has dropped by approximately 35%, largely driven by declining costs of PV panels and batteries; there has also been a reduction in the variation of costs, implying standardisation within the industry (see Figure 2.3). The reduction in battery costs has been significantly accelerated by the automotive sector strongly investing in lithium-ion technology, which has created a favourable landscape for its adoption in off-grid applications. In 2017, only 15% of the mini-grids surveyed employed lithium-ion batteries; by 2024, that figure had surged to above 90% (MGF, 2024). Counter to these trends, cable prices have surged by approximately 55% in recent years, although cabling accounts for a smaller share of mini-grid CAPEX. These overall capital cost reductions bode well for future investment in mini-grids, particularly as electrification expands to cover harder-to-reach communities where logistics and transport costs are likely to be higher.

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**Figure 2.33** ▷ **Capital cost per kWp of different mini-grids in Africa, 2021-2025**




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*Over the past five years, CAPEX on mini-grid systems has dropped by around 35%, largely driven by the declining cost of PV panels and batteries*

Source: IEA analysis based on MGF (2024).

Despite these cost improvements, increasing mini-grid investment will also rely on the ability of developers to demonstrate bankability and scalability. Low energy demand and difficult regulatory environments remain some of the main challenges to making mini-grids both affordable and bankable. The average energy demand from household mini-grid consumers remains roughly 9 kWh per month (close to the basic bundle), apart from certain exceptions such as **Husk Power**, which states an average demand per connection of 40 kWh per month. Commercial activities at least double the consumption per connection. Demand stimulation therefore serves the dual benefit of not only helping households to improve their socio-economic conditions, but also improving the commercial viability of mini-grids.

Regulatory developments can support this, as seen in Zambia and Nigeria, where governments supported portfolio approaches and longer licences, allowing for aggregated multi mini-grid sites to attract private investment. Aggregation and standardisation play a crucial role not only from a financial perspective, but also from a technical one. On a broader scale, there is a pressing need to define and enforce technical and performance standards to guarantee the quality of components and solutions, as has occurred in other power sectors such as utility-scale solar and grid infrastructure. Standardisation is critical to reducing both perceived and actual investment risks, enabling financiers to assess mini-grid assets with greater confidence through harmonised benchmarks and indicators, while ensuring quality assurance across system components, minimising operational costs and extending asset lifespans. The introduction of containerised solutions (compact and plug-and-play solutions,

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often integrated into a shipping container) and other standardised designs to meet different energy demand classes could help reduce extra costs and increase replicability and scalability.



The benefits of tendering large mini-grid portfolios and standardised designs were visible in the **Nigeria Electrification Project** Performance-Based Grant programme funded by the World Bank, under which more than 80 mini-grids have been commissioned and over 1.4 million SHS deployed (World Bank, 2025a). Equally, through the **Increased Access to Electricity and Renewable Energy Production** initiative, Zambia has a goal to connect more than 70 000 people through 71 solar mini-grids and 5.7 MW of installed power (ARE, 2024), financed with the support of USD 23 million of EU funds and USD 7.5 million from the **Facility for Energy Inclusion** (The Electricity Hub, 2021). Another example can be found in Madagascar, where **CrossBoundary Access** and **ANKA** announced a USD 20 million mini-grid portfolio to connect 62 000 people by 2026 (CrossBoundary Group, 2025a).

In more remote areas with low energy demand, SHS are the cost-optimal option to deliver energy to households, commercial activities and institutions. As integrated solutions, SHS can provide a rapidly deployable, reliable and safe connection. They are easy for households to install and do not involve the same technical complexities as mini-grids or the national grid, such as voltage or current fluctuations. However, unlike mini-grids, SHS do not allow households to easily move up the electricity ladder without purchasing new add-on appliances or systems, or integrating different standalone systems; SHS also tend to have shorter lifetimes, requiring replacements after 5-10 years. Despite this, governments and international organisations are increasingly incorporating SHS into their electrification planning, such as the prioritisation of distributed energy solutions under **Mission 300**. Another example can be found in the government-led **Kenya Off-Grid Solar Access Project** (KOSAP). The programme has raised a total of USD 150 million, of which USD 77 million was secured from the World Bank, to deliver 250 000 stand-alone SHS, 120 mini-grids and 65 000 clean cooking solutions to households (African Energy, 2025) (World Bank, 2025b).

### *2.2.3 Integrated planning and hybrid solutions*

Reaching universal access within a reasonable timeline requires not only the scaling up of capital but also its most efficient deployment. One means to ensure this is by promoting hybrid solutions tailored to local contexts, which are less focused on single technologies. By providing greater autonomy to local operators, developers can choose the most suitable technologies – not just from an economic standpoint, but also considering specific environmental, operational and social needs (Colombo, Crevani, Mereu, & Stevanato, 2024).

The ACCESS sees greater use of integrated energy planning and participatory approaches that allow for the development of these hybrid solutions. This helps ensure a focus on energy service – i.e. the duration, availability, reliability and affordability of the service – rather than purely the number of people connected. One such innovation that is gaining traction is mesh grids, where multiple decentralised solutions, such as SHS, are interconnected to share

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energy with nearby homes through low-voltage connections, in some cases reducing infrastructure costs (CrossBoundary Group, 2025b). By enabling scalability and future expansion, they can significantly reduce upfront capital investment during a project's initial phase while guaranteeing future flexibility and extendibility.

The adoption of integrated policies that include both on-grid and decentralised energy can also help improve project bankability by allowing developers to propose the most viable solution for areas where they are operational (Energy for Growth Hub, 2024). Under this approach, tenders to the private sector do not have a predefined technology for each area; instead, they define minimum service standards, allowing developers to deploy the most efficient mix of grid, mini-grid and SHS solutions. Service territories for developers and utilities can be designed to include a mix of areas with existing commercial activities or that have been including in national development programmes for economic development, alongside more rural areas to enable cross-subsidisation, making underserved areas more attractive for private investment. Subsidies can also be redesigned from upfront capital support for new connections – which tend to be targeted to a specific technology – to volumetric subsidies (USD/kWh) that focus on reliable service regardless of solution used to provide electricity.

S P O T L I G H T

## Digitalisation's role in supporting electricity access investment

Digital technologies, including digital payment solutions, are being applied across planning, operations and customer management to support first-time electricity access (see Table 2.1). Smart meters have proved essential to mini-grid, stand-alone system and grid-connected customers alike, while also providing policy makers and developers with key information on customer behaviour. Meanwhile, the development of pay-as-you-go (PAYG) financing models has been instrumental in the rollout of SHS. Data can be gathered to support advanced planning, using tools such as geographic information system (GIS) analysis, artificial intelligence (AI) predictive and generative processing, drone imaging and demand forecasting. These applications are relevant across both public electrification programmes and private-sector decentralised solutions development (IEA PVPS, 2025). International initiatives such as the IEA's **3DEN Initiative** are supporting countries in applying these tools to improve electricity access planning, delivery and monitoring.

**Table 2.1** ▷ **Notable examples of digital innovations**

| Category | Technology | Developer/agency |
|---|---|---|
| **Planning, deployment and access to finance** | Progress monitoring platform for SHS and mini-grids | **GET.invest, Prospect:** open-source data platform that aggregates, verifies and visualises different sources of energy data |

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| | | |
|---|---|---|
| | Energy supply-demand analysis through GIS datasets | **Energy Access Explorer (several countries):** Supports decision makers in energy planning |
| | Platform for RBF programme management and productive use financing | **Odyssey for RBF (Benin):** Facilitates funding access for solar businesses, improves programme transparency |
| **Customer accessibility and affordability** | "Request to pay" feature with client app for mobile-enabled transactions | **Upya Technologies (across Africa):** Streamlines payments, boosts customer engagement, supports financial inclusion |
| | Smart metering and consumer app for real-time tracking and billing | **E-Energietec (Niger):** Empowers consumers with usage data, improves billing transparency and efficiency |
| **Operations and system management** | Integration of SHS into a mini-grid for two-way energy trading | **Zonke Energy (across sub-Saharan Africa):** Enhances energy efficiency, allows prosumers to trade energy, fosters grid resilience |
| | Remote monitoring of power systems in health centres with smart meters | **Access to Energy Institute, Odyssey, Green People's Energy (Benin):** Improves reliability of energy in healthcare, enables real-time performance tracking |

### *Planning, deployment and access to finance*

Digital tools are supporting more targeted and efficient planning of electricity access programmes, contributing to efforts aimed at addressing last-mile electrification challenges. In Kenya, geospatial modelling was used between 2022 and 2024 to combine electricity infrastructure data with population density and flood risk layers for Narok County. The resulting County Energy Plan identified 75 healthcare facilities and 265 schools for connection through grid extension or mini-grids. The plan guided KES 2.5 billion (USD 19 million) of investment for more than 15 000 new household connections (WRI, 2025). As evidenced, the data available from digital planning tools can also improve access to finance by helping providers more adequately assess project bankability.

### *Customer accessibility and affordability*

Digital platforms have simplified customer management, reducing costs for developers and ensuring a more reliable service. They can also help with customer financing, via AI-enabled credit scoring and mobile loan systems that increase the accessibility of finance to customers who may struggle to secure traditional bank loans due to lack of collateral or credit history. In Togo, 20 000 prepaid smart meters were deployed in Lomé and at public institutions between 2022 and 2023. The meters enabled online credit purchases and remote management. The programme benefited around 80 000 people, while reducing operating costs and improving billing efficiency (World Bank, 2024). Private-sector operators are also using digital platforms to deliver electricity access. In Nigeria, **Husk Power Systems** integrated smart metering, app-based billing and AI-based demand

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forecasting, providing electricity at costs 25% lower than diesel alternatives (Husk Power, 2025). These tools increase accessibility, support consumer affordability, and enable decentralised investment models critical for expanding energy access in underserved regions.

*Operations and system management*

Digital solutions can also improve project evaluation, reduce system inefficiencies and support continuous learning, leading to smarter energy planning and reduced operational costs. Smart meters enable real-time verification of energy delivery and consumption, hence speeding up disbursement from results-based financing (RBF) grants. In Mozambique, 25 mini-grids were integrated into a central control platform between 2023 and 2024. The platform enables remote monitoring, automated switching between generation sources and improved fault detection. The results have been lower operating costs and fewer service disruptions, which are critical in areas with limited maintenance capacity (Odyssey, 2025). Data analytics platforms can also support developers and utilities with demand forecasting, system optimisation and financial planning. These data can strengthen national electrification planning and support tendering processes for private investors, as seen in Nigeria. At a technical solution level, **Vera Sol**'s appliance comparison database supports stakeholders when comparing different certified off-grid solutions, streamlining decision-making processes and ensuring they meet performance and durability standards.

## 2.3 How to scale up finance to achieve universal access

Scaling up investment in electricity access means mobilising a broad range of capital providers and utilising financing instruments that match the needs of developers and projects. As with utility-scale power investments in Africa, the private sector has a key role to play, but due to affordability constraints the public sector and concessional providers are also essential. The choice of financing instrument – broadly between debt, equity, and grant – also has a major impact on the speed at which capital can be mobilised, with poorly adapted capital slowing down the development of a pipeline of bankable projects.

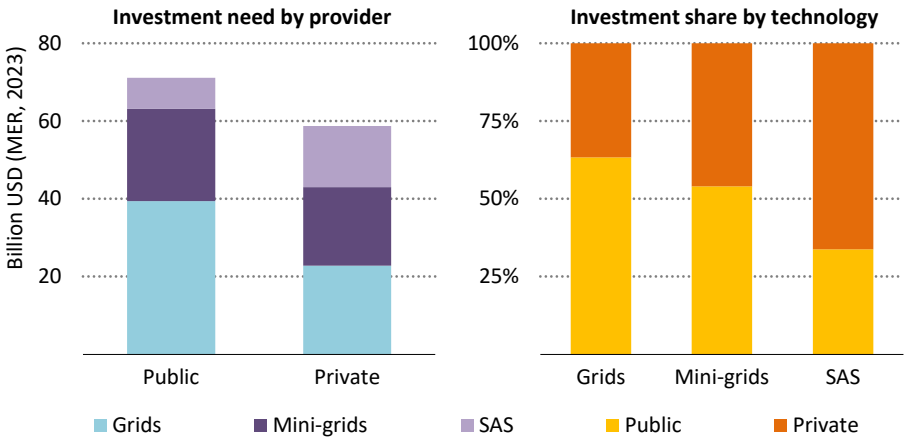
### *2.3.1 Provider*

Reaching universal access by 2035 requires a relatively equal financial commitment from public and private sources, with private finance accounting roughly 45% of spending. Public finance – both from domestic governments and from international providers – is essential, both as a source of direct funding for the hardest-to-reach communities and as concessional capital to unlock private investment. The role of each provider varies significantly across technologies, with the private sector accounting for more than 65% of investment in SHS – where business models have already been proven – to a more moderate 35% in grid

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connections, where regulatory hurdles and exposure to financially struggling utilities can hinder private investment (see Figure 2.4).

**Figure 2.4 ▷ Investment under ACCESS by provider, sub-Saharan Africa, 2025-2035**




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***Private investment accounts for roughly 45% of spending needed to achieve universal access, playing the largest role in SAS and mini-grids***

Notes: SAS = stand-alone systems. Public providers include domestic governments and international public finance providers; private providers include impact investors, commercial banks and corporates. Provider categorisation is based on the final distributor of funds i.e. privately managed funds that are capitalised by international development partners would be categorised as private. A full list of providers by type is outlined in Annex A: Methodology.

Sources: IEA analysis based on OECD (2025), IJGlobal (2025), GOGLA (2024), Cleantech Group (2025), Mission 300 (2025).

Across all technologies the creation of a favourable regulatory environment acts as the basis for future investments, including provision for private investment in grids, clear tariff design and targeted financial incentives. Beyond this, successful mobilisation of capital relies on understanding where private actors can feasibly be deployed in line with their own risk-return expectations and identifying how public finance can mobilise this private investment while also covering less commercial activity. The following actions help scale up the level of private finance to achieve universal access:

- Encourage private investment in distribution grids to support access goals.
- Strengthen mini-grid regulations to support scalability and bankability.
- Design tax incentives to attract private investment in affordable, high-quality SHS.
- Attract productive uses and anchor loads to bring in more private investment.
- Increase the level of concessional finance and target private sector mobilisation.

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### *Encourage private investment in distribution grids to support access goals*

As of 2023, only eight African countries allowed private sector involvement in distribution grids, and only four in transmission networks (IEA, 2023). Private investment in distribution is more common in the region, but does not always target last-mile connections for access given the complex economics of these projects. Multiple countries in the region are introducing reforms to expand the level of private involvement in grids, primarily via either independent transmission projects or concession agreements, and to establish clear frameworks for cost recovery. Electricity access considerations can be included in these reforms, including through the design of proposed concession areas and tariff and subsidy design.

An innovative example of the role the private sector can play in electricity access via distribution grids is **Weza Power** in Burundi. Weza Power is a privately owned and operated electricity distribution company, formed via a partnership between Anzana Electric Group and the government of Burundi. The utility aims to provide electricity to almost 70% of the population over a seven-year period. While there have already been private sector concessions in distribution, this is the first national-scale distribution company established in the region in over a decade. In order to scale up, Weza Power has received nearly USD 1.5 billion in funding pledges from development finance partners, including a grant from the African Development Bank (AfDB) **Sustainable Energy Fund for Africa** (SEFA), loans from the **International Finance Corporation** and the US **Development Finance Corporation**, and a guarantee by the World Bank's **Multilateral Investment Guarantee Agency** (MIGA) (Bloomberg, 2024). Anzana will provide the initial equity investment, itself an investee company of **Gridworks**, a British International Investment subsidiary. Should this model prove successful, it will demonstrate how concessional finance can be used to unlock private capital in grid investments targeting electricity access, while also showing how a government can leverage the private sector to support development goals. The model would also have potential for replication for large mini-grid concessions, including metro-grids that target city-wide electrification.

### *Strengthen mini-grid regulations to support scalability and bankability*

Regulatory barriers have also continued to hold up finance for mini-grids. Average regulatory approval times are roughly 50 weeks for mini-grids, with approvals from distribution companies and tariff approvals generally taking the longest time (AMDA, 2024). There is significant variation between countries, with tariff approval taking between 4 and 39 weeks, depending primarily on the expertise of key individuals within the regulator or utility. Long approval processes pose a major risk to scaling mini-grids, with the World Bank estimating that for 9 000 additional mini-grids an additional 1 500 regulatory approvals would be needed annually (AMDA, 2024). Removing these barriers would act as an impetus to mini-grid investment, reducing delays that could otherwise present an obstacle to bankability.

Beyond the approval process, there are also often regulatory gaps in relation to tariff design – such as ensuring timely adjustments for inflation and exchange rates – and clear guarantees

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or a compensation process for grid encroachment. Numerous countries have clear grid interconnection or compensation approaches enshrined in regulation, such as Nigeria, Tanzania, Uganda, Kenya and Sierra Leone. However, in many other countries mini-grids are not regulated separately, meaning these specifics are missed. In 2025, the **African Forum for Utility Regulators** (AFUR) launched a new mini-grid regulation tool in partnership with **GET.transform** that helps countries to update their mini-grid policies in line with international best practices. AFUR also offers a mini-grid tariff tool to support governments to set financially feasible tariffs for mini-grid calculations. Mainstreaming these tools can help countries create an attractive regulatory environment for private investment into the sector.

Governments can also attract further private investment into mini-grids by designing larger concession areas that contain a variety of different consumption and income levels. The government of the Democratic Republic of Congo (DRC) has launched ambitious plans to tender concessions for a series of metro-grids, which are similar to a mini-grid but much larger in scale and target a pre-designated urban area. The most advanced concession covers three cities in northern DRC with a combined population of over 600 000 people, where access to electricity is estimated at 1% (Gridworks, 2025). The concession has been awarded to **Moyi Power**, a consortium of **Gridworks**, **AEE Power** and **Eranove**. Moyi is currently raising USD 160 million in debt and viability gap funding, with support from **AfDB**, for the initial five-year phase of the project. The DRC government has also launched plans to develop metro-grids for two cities in the Central Kasai region with support from the World Bank's **Scaling Mini-Grid Initiative**. These cities represent the potential for close to 150 MW of installed capacity and 200 000 possible connections (World Bank, 2025c).

### *Design tax incentives to attract private investment in affordable, high-quality SHS*

Governments have also been increasing their focus on the role of SHS in achieving universal access, particularly in areas with lower predicted consumption levels over the medium term. National targets for SHS are now included in electrification plans in many countries, such as Nigeria, Ghana, Kenya, Uganda and Rwanda, with several adopting technology-agnostic planning approaches.

Ensuring the regulatory environment sets clear tax incentives and quality standards for SHS can support investment decisions. Tax exemptions play an important role in keeping the cost of SHS down for end users. Waivers are most commonly granted on import taxes and value added tax (VAT). SHS developers often flag difficulties with the implementation of the import tax waiver on associated appliances – such as solar water pumps, or solar TVs – which are important to support higher consumption levels. VAT exemptions have also become more controversial in some countries; for example, in 2023 Sierra Leone reintroduced a goods and service tax on solar equipment (SEforAll, 2023).

Equally, the low application of quality standards – with only around 27% of all SHS sales being quality-verified – can drive dissatisfaction among customers and reduce uptake (ESMAP, 2024). Various efforts are underway to support the adoption of harmonised standards – for

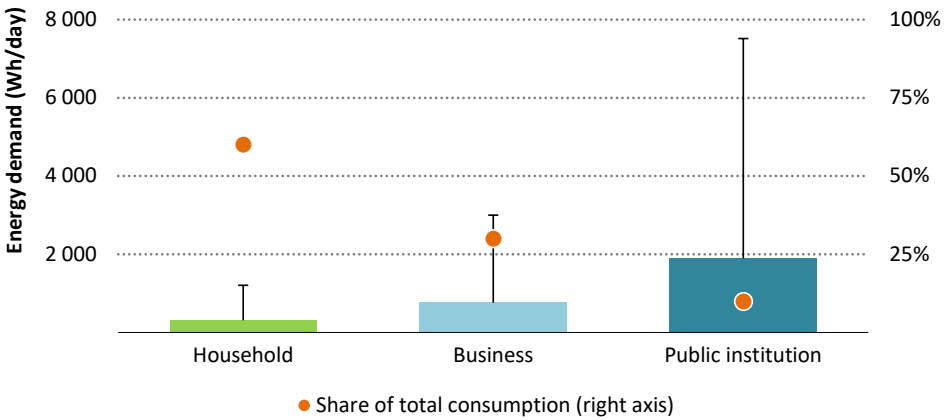
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example under the **VeraSol** quality assurance programme – which could eventually also be linked to fiscal incentives (i.e. only SHS meeting certain standards could benefit from tax or import duty waivers). However, even with standards in place, enforcement has proved to be complex due to administrative capacity constraints. Efforts to strengthen enforcement are crucial as standards have the potential to support positive long-term adoption of SHS, acting as a vital consumer protection tool.

### *Attract productive uses and anchor loads to bring in more private investment*

Off-grid users typically have lower and more fragmented energy consumption than grid users, limiting profitability and often resulting in higher tariffs than the national grid. To ensure off-grid energy projects reach sufficient scale and remain financially sustainable, it is essential to raise demand levels, particularly by engaging productive users and economic activities. This includes PUE either connected to mini-grids or with stand-alone systems such as solar water pumps, solar cold storage and solar inverters for micro- and small enterprises. These users, which can include small to medium-sized businesses from a broad range of sectors, not only drive local development but also serve as critical anchor loads, strengthening system viability. Businesses consume nearly from two to three times more energy per connection than households, while public institutions, such as schools or healthcare centres, could use six times more – yet they represented respectively just 30% and 10% of total consumption between 2020 and 2024 due to limited connections (see Figure 2.5).

**Figure 2.5 ▷ Consumption by mini-grid end-user type, sub-Saharan Africa, 2020-2024**




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***Businesses and public institutions consume significantly more energy per connection, yet they account for just 40% of overall energy demand due to limited connection coverage***

Source: IEA analysis based on data from Mini-Grid Asset database MGF (2024).

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Anchor customers, such as medium-sized and large businesses and public institutions, can therefore play a critical role in stabilising mini-grid revenue and attracting private investment. Their high, consistent energy demand and strong creditworthiness enable long-term contracts, providing reliable income and boosting project bankability. Increasing the coverage of anchor loads to around 30-40% can significantly mitigate the financial risks linked to the volatility of smaller rural users, while also allowing the developer to charge lower tariffs to households and to extend service to poorer households or small enterprises, fuelling broader rural electrification and economic growth (Mbazima & Lemaire, 2025).

Multiple programmes exist to drive increased investment in PUE technologies, often involving local commercial banks or microfinance institutions. As affordability remains a key consideration that can limit broader uptake, integrated energy planning includes programmes that facilitate the purchase of productive-use equipment, aiming to support local commercial activities and stimulate economic growth. For example:

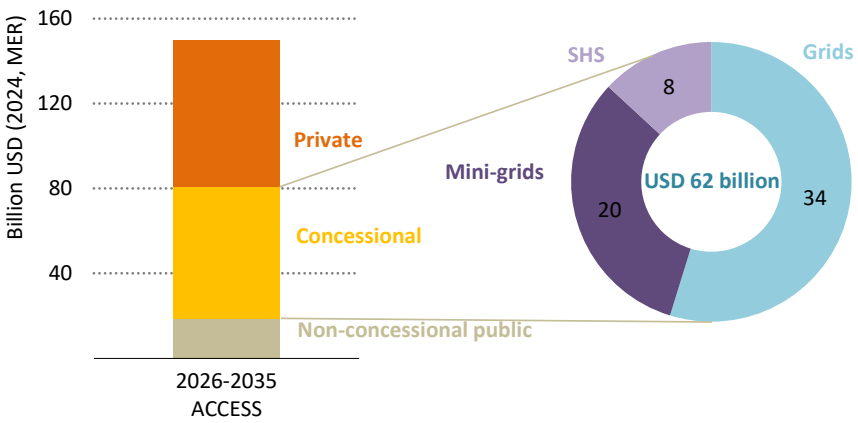
- The **Sustainable Energy for Smallholder Farmers** (SEFFA) programme, active in Ethiopia, Kenya and Uganda from 2021 to 2024, aimed to boost demand for PUE technologies, such as solar-powered irrigation, drying and cooling. It was backed by EUR 8 million in funding from **Energising Development** (EnDev), a multi-donor access partnership. A standout initiative under SEFFA is the partnership between **Faulu MicroFinance Bank** and **GIZ**, who together launched a green finance product targeting 400 smallholder farmers across six Kenyan counties, with a goal of disbursing USD 1 million to support the adoption of PUE technologies. This approach not only strengthens agricultural value chains in dairy and horticulture, but also demonstrates scalable business models for renewable energy in rural economies (WRI, 2024).
- **Clean Energy and Energy Inclusion for Africa** (CEI Africa), originally founded by KfW and later joined by the Swiss Agency for Development and Cooperation (SDC), launched a grant facility – the **Smart Outcomes Fund** (SOF) **Component** – in 2023 to provide outcome-based grants for the productive use of energy. Around 15 developers focusing on sectors such as agro-processing, cold chain, e-cooking and e-mobility have benefited from the facility. This has led to the deployment of around 10 000 productive use technologies, reaching more than 260 000 end users. The SOF Component is now in its third round, after receiving a further commitment from SDC of CHF 4 million (USD 5 million) in July 2025 (CEI Africa, 2025).
- The **Zambia Energy Demand Stimulation Incentive** (ZEDSI) programme was launched in November 2024 as part of the Zambian Presidency's aim to power 1 000 communities with commercially viable decentralised solutions. The programme is led by Sustainable Energy for All (SEforAll) under its **Universal Energy Facility**, with financial support from the Rockefeller Foundation and the Global Energy Alliance for People and Planet (GEAPP) (Universal Energy Facility, 2025). Developers can apply for performance-based funding under ZEDSI to support activities that increase electricity usage among rural microenterprises, such as agro-processing and irrigation businesses, and public facilities, including schools and clinics.

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*Increase the level of concessional finance and target private sector mobilisation*

Concessional finance plays an essential role in de-risking private investment. Historical commitments have fallen below the level needed to achieve universal access and have been geographically concentrated. To reach universal access, a total of USD 62 billion of concessional funding needs to be disbursed (see Figure 2.6). This is a significant jump from today's levels: between 2019 and 2023, volumes of committed concessional capital averaged just over USD 1 billion per year.

**Figure 2.6 ▷ Concessional funding needs in the ACCESS, 2026-35**




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***An estimated USD 6.2 billion in concessional finance is needed per year to achieve universal access in 2035; roughly 45% of this is directed to decentralised solutions.***

There are indications of a renewed commitment to electricity access from concessional funders, notably under the **Mission 300** (M300) programme. The programme was launched in 2024 by the World Bank and AfDB with the aim of connecting 300 million people to electricity by 2030, 250 million of whom would be electrified by World Bank financing and another 50 million by the AfDB. M300 is underpinned by national energy compacts that outline country development plans and investment needs. An initial 12 national compacts were announced with the launch of M300, with a further 17 published in September 2025. Based on the initial compacts, about half of the investment needed to reach universal access will be to support grid connections, while the other half will be directed to decentralised solutions. M300 received initial pledges from development partners of over USD 50 billion at the Africa Energy Summit in January 2025 and announced the creation of several new financing opportunities (World Bank, 2025d). A new catalytic fund, the **Zafiri** Fund, will be launched, and an **M300 Accelerator** was set up with USD 10 million in technical assistance to be deployed across 15 projects in 11 countries (RF Catalytic Capital, 2025). Various new programmes or the scaling-up of existing programmes will contribute to achieving the M300

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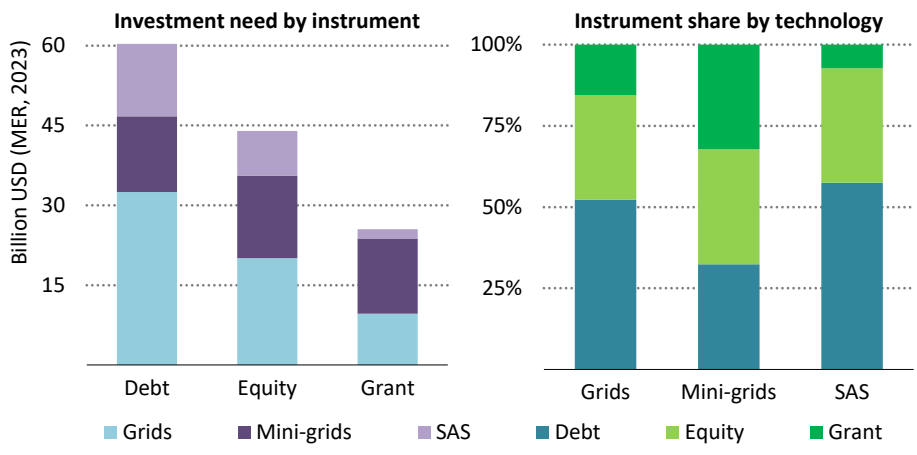
objectives, including the World Bank's **Distributed Access through Renewable Energy Scale-up** (DARES) programme in Nigeria and the **Ethiopia Electrification Program** (ELEAP), as well as AfDB's **SEFA**.

M300 represents an important, co-ordinated effort to increase financial commitments to electricity access. However, it should be remembered that outside M300, a further 300 million people need to be provided with access to electricity. There is a risk that this could include some of the hardest-to-reach communities, where public and concessional finance is essential, requiring further fundraising to achieve universal electricity access.

### 2.3.2 Instrument

To achieve the scaling-up of capital needed to provide universal electricity access, there needs to be a change in the instruments used to finance projects, with a notable increase in equity financing (see Figure 2.6). Based on average financing commitments over the past five years, equity accounted for roughly 20% of commitments to support new electricity access connections, but this increases to roughly a third of investment over the next decade under the ACCESS. Much of this change relates to decentralised solutions, with the instrument approach for grids remaining broadly in line with the structures used today, where debt accounts for just over half of all investment.

**Figure 2.7 ▷ Investment under ACCESS by instrument, sub-Saharan Africa, 2025-2035**




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*Debt accounts for the largest share of investment, but to unlock this level of lending, equity investment and grants both increase, especially targeting rural areas*

Notes: SAS = stand-alone systems

Sources: IEA analysis based on OECD (2025), IJGlobal (2025), GOGLA (2024), Cleantech Group (2025).

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The following actions can help ensure the adequate capital mix to achieve universal access:

- Increase the availability of patient equity for decentralised solutions.
- Unlock pension funds as local currency equity and debt providers.
- Improve access to debt from local commercial banks.
- Review RBF design to ensure maximum impact.

### *Increase the availability of patient equity for decentralised solutions*

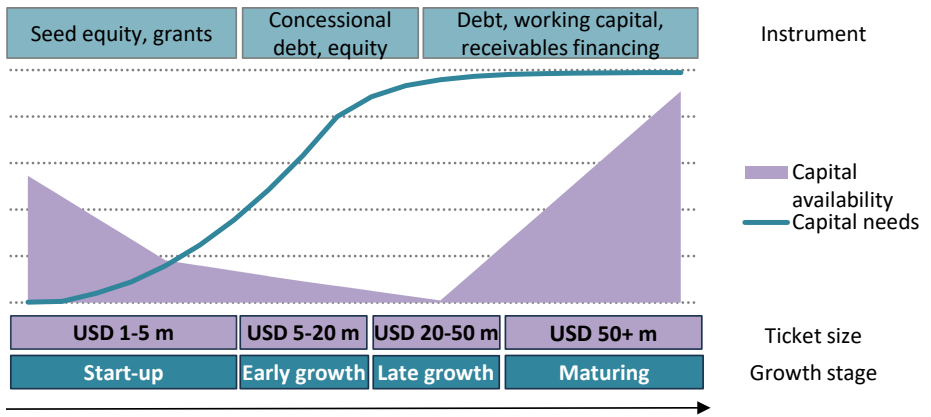
Increasing the availability of equity for electricity access projects would be one of the most important levers to achieve universal access. Patient equity – long-term equity investments that are more tolerant of delayed returns and slower exits – is particularly crucial. Equity investment for grid projects will generally be covered by the state utility and represent less of a hurdle, but for mini-grid and SHS developers, the lack of equity is the most commonly cited challenge to scaling up projects. With the availability of equity shrinking over recent years, developers struggle to access either early-stage equity that is vital to fund development activities, such as feasibility studies or pilots, or construction-phase and growth-stage equity that supports the development of projects and expansion into new markets (see Figure 2.7). Without equity, developers are forced to use debt or grant facilities that are not well adapted to their financing needs. For example, debt facilities may need repayment on a schedule that is too short for project revenues, and grants can be too small or include limitations on the work they can be used to finance.

The limited availability of equity is most keenly felt in some of the less mature market segments and business models, particularly those that target rural customers. As the region moves closer to universal access, it is these models that need to see the most expansion.

New sources of patient, affordable equity emerge and are rapidly scaled up under the ACCESS by 2035. Under M300, in January 2025 the International Finance Corporation (IFC) announced the launch of **Zafiri**, a new investment company that will invest equity into decentralised electricity providers, particularly mini- and metro-grid operators. Zafiri's anchor partners – the World Bank, the AfDB and the Rockefeller Foundation – provided an initial USD 300 million, half of which is in junior equity, with the objective of growing the capital base to USD 1 billion over the next decade.

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**Figure 2.8 ▷ Capital availability and financing needs for decentralised solutions**




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*During the early and late-growth phases, when capital needs are the highest, financing – in the form of equity and concessional debt – is scarce*

Note: This figure reflects the current experience of companies that are primarily international or cover multiple countries. The experience of nationally owned developers, especially micro, small and medium-sized companies, is of having even less access to capital, as discussed in the text.

Sources: IEA analysis based on REPP and AMDA (2023) and Persistent Energy (2015).

### *Unlock pension funds as local currency equity and debt providers*

Domestic pension funds also represent an important potential source of patient local currency equity and debt finance. Thanks to the combination of pension fund reform to allow privately managed funds and rising per-capita incomes, the size of pension funds on the African continent has been growing. However, most pension funds in Africa still have a strong preference for government securities over equities or corporate debt, given their relatively high yields at comparatively low risk. For example, pension funds in Egypt, Ghana and Nigeria allocate over 75% of their assets to government securities (IEA, 2023). In recent years, there have been efforts in multiple countries to increase pension fund involvement in alternative asset classes, particularly infrastructure. Once operational, infrastructure assets can provide important diversification for pension portfolios since they are characterised by long-term predictable revenue streams.

Attracting pension funds into decentralised energy solutions can prove complex. Not only can there be a mismatch in ticket sizes, but most pension funds also have limited experience of investing in mini-grids, which can make it harder for them to assess the risk of projects and increase the time taken to agree deals. However, several milestone projects indicate such investments are possible. In June 2025, **OnePower** – a mini-grid developer active in Lesotho, Benin and Zambia – announced that it had secured LSL 40 million (USD 2.3 million)

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in debt from the **Lesotho Public Officers' Defined Contribution Pension Fund** for its mini-grid project in Lesotho. This project sets an interesting precedent as the pension fund investment was secured while the project was still in the construction phase, indicating that with the right capital stack, pension funds can provide vital additional debt, or potentially equity, in a project's early stages. Another interesting example comes from Nigeria, where mini-grid developer **Darway Coast** was able to attract local pension funds into a green debt issuance, thanks in large part to a local currency guarantee provided by **InfraCredit** and first-loss funding from the UK-funded **Climate Finance Blending Facility**. While both of these projects resulted in debt finance from pension funds, growing fund familiarity with mini-grid projects could open the door to future patient equity capital. While these providers are unlikely to account for the dominant share of future private equity and debt in decentralised solutions, they could serve as a much-needed addition to the financing landscape, particularly for more mature assets.

### *Improve access to debt from local commercial banks*

Interest in financing electricity access projects is growing among local banks, particularly in segments such as PUE technologies, which offer more proven commercial returns. Local banks and microfinance institutions play a unique role in that they are positioned to provide both supply-side finance – loans to developers or in project finance structures – and demand-side finance via end-user lending to cover the cost of appliances or services.

Local banks are already familiar with approaches to assess the risk in a number of the sectors where PUE technologies are commonly used, notably agriculture, but their traditional loan structure is not well-adapted to end-user financing for either electricity access or PUE technologies. Many consumers lack credit history, complicating traditional risk assessments, and their variable and seasonable income may require flexible repayment terms. Newer lending models are emerging, as well as initiatives to offer preferential rates and longer tenor loans.

Concessional funders have also been supporting the growing role of commercial banks, through both technical assistance and capacity building, and the introduction of blended finance vehicles. Non-energy-specific facilities are already operational – such as the **African Guarantee Fund** – although new energy access-specific solutions are now emerging. The **Green for Access First Loss Facility** (G4A) is a risk mitigation fund managed by **GreenMax Capital**, with backing from the **IKEA Foundation**, **CLASP** and the Pioneering Green Partnerships (**P4G**) Platform. It supports local currency lending by partnering with local financial institutions and deploying a tiered capital structure – a grant-funded first-loss tranche, junior debt from impact investors, and senior loans from development finance institutions – to de-risk lending and catalyse private capital. Its first product – a cash deposit guarantee covering up to 20% of portfolio losses on energy access loans held by local banks – is designed to accelerate lending while reducing perceived risks (GreenMax, 2023).

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*Review RBF design to ensure maximum impact*

Over the past decade, development partners have seen RBF as a key solution to provide consumers with subsidised electricity access. RBF became a preferred solution over grants or traditional subsidies because disbursement is linked to the achievement of key objectives, making the impact of donor funding more measurable and targeted. By 2023, donors had channelled an estimated USD 2.6 billion into RBF for energy access globally (SEforAll, 2025).

Crucially, under RBF, payments from donors are not made upfront. Companies therefore need to be able to raise financing from other sources to fund the construction or distribution phase. This can disadvantage smaller and locally owned companies that struggle to access finance (CCG, 2025). Smaller companies are also likely to be less suited to the complex application and due diligence process, which require significant time and resources to complete. Additionally, some finance providers – including many commercial banks – will not consider revenue from RBF when assessing a company's future cash flow as it is not designed to be long term, which can affect whether the project is considered bankable. While RBF continues to make up a key part of the financing mix, to achieve universal access improvements are necessary to ensure it is filling the intended financing gap and targeting the most vulnerable communities.

## 2.4 Innovative financing for decentralised solutions

Given the critical importance of decentralised solutions to achieving universal energy access and their unique financing challenges, innovative solutions are emerging that can be replicated to bring in more private capital. One of the most high-profile of these approaches is the use of securitisation to raise working capital for SHS developers, but this is most applicable to larger SHS companies with a strong track record of delivery. Energy-as-a-service models are also being adapted to allow private investors to support low-income areas, which traditional financing approaches would previously have rendered too high risk for most investors. Green debt issuances, although more common for utility-scale power projects, can also be utilised for mini-grid projects, with the right concessional support. And finally, crowdfunding, although likely to be smaller in scale than the other solutions, represents a unique opportunity to involve retail consumers in electricity access financing. Advancing these solutions requires an increase in risk-taking capital from providers such as philanthropies, corporate foundations and development partners (see Chapter 3).

### *2.4.1 Off-balance sheet financing for PAYG SHS*

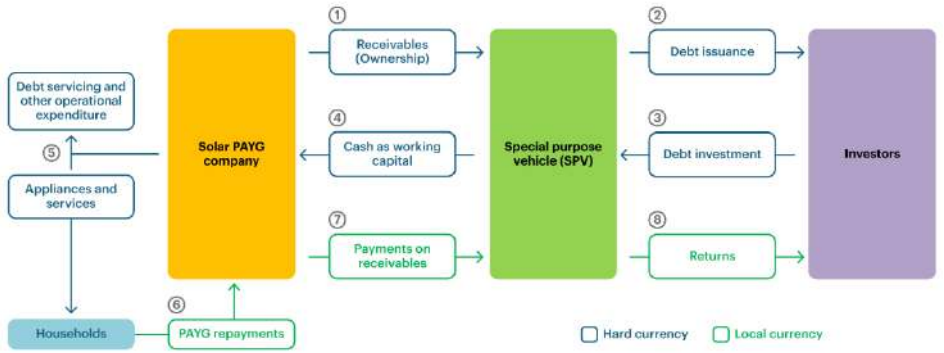
Historically, SHS financing has primarily occurred from company balance sheets. This can prove restrictive due to SHS developers' dual role as both hardware retailers and consumer finance providers. Most PAYG SHS companies raise debt on their balance sheet to fund inventory purchases. Appliances are then sold on to consumers based on a contract value that they repay over time, during which time the liability remains on the developer balance sheet. This restricts the developer's ability to reinvest capital into the purchase of new

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equipment, while also potentially making it harder for developers to meet their own debt repayment schedules.

Off-balance sheet structures have been crucial for driving private investment into other parts of the energy system in Africa, notably in utility-scale power generation, since they create a different risk exposure for investors. In the case of PAYG SHS, recent years have seen the emergence of off-balance sheet transactions via securitisation of company receivables – the future payments from customers as they pay back their SHS obligations. These future flows can be packaged together and sold on to investors through a special-purpose vehicle (SPV), removing the liability from the SHS developer balance sheet (see Figure 2.8).

**Figure 2.9 ▷ Simplified structure of a PAYG SHS securitisation deal**




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*Securitisation deals allow PAYG companies to obtain off-balance sheet financing, reducing their leverage and helping them to raise valuable working capital*

Securitisation deals have multiple benefits for the SHS developer. The investment raised by the off-balance sheet vehicle is paid to the SHS developer, providing an inflow of operating capital. This can be used to support expansion or pay off on-balance sheet debt. Importantly, the payment from the SPV to the developer is most likely to be in hard currency. Many SHS developers carry significant levels of currency risk since they are generally forced to raise debt in hard currency, but their main source of revenue is in local currency from consumer purchases of equipment and services. Securitisation deals allow the developer to access hard currency working capital, which they can use to pay down their debt without incurring losses due to a currency mismatch. The currency risk is either hedged or transferred to the SPV, which is able to absorb it, primarily through over-collateralisation – the practice of ensuing that the face value of the receivables that underpin the transaction are significantly higher than debt raised by the SPV.

An additional benefit to the developer is that by shifting some of the debt off-balance sheet, it reduces the company's leverage and potentially allows cheaper debt to be raised in the

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future. The lower leverage also boosts annualised equity returns, with modelling showing increases of 8-28% over a 10-year period (Persistent Energy, 2023). Finally, the off-balance sheet vehicles created in securitisation deals can have higher credit ratings than the associated SHS developer since investors are only exposed to risks associated with the agreed upon receivables as opposed to the company as a whole. This can attract a broader group of investors, including commercial banks.

The first African off-grid securitisation deal was closed between **BBOXX** and **Oikocredit** in 2015 for USD 500 000, with Oikocredit buying tranches of BBOXX's Kenyan receivables. Since then, the scale has increased significantly, with a number of key milestones:

- 2020: African Frontier Capital established an off-balance sheet vehicle – **Brighter Life Kenya 1 Limited (BLK1)** – to acquire receivables from **d.light's** Kenya business. BLK1 was funded primarily by senior debt of USD 110 million from **Development Finance Corporation** and **Norfund**. In February 2024, AFC and d.light announced that the senior debt had been repaid ahead of schedule, based solely off internally generated cash flows (i.e. from the receivables, not through any refinancing of the debt). This type of repayment was an industry first and can serve to increase confidence in the viability of these types of deals.
- 2023: **Sun King** and **Citi** announced a Kenyan shilling-denominated USD 130 million securitisation transaction. The transaction also included **ABSA Kenya**, **BII**, the Dutch Development Bank **FMO**, **Norfund**, **Standard Bank** and the **Trade and Development Bank**. The size of the deal and the involvement of multiple commercial banks were both particularly notable for the SHS sector.
- 2023: the Ivorian government-led **Electricity for All Programme** created an SPV to issue an asset-backed social bond for CFA 60 billion (EUR 91 million), based on PAYG receivables. The bond included three tranches of different tenors, the longest of which was 15 years. The primary investors were **IFC** and the **Emerging Africa Infrastructure Fund**, one of the largest blended finance infrastructure funds in Africa, which took on 80% of the loan book. The bond represents the longest tenor securitisation deal based on PAYG receivables. The long tenor was made possible by a 98.7% over-collateralisation of the bond – i.e. the value of the receivables underpinning the bond was nearly double the face value of the bond – and a guarantee from the anchor investors to take on at least 62% of the loan book.

While these examples have demonstrated the viability of securitisation deals for PAYG SHS, there are still several challenges to the scale-up. A country's regulatory environment may need to be updated to allow for securitisations and deals can be complex and time-consuming to set up, especially in new markets. Once the necessary regulatory framework is in place, it can take time for the market to familiarise itself with the new asset structure, but then it can quickly gather momentum. The West African Economic and Monetary Union introduced a securitisation framework in 2010, since when there have been 12 securitisation deals, six of which took place within two years, although none related to electricity access.

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Another major challenge is that to create a package of receivables stable enough to attract investors, companies often need to have sufficient scale and a credit history of at least three years. This can prevent smaller SHS developers from being able to develop off-balance sheet financing. Several innovations have been proposed and are currently being piloted to translate this into a tool for smaller companies by introducing a warehouse facility or an aggregator platform (see more details in Chapter 3). While these aggregation solutions are still in their early stages, such innovations could help broaden the use of securitisation structures, opening up new financing options even to smaller SHS developers.

### 2.4.2 Energy-as-a-service for underserved communities

SHS are likely to be the least-cost model for some of the hardest-to-reach areas, including households with the lowest incomes. In many of these areas, households can only afford to pay USD 2-3 per month for electricity services. The traditional PAYG SHS model can therefore prove untenable for these households. The repayments for appliances can be too large, and in many cases household income may not be regular enough to meet payback requirements. Even in instances where households do manage to acquire a SHS, if the appliance breaks, they cannot afford maintenance or replacement parts, which themselves can also be more expensive due to a lack of skills or parts in the area. This maintenance issue is also true for public institutions in hard-to-reach communities. For example, in 2022, a study in Malawi found that over 87% of healthcare institutions surveyed had a non- or sub-functioning solar system (Solar Aid, 2024). As a result of these challenges, private investors have struggled to find business models that match their own risk-return requirements.

An emerging solution to attract private finance into these areas is the introduction of an energy-as-a-service approach that separates out the role of an asset company, which owns the SHS, and an operations contractor, which is responsible for distribution and maintenance. Under this service-based model, the SHS developer does not sell infrastructure outright, as is common practice today, instead charging consumers based on capacity or availability of service. From a consumer perspective, this approach significantly lowers the upfront cost and allows them to make smaller payments based on usage, while also shifting maintenance costs to the service provider. When developers take on the lifetime risk of the asset instead of the customers, they have a strong incentive to maintain the asset for as long as possible, which encourages better quality and longer term reliability.

There are multiple approaches to financing this type of service. Generally speaking, an asset company is created, which can be either publicly or privately owned, that procures the SHS, often with the help of subsidies from either the government or a development finance institution (GET.invest, 2024). The asset company then contracts a separate operating company – most likely to be a private SHS developer – that will be responsible for distribution, maintenance and fee collection. Users can be charged based on capacity or availability of service, or consumption levels as you already see in mini-grids and grids. In either case, given that target households are likely to be those with lower incomes, subsidies

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are essential. Subsidies can either be provided as end-user subsidies – commonly cash transfers – or as sales subsidies that are embedded into the business model.

Practical Action carried out surveys in Nepal, Rwanda and Zambia and found that the most effective way to deliver electricity to households in extreme poverty is through energy-as-a-service, combined with a 50% sales subsidy. They found energy-as-a-service could expand the number of households willing to pay for electricity by up to 620 000 in Rwanda and 1.7 million in Zambia (Practical Action, 2024). Solutions need to be designed with the specificities of the target households clearly in mind. Households in extreme poverty are most likely to gain access to electricity via SHS that provide basic bundle level consumption (between 4-6 kWh per household per month), with options to move up the energy ladder when possible. Payment schedules also need to have enough flexibility to account for the seasonal or unreliable nature of household incomes. To allow for this flexibility, service providers are likely to need a significant level of grant funding or highly patient, low-cost debt in their capital stack to guarantee that subsidies can be provided to customers and that periods of low usage or delayed payments can be absorbed if necessary.

**Table 2.2 ▷ Notable examples of energy-as-a-service in households or healthcare centres in Africa**

| Company | Country | Description |
|---|---|---|
| **Moon** | Togo, Senegal | Electrified 37 000 households in Togo, Senegal and Madagascar. By leveraging a USD 110 smart end-user subsidy, customers are able to pay only USD 2 per month |
| **SolarAid** | Malawi, Zambia | Electrified 8 000 households in Malawi, 97% of whom live in extreme poverty. Through their "Powering Healthcare" programme, providing plug-and-play systems to healthcare centres in Malawi and Zambia |
| **EasySolar** | Sierra Leone | Connected 2 000 households under the Lite Salone programme, with a further 10 000 expected to be connected in 2025, followed by an additional 15 000 in 2026. Electrified 20 healthcare facilities in partnership with the Government of Sierra Leone since 2020 |
| **Jiro-VE** | Madagascar | Utilises a franchise model where local entrepreneurs act as franchisees, distributing rechargeable solar LED lights and power banks, and also offer recharging services. Jiro-VE currently has 16 000 members and an estimated 120 000 beneficiaries; under its school programme it has electrified 79 schools serving 6 000 students |
| **Electricity Access Scale-Up Project** | Uganda | Planning to utilise energy-as-a-service to support around 700 schools and healthcare centres, with the Uganda Energy Credit Capitalisation Company providing grants to help energy service companies with capital costs, alongside support for site selection, procurement guidance and other technical expertise |
| **MoPo** | Nigeria, Sierra Leone, DRC | Pay-per-use battery company where consumers can recharge battery packs at solar hubs without credit. Recently reached 1 million rentals a month, expanding into multiple countries. Supported by the Transforming Energy Access programme and investments by BII and Octopus Energy |

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Energy-as-a-service has also shown promise for electrification of public institutions in rural or remote locations, most notably healthcare centres. Roughly a quarter of healthcare facilities in Africa operate without electricity and only 28% report access to reliable power (CORDIS, 2024). In many cases, the primary obstacle is lack of access to adequate finance, but studies have also shown poor equipment monitoring or maintenance, and a lack of responsibility for systems. Energy-as-a-service can help resolve these by shifting many of the responsibilities to the service provider. This approach has proved successful in rural areas in India through public-private partnerships and is already beginning to be used in several African countries, notably Uganda and Malawi.

### 2.4.3 Green debt issuances for mini-grid projects

Green debt issuances – particularly green bonds or green sukuk, the equivalent in Islamic finance – have been increasingly common for clean energy projects. Over the past decade, annual issuances of green debt have risen nearly twenty-fold from USD 45 billion in 2015 to USD 800 billion in 2024 (IEA, 2025a). However, these have been heavily concentrated in Europe, driven in large part by the region's strong sustainable finance regulation, with Africa accounting for less than 1% of global issuances and roughly 0.3% of the total value (FSD Africa, 2025). Between 2019 and 2024, the average green bond deal size in Africa was around USD 115 million. While this is smaller than in other regions, it remains too large for most energy access projects, which typically require much smaller amounts of financing and therefore would struggle to access capital through standard green bond structures.

Several innovations have been seen to support this use case, in particular funds issuing green bonds to support their own mini-grid investments, and concessional support to de-risk local currency bond issuances. Nigeria has seen the use of green debt raising for mini-grid projects, facilitated by the strong regulatory environment and a combination of catalytic capital, credit guarantees and deep local capital markets. Domestic institutional investors invested in three mini-grid debt-raising transactions between 2022 and 2024, benefiting from a partnership between the UK government's **Climate Finance Blending Facility** (CFBF), **InfraCredit's Clean Energy Funding Programme** and the Technical Assistance Facility from **FSD Africa**. CFBF provides subordinated debt to the project developer, and a funding SPV is created to raise green debt for the developer. InfraCredit provides a credit guarantee, improving the credit rating of the bond or sukuk[1] to AAA, attracting domestic institutional investors alongside international sources. Projects funded under this approach in Nigeria include:

- **Darway Coast**: In December 2022, Darway Coast issued a green bond to develop mini-grids in six communities in Rivers and Abia states. This marked the first time domestic

[1] Sukuk are Sharia-compliant financial certificates that function as an alternative to conventional bonds. Under Islamic law, "riba" (interest) is prohibited. Sukuk structures provide holders with a proportionate ownership stake in the underlying asset, allowing the holder to earn returns based on profits generated by the underlying asset, as opposed to a traditional bond where the return is based on debt repayment obligations.

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institutional investors participated in a mini-grid transaction. The bond mobilised NGN 800 million (USD 2 million) in private capital (CFBF, 2022).

- **ACOB Lightning Technology Limited**: In December 2023, ACOB issued a green bond to develop seven solar-hybrid mini-grids in Edo and Ondo states. The bond mobilised NGN 755 million (USD 845 000) in private capital (CFBF, 2023).
- **Prado Power:** In October 2024, Prado Power issued Nigeria's first green infrastructure sukuk to fund the development of four solar-hybrid mini-grids in Akwa Ibom and Benue states, serving over 15 000 households. The sukuk mobilised NGN 1.95 billion (USD 1.1 million) in private capital (CFBF, 2024).

This transaction structure is replicable across other markets, but it relies on both a strong regulatory environment for mini-grids and a deep capital market. The Nigerian government has made mini-grids a key part of its rural electrification strategy, with comprehensive regulation and financial incentives for developers. The government also launched a green bond programme in 2017, which has included multiple sovereign and corporate issuances, developing domestic investors' familiarity with and interest in green debt instruments. The use of green bonds for clean energy projects elsewhere in the region has been rising, with many bonds supported by UK government-funded FSD Africa. As more mini-grid markets mature, concessional finance can be used to help scale up green debt issuances and to de-risk investments for local capital providers.

Another way off-grid electricity access companies can benefit from the rise in sustainable debt is via impact investment raising. Here, a financial institution, generally an impact fund, issues a green bond where the proceeds are allocated to investment in mini-grid or SHS developers. This approach has multiple advantages. For the issuer, the use of a bond as opposed to traditional equity and debt raising is likely to result in lower cost of capital and a broader investor base. Equally, this increases the availability of capital for smaller project developers, with the impact investor effectively acting as an aggregator. For example, in February 2024, **Social Investment Managers and Advisors** (SIMA) raised a USD 150 million green bond, which aims to finance over 220 MW of mini-grid and SHS developments by small and medium-sized local developers. The bond allows SIMA to offer short-term corporate finance and project finance of up to 10 years. Buyers of the bond were primarily development partners, including but not limited to the IFC, the Finland-IFC Blended Finance for Climate Program and GEAPP, although SIMA expected to attract a further USD 25 million in private capital (15% of the bond value) in a second close. Under this approach, smaller locally owned developers are able to benefit from funding from the bond investors, who would otherwise not have been able to support such small-scale projects.

### *2.4.4 Crowdfunding and retail investors*

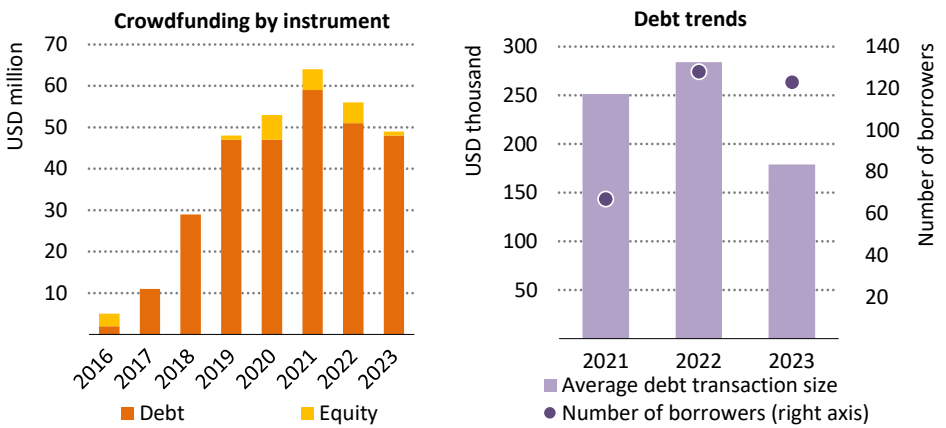
In recent years, retail investors – individual, non-professional investors – have been playing a more prominent role in financial markets thanks to the rise of low-cost digital brokerage platforms and social media finance influencers that have made investment more accessible. There was a sharp spike in interest in retail investing during the Covid-19 pandemic, partly

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driven by the "meme stock" phenomenon, with stock-trading annual app users rising from around 50 million in 2019 to 140 million in 2021 (WEF, 2025). While levels dropped to around 110 million users in 2022, interest continued to rise in 2023, showing long-term upward momentum. While retail investors are far from a homogeneous group, various surveys have found that they are motivated not just by financial gains, but also by impact. In 2024, 82% of surveyed retail investors in the United States said they considered protecting nature, and 77% considered reducing economic inequality (GlobeScan, 2024). This presents an opportunity for energy access projects, which present a strong social and environmental narrative and which can provide clear impact indicators. These investments could also appeal specifically to members of the African diaspora, who sent USD 95 billion in remittances back to the region in 2024 (AFC, 2025). While these are currently almost exclusively sent directly to households, it indicates a potential pool of capital for electricity access projects to tap into

The primary means for retail investors to invest in energy access projects is via crowdfunding platforms, which pool small contributions from individuals into debt and equity investments in access projects. The global crowdfunding market reached over USD 2.1 billion in 2024 and is expected to more than double by 2030 (Grand View Research, 2024). Energy access projects represent a small share of the overall crowdfunding market, but have still raised over USD 300 million globally since 2016 (Crowd Power, 2024). As with many other retail investor-based instruments, there was a spike in 2021, with 2023 investments falling by 23%, back to 2019 levels. The vast majority of these investments are made via loans and bonds (accounting for around 95% of total energy access crowdfunding since 2016).

**Figure 2.10 ▷ Crowdfunding for energy access projects globally, 2016-2023**




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*Crowdfunding has raised over USD 300 million for energy access projects in the last eight years, and despite a fall since the highs of 2021, debt issuances appear to be stabilising*

Note: Energy access investments include commercial and industrial projects.

Source: Crowd Power (2024).

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Underlying the drop in crowdfunding since 2021 is a shift in the type of projects funded. Lending to SHS companies fell after a number of loans were written off due to challenges in the sector. **Energise Africa**, one of the largest crowdfunding platforms, reports that 10% of repayments are overdue, with a further 8% written off (Energise Africa, 2025). As a result, they announced a more conservative stance, focusing primarily on existing borrowers. **Trine**, another large platform, revealed that underperformance in SHS loans was leading to 9% annualised losses in 2020. They chose to shift their investment strategy to prioritise commercial and industrial (C&I) borrowers, which are often larger and more mature and offer the opportunity to add more geographic diversity to platform portfolios. In 2023, C&I projects accounted for 60% of energy-related crowdfunding transactions, with only a quarter in sub-Saharan Africa (Crowd Power, 2024). That being said, there are still some notable electricity access deals, including in April 2025 when mini-grid developer OnePower raised a bond of GBP 305 000 via Energise Africa to support operations in Benin.

Using concessional funds to support crowdfunding platforms can allow them to continue investing in access projects – including SHS and mini-grids – and hence offer a channel for retail investors into the space. Numerous approaches exist, from supporting the platforms themselves, to co-investing or offering more traditional credit enhancement solutions such as guarantees and currency hedging (see Table 2.3). These can be crucial not only to reduce the risks associated with the borrowers, but also to help reduce the costs of the transactions, which can be relatively high since retail investments are a tightly regulated space.

**Table 2.3 ▷ Notable donor initiatives to support crowdfunding**

| Approach | Description | Example |
|---|---|---|
| **Platform building** | Support to crowdfunding platforms to scale and reduce operating costs | **Crowd Power**: Delivered by Energy 4 Impact, with funding from Transforming Energy Access (TEA) and Mercy Corps, Crowd Power was instrumental in the development of the Energise Africa platform. In the past nine years, the programme has provided due diligence funding, investor outreach services and match funding, helping 72 energy access companies raise over USD 26 million on 15 crowdfunding platforms. |
| **Co-investment or matching funding** | Donors co-invest alongside retail investors, often acting as an anchor investor | **CEI Africa:** Managed by a consortium of Triple Jump, Persistent Energy and GreenMax Capital, CEI Africa offers a crowdfunding co-investment window (co-investing up to one-third of the campaign value) as well as grants and technical assistance. CEI Africa was established in 2021 by KfW, with the Swiss Development Cooperation (SDC) joining as a contributor in 2022. Total contributions currently stand at EUR 82 million. |
| **Currency hedging** | Multiple hedging approaches exist, but the most suitable is likely to be via the creation of a ring-fenced fund to manage currency volatility | **Charm Impact:** With support from CLASP and funding from the IKEA Foundation and TEA, Charm Impact announced a partnership to develop a EUR 200 000 currency first-loss pool. Borrowers will be able to borrow at a fixed exchange rate, with a portion of the first-loss pool allocated to each loan. If currency volatility results in a shortfall in repayments, the pool will be drawn down. |

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| Approach | Description | Example |
|---|---|---|
| **Guarantees** | As with traditional investments, guarantees can be used to cover a range of non-commercial risks | **Bettervest and AGF:** Bettervest launched a guarantee with Africa Guarantee Fund (AGF) in 2022, where AGF provided a partial guarantee. While guarantees have proved vital for other private investors in electricity access, in 2024 Bettervest reported that the guarantee had not resulted in a significant increase in funding. |

The adoption of innovative finance models is essential to scaling up electricity access in Africa because traditional funding patterns have not, so far, been able to reach the continent's rapid electrification needs. Mechanisms that can bring in new sources of both low-cost public finance and private finance will be key to deploying the necessary grids, mini-grids and SHS to provide affordable connections to the 600 million people that still lack access to electricity.

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# Beyond new connections

## Providing an affordable, equitable and quality service


### SUMMARY

- Affordability constraints can prevent households from gaining access to electricity or from taking advantage of electricity services once a connection is made. An estimated 220 million people in sub-Saharan Africa (around 40% of those without access) would find the basic bundle unaffordable, rising to 400 million for the essential bundle (65% of those without access). Filling this affordability gap would cost an additional USD 2-10 billion per year, via supply-side subsidies to reduce developer costs, demand-side subsidies to reduce consumer costs, or reductions in financing costs.
- The cost of capital for electricity access projects is three to four times higher than grid projects in advanced economies, due to higher perceived and actual country-level and project-related risks. If financing was available at rates more in line with advanced economies, this would reduce the cost of electricity access projects by 15-25%, making the basic bundle affordable for 40 million more people.
- Supply-side subsidies via grants to developers can also drive down the cost of access. Using grants to cover 30% of capital and operational expenditure on mini-grids and 50% on solar home systems (SHS) would make the basic bundle affordable for 110 million people. While this marks a notable improvement, it also highlights that demand-side support remains necessary, particularly for the poorest households.
- Hundreds of millions of Africans are living in vulnerable situations such as informal settlements, displacement settings, fragile and conflict prone states or small islands. These communities have some of the lowest electrification rates on the continent but are often excluded from financing due to their complexity. In many of these settings, decentralised solutions are viable, but higher risks mean public and highly concessional capital will be necessary, particularly to pilot new financing models.
- Women play an integral role in electricity access since they are often managers of household energy, as well as consumers, including as entrepreneurs. They face severe barriers to accessing finance, with an estimated USD 42 billion financing gap for women-led businesses on the continent. Improving sex-disaggregated data is key to understanding both supply- and demand-side challenges, as well as introducing tailored financial products such as loans backed by cash flows or moveable collateral.
- The impact of concessional capital is maximised when directed to the most underserved communities and to close affordability gaps – roles that other providers are unable to fill. It is crucial to build an enabling environment by improving data availability, supporting policy reform and developing local capacity. To ensure financing is catalytic, investors need to take higher-risk positions, support innovative deal structures, scale up risk mitigation tools, and plan for responsible exit strategies.


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## 3.1 Introduction

Achieving universal access is not only about funding initial connections – it also requires ensuring that electricity services remain reliable, affordable and sustainable over time. Households must be able to pay for ongoing consumption to fully benefit from electricity access and to increase electricity consumption, moving from basic lighting to productive and income-generating uses. In many cases, this can require additional financial support, either by reducing the cost of electricity access projects, or by providing financial support to consumers directly. The pathway to universal access laid out under the IEA **Accelerating Clean Cooking and Electricity Services Scenario** (ACCESS) considers what are the most cost-effective technologies for communities, but investment numbers in the scenario do not include financial support necessary to ensure affordability. In Sections 3.2 and 3.3 we explore the size of this affordability gap per technology, based on the pathway laid out in the ACCESS, and analyse the impact of interventions in financing and capital costs on affordability.

There are also certain communities that risk not having equal opportunities to benefit from electricity access, which are discussed in Sections 3.4 and 3.5. Special attention also needs to be paid to vulnerable communities – those based in some of the most complex situations on the continent, such as fragile and conflict prone states, informal settlements, displacement settings or small islands – who are often left behind in financing discussions. Equally, women-led businesses currently struggle to access finance, preventing their ability to scale up productive uses of energy. This chapter explores these issues, ending with a summary of where concessional finance can play the most impactful role to reach affordable and equitable universal access.

## 3.2 The affordability gap

Affordability of electricity is a major barrier across Africa. Electricity is considered affordable if meeting basic energy needs requires spending less than 5% of a household's disposable income – a threshold commonly used to define energy poverty. Affordability must be considered across several dimensions: there is the affordability of being able to pay for the initial access to electricity either via a connection charge to a grid or the purchase of an off-grid appliance like an SHS, both of which could be subsidised. Once a connection has been secured, households also need to be able to pay for continued use of the service. Time and again, households make the first important leap and gain access but then are unable to afford either electricity at all or a level of service that will allow for productive use. This is especially evident in rural areas in Sub Saharan Africa, where the average household yearly income is around USD 1 400, between 15% and 50% of incomes in urban areas. Improvements in the energy efficiency of appliances has played a significant role in allowing access to higher bundles of electricity while reducing both the cost to consumers and strain on electricity infrastructure, but these measures alone are not sufficient.

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### *Grid connections*

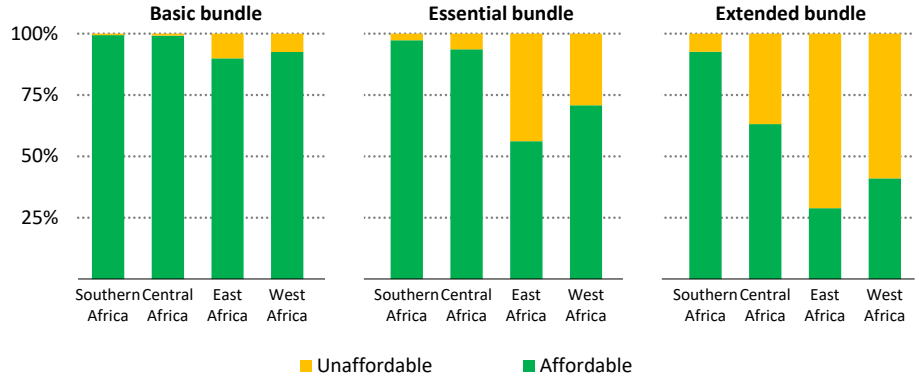
For households, the primary costs associated with gaining access via the grid are the connection charge and associated domestic wiring costs. In sub-Saharan Africa, on average, connecting to the national grid for the first-time costs USD 50, and represents about 50% of household monthly income in the 26 countries that we collected data for. There is, however, significant variation between countries due to differing approaches to setting connection charges. Most countries charge different connection fees depending on the power level requested, as in the Central Africa Republic and South Sudan, allowing the prices for all consumers to be standardised regardless of their location within an electrified area. While this is the most common option, some countries – such as Angola, the Gambia and Tanzania – set additional connection charges based on the distance from existing infrastructure. This pricing system adds a barrier to electricity affordability, particularly in rural areas, as the fees are often prohibitively high.

Given the barrier to access to electricity caused by these high connection costs, several countries are implementing measures to reduce them. In South Africa and Liberia connection charges are waived (100% subsidy) regardless of household income (Eskom, 2025). Other countries allow households to spread the payment of connection fees over several months (and even years), often with a deposit. Gabon, for example, allows connection fees to be paid in 12 monthly instalments, with a 25% prepayment (SEEG, 2025). In Kenya, where connections charges are USD 108 (50% of average household income), repayments can be made over up to 36 months (Kenya Power & Lighting Plc, 2025).

Once a connection has been secured, electricity consumption can remain prohibitively expensive. The IEA has analysed electricity tariffs and considers electricity affordable if it costs less than 5% of household monthly income. Studies of rural communities in Rwanda and Kenya have shown that once the grid arrives, consumption does not scale up in the manner predicted by many utilities (see Chapter 2). Providing up to 5 kWh/month (the IEA basic bundle) is broadly affordable to most households, but this low level of energy service would not allow utilities to recoup the costs associated with grid extensions. As consumption increases, affordability presents a much greater challenge. According to new IEA least-cost modelling, of the almost 265 million people in sub-Saharan Africa who gain access to electricity via the grid by 2035 under the ACCESS pathway, almost 16 million cannot afford today's tariffs associated with the IEA basic bundle, or about 6% of the population studied. Considering the essential bundle (40 kWh/month), this number rises to almost 70 million people, or over a quarter of those gaining access via the grid. When energy service levels rise to the extended bundle (100 kWh/month), the number increases to almost 145 million people, over half of those gaining access via the grid.

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**Figure 3.1 ▷ Percentage of population in sub-Saharan Africa that can afford grid electricity by region per IEA bundle**




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*Over 25% of the sub-Saharan Africans who gain access to electricity via the grid by 2035 cannot afford the essential bundle, rising to almost 55% for the extended bundle*

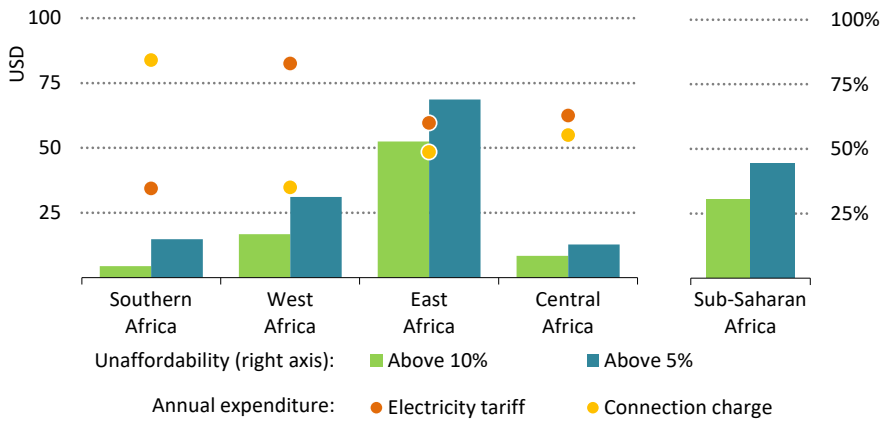
Notes: Based on least-cost modelling using OnSSET. Income level is estimated from the Relative Wealth Index. For definition of the IEA bundles, refer to Section 1.2.

Sources: IEA analysis based on the latest electricity tariff data in 45 African countries; data collected by Toulouse School of Economics.

The determining factor preventing electricity access via the grid may be connection charges, monthly electricity bills, or both, depending on the country. Given that a household must have a connection and pay for monthly consumption to have electricity, the affordability of connection charges and monthly grid subscription must be analysed together. Amortising connection costs over a year, together with annual consumption of the IEA "essential bundle", Figure 3.2 shows that during the first year, 44% of households exceed 5% of their monthly income, and for 30% of households this share exceeds 10% of their income. In comparison, without connection charges, almost 26% of households cannot afford the essential bundle based on a threshold of 5% of income.

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**Figure 3.2 ▷ Share of population for whom first-year electricity expenses exceed 5% and 10% of monthly income, essential bundle**




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***The essential bundle would be more than 5% of household income for 45% of households across Africa in the first year, rising to almost 70% in East Africa***

Notes: Based on least-cost modelling using OnSSET. Income level is estimated from the Relative Wealth Index. For definition of the IEA bundles, refer to Section 1.2. The regional tariffs are calculated based on 26 countries mentioned in the methodology.

Sources: IEA analysis based on electricity tariff and connection fee data in 26 African countries.

### *Mini-grids*

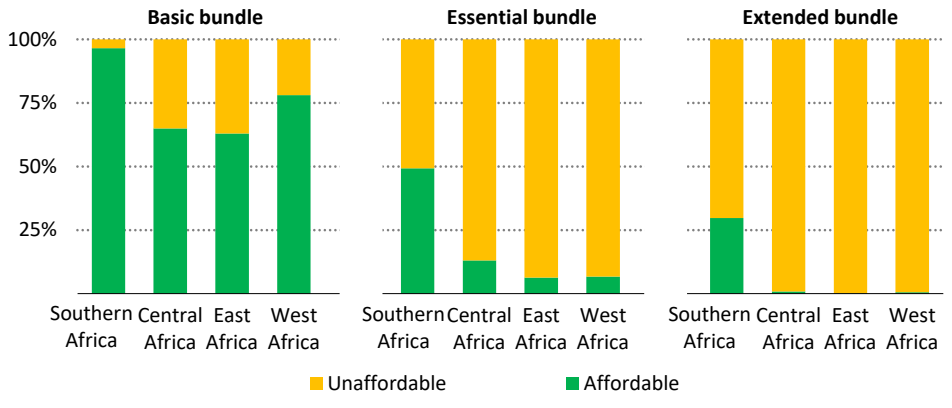
Mini-grid tariff setting can be a lengthy process, involving numerous steps with the regulator and government, resulting in significant variation in approaches and outcomes across countries. Mini-grids typically have higher generation and distribution costs than national grids due to their smaller scale, remote locations and the inability to cross-subsidise across a broader network. Given many rural communities have a low ability to pay, and to ensure equity with urban grid-connected citizens, countries push for a single uniform price across the country, which would make many mini-grid projects unbankable without subsidies. Currently several countries have adopted standardised tariff calculation methodologies, including Kenya, Nigeria, Sierra Leone, Tanzania and Zambia, although tariffs remain above those on the national grid (AFUR, 2021).

Based on current regional averages of subsidised and applied tariff levels and considering the population that gains electricity through mini-grids under the ACCESS, around 70% of households (120 million people) can afford the basic bundle, 10% the essential bundle (around 15 million people) and 2% the extended bundle (3 million people). Regional differences exist, given variations in income and tariff levels. For the basic bundle, in Southern Africa, given higher incomes, affordability is above 90% (see Figure 3.3) while both East and Central Africa are below 70%. Differences widen further in higher consumption

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bundles; around 50% of the population of Southern Africa can afford the essential bundle compared to less than 10% in other regions. The extended bundle is accessible to only a minority, with just 30% of the population in Southern Africa able to afford it.

**Figure 3.3 ▷ Percentage of population that can afford mini-grid electricity by region per IEA bundle**




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*While the basic bundle is affordable for around 70% of households gaining access via mini-grids, higher bundles remain out of reach for all regions except Southern Africa*

Notes: IEA and KTH Royal Institute of Technology analysis based on the OnSSET model developed by KTH Royal Institute of Technology. Income levels per location are approximated based on the Relative Wealth Index. The model applies the real tariffs of existing mini-grids to future mini-grids. These are gathered from different operators across the region and from GOGLA data.

Sources: IEA analysis based on Relative Wealth Index META (2025), OnSSET results KTH (2025), ESMAP (2025), Mukisa, Manitisa, Nduhuura, Tugume, & Chalwe (2022).

### *Solar home systems*

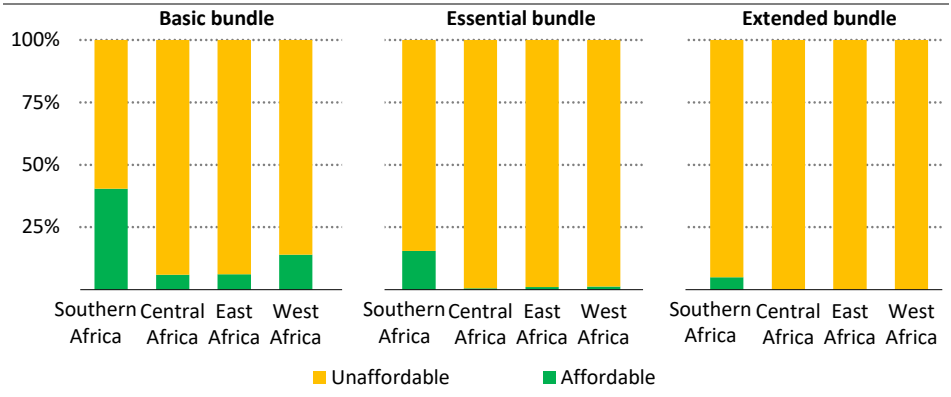
SHS present different tariff structures and challenges compared to mini-grids, with different business models involved. Indeed, these systems are directly sold or leased to the final user, with prices and tariffs that can vary dramatically in structure and quantity, depending on system size, financing mechanism, customer service and maintenance arrangement. In the past five years, SHS have become less affordable, driven by currency devaluations, even with reductions in component prices. While many countries are adopting quality standards, only around 27% of all off-grid solar appliance sales have been quality verified, highlighting how poor-quality products still remain a major barrier to growth in the market, leading to consumer dissatisfaction and suppressed demand (ESMAP, 2025).

Based on regional averages of subsidised and applied tariff levels today and considering the population that gains electricity through SHS under the ACCESS, around 10% of households (15 million people) can afford the basic bundle, 2% the essential bundle (3 million people) and none the extended bundle. In this context, too, regional differences exist given variations

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in income and tariff levels. For the basic bundle, in Southern Africa, given higher incomes, affordability is around 40% (see Figure 3.4), with West Africa at 15% and both East and Central Africa below 10%. The extended bundle is out of reach for the vast majority, with only 5% of the population in Southern Africa being able to afford it.

**Figure 3.4 ▷ Percentage of population that can afford SHS electricity by region per IEA bundle**




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***Only limited levels of energy service are affordable to around 10% of households gaining electricity through SHS, with higher bundles unaffordable across the region***

Notes: IEA and KTH Royal Institute of Technology analysis based on the OnSSET model developed by KTH Royal Institute of Technology. Income levels per location are approximated based on the Relative Wealth Index. The model applies the real tariffs of existing SHS to future SHS. These are gathered from different operators across the region and from GOGLA data.

Sources: IEA analysis based on Relative Wealth Index META (2025), OnSSET results KTH (2025), ESMAP (2025), Mukisa, Manitisa, Nduhuura, Tugume, & Chalwe (2022).

### *Affordability gap for on-grid and decentralised solutions*

Analysis of affordability for on-grid and decentralised electricity under the ACCESS based on least-cost modelling and actual subsidised tariffs, shows that access to electricity remains unaffordable for most of the population. The basic bundle is unaffordable for 16 million people expected to gain access via the grid, more than 5%, and 200 million people expected to gain access via decentralised solutions, around 60%. This is equivalent to 40% of households that do not yet have access to electricity. The affordability gap is greater for the essential bundle. It remains unaffordable for 70 million people expected to gain access via the grid, around 25%, and 315 million people expected to gain access via decentralised solutions, more than 90%. This is equivalent to 65% of households that do not yet have access to electricity.

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Grid electricity solutions benefit from subsidies that are applied to national tariffs. In countries such as Zambia and Angola, national average electricity tariffs are approximately USD 0.020 per kilowatt hour (kWh). These subsidised rates significantly reduce the affordability gap for households connected to the national grid, enabling broader access to electricity services. The impact of these subsidies becomes particularly evident when comparing the populations that can afford the maximum electricity bundles.

With subsidies, nearly the entire grid-connected population in these countries could afford the essential and extended bundles, underscoring the critical role of tariff policy and targeted subsidies in shaping electricity access outcomes. However, just because these solutions are affordable does not mean they will be bankable: as discussed in both Chapters 1 and 2, current tariff structures do not allow cost recovery for most grid extensions. This highlights the inherent tension in tariff policy to both provide an affordable service and support the financial health of utilities, and by extension alleviate government debt levels.

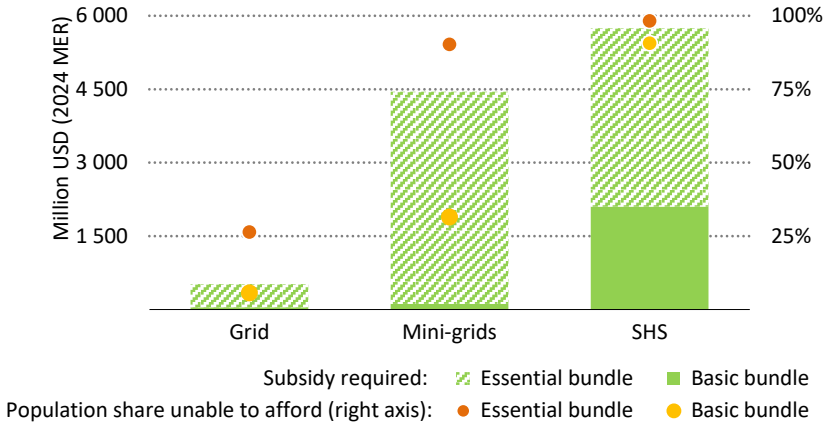
In many areas the least-cost option for electricity access is off-grid solutions, particularly in parts of Central and East Africa, where electricity tariffs remain prohibitively high for a significant portion of the population. In these areas, the difference between the tariff for the essential bundle and what 50% of the population can afford can exceed USD 10 per month, presenting a substantial barrier to electricity access. This level of expenditure is far beyond what many low-income households can sustain, underscoring the urgent need for financial interventions and robust state support to bridge the gap.

## 3.3 Reducing the cost of electricity access

To close the affordability gap, households would need an additional USD 2.3 billion annually in financial support to make the basic bundle affordable, which is equivalent to 3% of total energy investment in sub-Saharan Africa in 2025. Of that, around USD 2.1 billion would be directed to households gaining access via SHS, USD 120 million to households gaining access via mini-grids and the remaining USD 45 million to households gaining access via grids. To expand usage to the extended bundle, the affordability gap increases to USD 10 billion – equivalent to 15% of total energy investment in sub-Saharan Africa in 2025. Of that, around USD 6 billion would be directed to households gaining access via SHS, USD 4.5 billion to households gaining access via mini-grids and the remaining USD 500 million to households gaining access via grids.

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**Figure 3.5 ▷ Affordability gap by technology and region in sub-Saharan Africa, 2025**




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*Around USD 2.5 billion is required to cover the affordability gap for the basic bundle; the affordability gap increases to USD 10 billion for the essential bundle*

The final subsidy depends on factors such as technology choice, household income levels and the cost of developing projects. There are several approaches to closing the affordability gap:

- **Reducing financing costs:** electricity access projects are capital-intensive, which means the cost of capital can have a major impact on overall electricity access project costs. Reducing the cost of capital can reduce costs to consumers and increase the number of projects that would be considered bankable.
- **Applying supply-side subsidies:** supply-side subsidies provide financial support to electricity suppliers to lower the cost of producing and/or distributing electricity, ultimately reducing costs for consumers. Common examples include government funding for rural grid expansion or grants and results-based finance programmes for decentralised solution developers.
- **Using demand-side subsidies:** demand-side subsidies describe financial support to reduce the upfront or ongoing costs of electricity for consumers. The most common demand-side subsidies in electricity access are reduced connection charges, lifeline tariffs, voucher or coupon schemes, or zero-interest financing for off-grid appliances.

An ideal solution involves some combination of all three. This requires collaboration between domestic governments, particularly in relation to tariff schemes, international donors, who are likely to be the main providers of grants, and electricity suppliers, who are the main interface with consumers. To understand the potential impact of each of these approaches, the analysis below considers their impact on the levelised cost of access (LCOA) – a measure of the total cost of an access project (see Box 3.1).

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**Box 3.1 ▻ Explaining the levelised cost of access**

The cost of supplying electricity is most commonly measured via the levelised cost of electricity (LCOE), which measures the average cost per unit of electricity generated over the lifetime of a project. In the context of off-grid electricity access projects, energy production assets are serving a fixed number of customers without the option to export excess power. Operators and providers are not merely delivering electricity, but they are offering an energy service that considers not just quantity, but also quality, safety, sustainability and reliability.

The levelised cost of access (LCOA) – first proposed by Alexandre Tourre, CEO of Easy Solar in 2025 – represents the total lifetime cost of maintaining a monthly reliable energy service, based on different electricity bundles. The LCOA is calculated as the entire costs of an off-grid energy asset, including CAPEX, lifetime OPEX, financing and decommissioning, divided by the number of households or clients it serves and the asset's useful life (Easy Solar, 2025). It can be interpreted as the minimum amount the operator should receive on average per client per month to reach financial sustainability.

Unlike the LCOE, which focuses solely on the cost per unit of electricity generated, the LCOA captures the broader economic and operational realities of delivering reliable, secure and tier-specific energy services to households, businesses and institutions, and is applicable to different energy services.

This metric, which has been championed by various electricity access developers and operators, is particularly valuable in electricity access planning, as it allows for direct comparison with:

- Monthly tariffs paid by clients.
- Household income levels.
- Affordability thresholds.

By comparing the LCOA with the average income of a village or community, stakeholders can identify the affordability gap – the difference between what electricity costs and the affordable tariff. This gap is a critical indicator for determining the level of subsidy or financial support required to ensure equitable access to electricity, and can even be used to define the energy service that better answers to local context needs. The LCOA therefore provides a more holistic and actionable framework for evaluating the sustainability and inclusiveness of off-grid energy projects.

### *3.3.1 Reducing financing costs*

The cost of finance for electricity access projects can have a substantial impact on the cost and affordability of the delivered energy service. Financing costs – measured by the weighted average cost of capital, the combination of the cost of debt and the cost of equity for any given project or company – reflect the risks, both actual and perceived, borne by finance

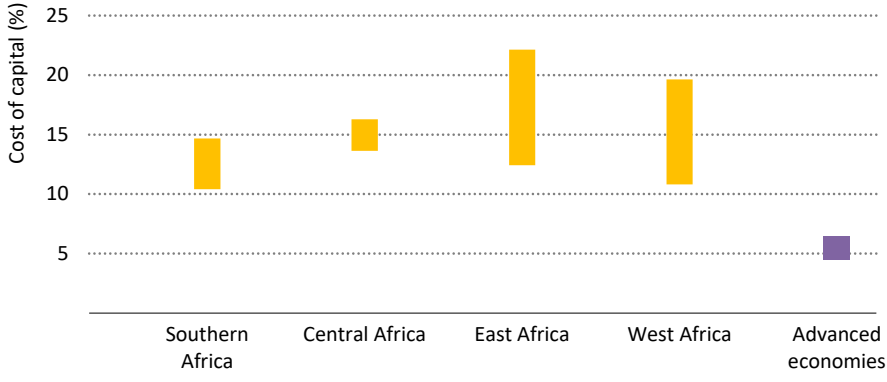
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providers. These include risks related to currency volatility, macroeconomic conditions and, in the case of electricity access, the challenges of smaller project sizes, lack of standardised financing models and the often-limited number of reliable offtakers at scale.

Debt is generally significantly cheaper than equity, as lenders take on lower risks and often provide the bulk of financing. Public sector financing from domestic governments, development finance institutions or state-owned energy utilities has historically dominated grid investments in Africa, primarily using low-cost, long-tenor debt (see Chapter 1). Meanwhile, mini-grids and SHS often rely on equity financing, which is more expensive and harder to raise, driving up the cost of finance for electricity access projects.

Empirical data on financing costs for electricity access projects are extremely limited. IEA analysis, based on local bond rates and associated risk premiums, shows that the cost of capital for developers is between three to four times higher than in advanced economies, with significantly more variation (see Figure 3.6).

**Figure 3.6 ▷ Estimated costs of capital for electricity access projects across selected regions**




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*The cost of financing electricity access projects in Africa is around three times the cost of capital for transmission and distribution projects in advanced economies*

Note: Advanced economy cost of capital is based on the cost of transmission and distribution projects given that universal access has already been achieved.

Sources: IEA analysis based on Hatton, Staffel, Jansen, Oluleye, & Hawkes (2025), and Agutu, Egli, Williams, Schmidt, & Steffen (2022).

Limited development of domestic capital markets in many African nations, coupled with elevated interest rates, often renders local currency financing for electricity access projects financially unfeasible. Developers often report local debt providers, primarily commercial banks, offering interest rates above 15%, compared to advanced economies where the rate is closer to 5%. Such high rates make debt repayments unsustainable for projects that already

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have tight profit margins since they are serving customers with constrained budgets. Many electricity access projects are therefore reliant on concessional financing – either through grants or low-cost project debt – to be considered bankable.

Much of concessional finance comes from international sources. While coming at lower rates, this financing is almost always provided in hard currency – primarily US dollars or euros. When revenues for electricity access projects are collected in local currency, but financing and equipment purchases are denominated in hard currency, this mismatch introduces a foreign exchange risk for developers. For larger developers, the currency risk can be absorbed or passed on through measures such as currency hedging, but these can be expensive and complex for smaller local companies or particularly volatile currencies. These smaller local companies are then locked out of accessing cheaper capital, which stymies the growth of the sector by preventing the creation of a pipeline of bankable projects.

High costs of capital across Africa significantly influences both the final electricity tariff and the overall cost of access to electricity. Since most grid financing comes from public sources – where cheaper debt is more widely available – this issue is most pronounced for decentralised solutions. Variations in the cost of capital translate into differences in both service costs and the financial viability of projects, with underserved or remote communities in particular being negatively affected. For mini-grid projects, half of the total LCOA stems directly from financing costs. If the cost of capital can be reduced to the average rate available in advanced economies, this could lead to a 25% reduction in the overall LCOA for mini-grids, allowing an additional 35 million people to afford the basic bundle, or an additional 5 million can afford the essential bundle. For SHS projects, around 20% of the total LCOA stems directly from financing costs, meaning the same decrease in financing costs would reduce the overall LCOA by 15%, allowing an additional 2 million people to afford the basic bundle. This demonstrates the importance of credit enhancement from international public finance to lower financing costs – these measures can be a particularly cost-effective when affordability needs are taken into consideration.

### *3.3.2 Using supply-side subsidies to reduce non-financing costs*

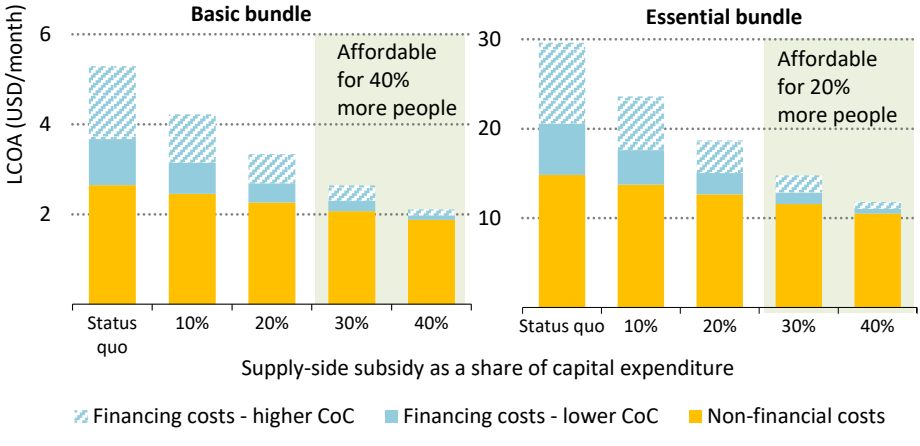
Targeted supply-side subsidies can be used to reduce the costs for developers without compromising service quality or long-term sustainability. One key instrument among supply-side subsidies is results-based financing (RBF), where payments to developers are made only after specific milestones are achieved. This approach shifts the performance risk to developers, incentivising them to deliver results. Financing is typically linked to measurable outcomes, such as the number of connections established or the quantity of electricity delivered. The extent of the subsidy has a clear impact on affordability gains.

Currently, mini-grids are primarily financed using equity and grants, with a very low share of debt. Adjusting these shares, increasing the debt and grant shares in particular, can have a significant impact on the affordability of projects. Today, only 45% of the population gaining access via mini-grids in the ACCESS pathway can afford the basic bundle. This number falls to

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less than 5% for the essential bundle. If CAPEX is subsidised by a further 30% via grants, the basic bundle becomes affordable for an additional 40% of the target population (equivalent to 63 million people), and the essential bundle becomes affordable to a further 10% (20 million people) (see Figure 3.7). Impact of cost of capital and supply-side subsidies on the LCOA of mini-grids for basic and essential bundles

**Figure 3.7 ▷ Impact of cost of capital and supply-side subsidies on the LCOA of mini-grids for basic and essential bundles**




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*Utilising supply-side subsidies to reduce CAPEX can have a significant impact on the affordability of mini-grids, making it easier for households to scale up consumption*

Notes: CoC = cost of capital. This analysis is based on real CAPEX, electricity demand and operating expenditure data from MGF (2024). Electricity is considered affordable if it accounts for less than 5% of a household's estimated household income. The higher cost of capital is assumed at 15%; lower cost of capital is assumed at 5%, based on analysis in section 3.3.1. Status quo refers to grant share of CAPEX at today's level of 40% and 60% of equity (see Chapter 1).

Source: IEA analysis based on data from Mini-Grid Asset database MGF (2024).

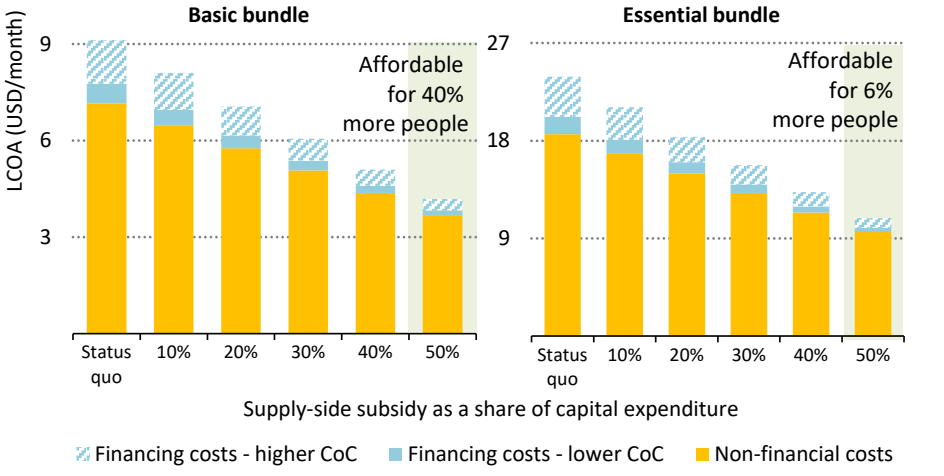
Another option is to improve mini-grid developers' access to debt. With the notable exception of a handful of mature mini-grid companies, the vast majority have not been able to access debt facilities at scale. Under the ACCESS, debt levels increase from the negligible levels seen today to 50%, with grants falling from 40% as of today to 20%. These changes combine to reduce the cost of financing mini-grid projects by up to 40%, which translates into a 25% reduction in overall project costs.

Bankability of mini-grid projects depends not just on households' ability to pay, but also on their energy service levels: most projects are not considered to be bankable if households can only afford the basic bundle, unless anchor loads are present. Further demand-side subsidies are therefore needed alongside supply-side measures to ensure energy service levels are high enough to support viable mini-grid development.

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Unlike mini-grids, SHS companies have had more success in raising debt finance, which accounts for over 60% of SHS financing (see Chapter 1). Non-financing costs therefore account for a much larger share of overall project costs for SHS companies than mini-grid companies. Supply-side subsidies targeting these non-financial costs can have a notable impact on affordability. Today, only 10% of the population gaining access via SHS in the ACCESS can afford the basic bundle, falling to less than 5% for the essential bundle. If an additional 50% of the CAPEX is subsidised by grants, then 45 million more people (40% of the population that gain access via SHS in the ACCESS) are able to afford the basic bundle, and an additional 10 million people (around 6 % of the target population) are able to afford the essential bundle (see Figure 3.8).

**Figure 3.8 ▷ Impact of cost of capital and supply-side subsidies on the LCOA of SHS for basic and essential bundles**




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*SHS are the solution for remote and low electricity demand households so they can power a minimum of appliances while supply-side subsidies are kept low*

Note: CoC = Cost of capital. This analysis is based on real CAPEX, energy demand and OPEX data. The LCOA is shown for two types of SHS, the basic bundle and the essential bundle. Electricity is considered affordable if it accounts for less than 5% of a household's estimated household income. The higher cost of capital is assumed at 15%; lower cost of capital is assumed at 5%, based on analysis in Section 3.3.1 Status quo refers to grant share of CAPEX at today's level of 5%, 60% of equity and 35% of debt (see Chapter 1).

Source: IEA analysis based EnDev (2024), GOGLA (2024) and SEforAll (2022).

The appropriate level of supply-side subsidies should be weighed up against many competing criteria. Firstly, grant capital is limited and plays many other important roles in increasing electricity access, so the cost-benefit analysis for this type of intervention needs to be carefully considered against other potential grant uses. Secondly, many concessional finance providers argue there are not enough bankable projects for them to provide subsidies to, so

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emphasis needs to be placed on helping the development of those projects (as outlined in the discussion of how finance evolves under the ACCESS in Chapter 2). The objective of this analysis is to highlight how this type of intervention can impact affordability to support a more nuanced discussion of how best to target concessional funding.



### 3.3.3 Using demand-side subsidies to reduce the cost for consumers

Even with reductions in financing costs and CAPEX, demand-side subsidies will almost certainly be necessary for at least the hardest-to-reach households. Demand-side subsidies are typically applied for connection charges and/or ongoing use of the electricity, for example by providing a cash benefit to low-income households or a certain amount of free electricity each month. However, when subsidies only cover connection fees, they are often insufficient to maintain usage, due to the low affordability of both electricity and appliances. A randomised evaluation in rural Kenya offered households different subsidy levels for grid connections, including some who received a 100% subsidy (free connection). Even with free connections, uptake remained low. Most households did not connect or, if connected, used very little electricity. The main barriers were not just the connection fee, but ongoing costs of electricity, credit constraints and the inability to afford appliances (J-PAL, 2016).

Robust, ideally geospatial, analysis of connection fees, electricity usage, and household income, will ensure that subsidies are set at the correct level. Furthermore, targeting will ensure that the most in need receive the subsidy and it does not have a market-distorting impact. Fossil fuel subsidies are often untargeted, which tends to benefit wealthier households. For example, in Indonesia in 2019 the top 20% of households by wealth received nearly half of all fuel subsidies, while the bottom 40% received less than one-fifth. Middle- and upper-income households, which make up about 20% of the population, consumed 42-73% of subsidised diesel and almost 30% of subsidised LPG (IEA, 2024).

Several countries across Africa have introduced effective subsidy schemes in support of access to electricity. In 1994, South Africa launched its **National Electrification Programme**, a large-scale, state-subsidised electrification programme targeting low-income households in both urban and rural areas. Subsidies covered a substantial portion of the connection cost, enabling millions of new connections (UCT, 1999). Then in 2003, the South African government launched the **Free Basic Electricity Policy**, providing a monthly allocation of free electricity (typically 50 kWh) to low-income households, ensuring that the lowest-income families access a basic level of electricity for lighting and essential appliances. Burkina Faso, supported by the Africa Development Bank (AfDB), introduced a project to invest in upgrading infrastructure and subsidising connections for electricity access among communities. The project reduced the connection cost by up to 80%, improving affordability and achieving over 32 000 new connections (AfDB, 2022). A study into the results of this programme showed that despite low uptake of electricity at the household level, there was a positive overall impact at the community level, including an increase in infant vaccination rates, electrified schools and drinking water provision (Schmidt & Moradi, 2022).

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All three approaches to improving affordability – reducing financing costs and employing supply- and demand-side subsidies – have the dual role of making projects more bankable while also reducing costs to consumers. A combination of all three approaches is likely to be necessary to support universal electricity access, particularly in some of the harder-to-reach communities. Broader efforts to improve economic development will also be essential to provide the most sustainable, long-term solutions.

## 3.4 Supporting vulnerable communities

Traditional market-based financing approaches often fail to reach the poorest, most isolated and often most in-need populations. Across the African continent there are hundreds of millions of people who live in challenging situations, be they refugees, internally displaced people (IDPs), or those living in informal settlements, conflict-prone states and small island developing states. These different groups are often geographically dispersed and bring unique challenges for providing and financing electricity access. In all these situations, electricity has the power to be life-changing. The following sections take each community in turn, discussing their unique challenges and highlighting financing solutions.

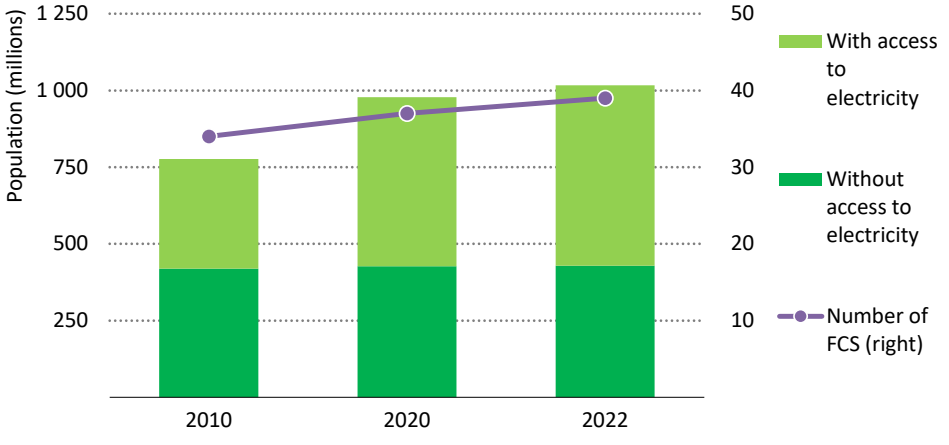
### *3.4.1 Fragile and conflict-prone settings*

Almost 60% of people who currently lack electricity access globally live in the 39 countries deemed as being in fragile or conflict-affected situations (FCS) by the World Bank. These are countries with high levels of institutional and social fragility and/or that are currently affected by violent conflict. Of these countries, over half (21) are in Africa, reflecting the continent's disproportionate share of conflict and instability, in addition to accounting for the largest share of the global population without electricity access. While energy access rates in FCS have increased from around 45% to nearly 60% since 2010, the absolute number of people without access to electricity in FCS has remained stubbornly constant (see Figure 3.9)

Financing electricity access projects in FCS presents additional challenges and barriers, including higher deployment costs, smaller project sizes, limited numbers of reliable offtakers and more volatile exchange rates. Conflict-related risks can lead to equipment damage, fuel shortages, unforeseen costs and prolonged construction times, all of which introduce additional risk to investors. Despite these challenges, cost reductions for renewables in recent years have led to solar mini-grids in particular being an increasingly attractive solution to address energy deficits in FCS, if finance can be accessed at affordable rates and risks can be adequately addressed or shared.

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**Figure 3.9 ▷ Evolution of energy access rates in fragile or conflict-affected situations globally, 2010-2022**




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*While energy access rates have increased, the rising number of FCS has meant that the number of people without access to electricity has remained roughly constant*

Note: FCS = fragile and conflict-prone states.

Source: IEA et al. (2025).

To overcome the higher costs and risks associated with electricity access projects in FCS while delivering affordable energy requires drawing upon a range of financing and de-risking tools and policy levers, including grants, guarantees and concessional loans. Many mini-grid projects in FCS are only viable with the support of these interventions, as otherwise they face difficulty in attracting commercial finance at affordable rates. For example, Nuru secured over USD 40 million in 2023 to develop solar mini-grid hybrid projects in the Democratic Republic of the Congo, the mobilisation of private finance for which was only possible by leveraging concessional capital from a number of international partners alongside full guarantees from the World Bank's Multilateral Investment Guarantee Agency.

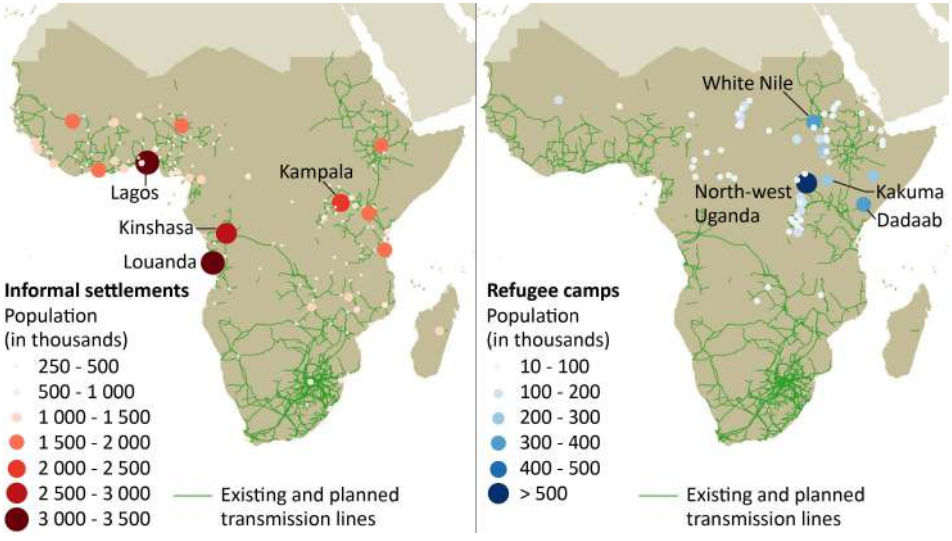
Innovative financing mechanisms for electricity access projects in FCS are also being explored. For example, Energy Peace Partners has developed a specialised version of the International Renewable Energy Credit (REC) for projects in FCS, the Peace REC, which provides a source of additional revenues to developers that can improve project viability and bankability. Over a dozen corporate transactions have already taken place, with a cumulative total of USD 1 million supporting the expansion of access to 125 000 people in five countries in sub-Saharan Africa.

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### 3.4.2 Informal settlements

As of 2018, around 45% of Africa's urban population lived in informal settlements – just under 240 million people (UN Stats, n.d.). The proportion is particularly high in sub-Saharan Africa, where over 60% of urban residents live in informal settlements (UN-Habitat: PSUP, 2020). These settlements range in size, with some of the largest like those near Lagos, Luanda, Kinshasa, Kampala and Nairobi hosting more 500 000 people (see Figure 3.10). Cities in Africa are expanding at an average rate of 3.5% per year, making it the world's fastest urbanising region. By 2050, the number of Africans living in urban areas is projected to double, with most of this growth expected to occur in informal settlements (OECD, 2025).

**Figure 3.10 ▷ Total population of largest informal (left) and refugee settlements (right), sub-Saharan Africa, 2023**




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*Millions of people in Africa live in informal settlements near urban areas or in displacement settings, where electricity access rates are often lower than other large population centres*

Sources: IEA analysis based on UNHCR (2025) and Büttnerm, Stalder, Volpi, Suel, & Harttgen (2025).

Rates of electricity access vary greatly between informal settlements, with many households gaining access through informal and/or illegal connections. Residents struggle to obtain a grid connection due to the lack of legal title on the land – utilities will often ask for proof of residence to justify the investment. Informal settlements are often unplanned, with narrow winding paths that make it prohibitively expensive and challenging to provide a grid connection. For example, it is estimated that 86% of household connections in Nairobi are informal, with only 14% relying on formal connections (Nuvoni Research, 2023).

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A number of African countries, such as Kenya, Ghana, Uganda, Sierra Leone, Tanzania and South Africa, have shown the political will to include informal settlements within official urban areas, and with it provide grid connections. South Africa has achieved an electrification rate close to 90% in informal settlements in Cape Town, which account for 16% of the total households of the city. However, the quality of the service can be low, with frequent outages (Caprotti, de Groot, Mathebula, & al., 2024). A recent study examining seven African cities found that residents of informal settlements are among the most disadvantaged urban populations, with income levels substantially lower than those in formal neighbourhoods, (ACRC, 2024). These low incomes make electricity access unaffordable for most residents.

Coupled with this is the challenge of informal connections reducing the ability to recoup investment. Organised gangs and cartels can establish control over illegal electricity connections. Playing a central role in both supplying power and maintaining their influence over residents and businesses, even when residents establish a legal connection, these gangs can disconnect them, forcing consumers back onto their illegal connections (Africa News, 2021). In Accra, informal settlement residents can have to pay up to 500% of the official connection fee due to bribes, unofficial meter acquisition and the need to buy extra infrastructure, and then pay electricity tariffs up to 60% higher than those in formal residential areas (Mensah, 2022).

Several financing solutions have been implemented as shown in Table 3.1, often utilising mini-grids with grant-based financing to make projects affordable and involving local communities in the project design and implementation.

**Table 3.1 ▷ Financing solutions to provide electricity access in informal settlements**

| Project | Description | Key innovation |
|---|---|---|
| **iShack, Cape Town, South Africa** | Set up in 2013, iShack provides SHS to households in informal settings. Initial grant funding came from the Bill and Melinda Gates Foundation and other private donors. | The repayment approach for households varies per settlement. In Stellenbosch, iShack has a PPP with the municipality, providing a maintenance and operation subsidy. Where PPPs are not available, a traditional PAYG model is adopted. |
| **Kasese Energy Access Fund, Kasese District, Uganda** | The fund was active during 2014-2020, allowing residents to purchase SHS and cookstoves. The EUR 5.7 million programme was managed by WWF with funds from the European Union and support from local government. | The fund was able to make bulk purchases of SHS to lower the costs. As a revolving fund, it would be replenished as households made repayments for their SHS. Microfinance repayments allowed households to pay in small instalments, and partial subsidies were provided by district government partnerships. |
| **ENACT Project, Kampala, Uganda and Freetown, Sierra Leone** | ENACT is funded by UK government through the Transforming Energy Access (TEA) platform. Across the TEA Platform, the UK government has committed GBP 265 million and the programme has leveraged GBP 1.58 billion to date. | ENACT adopts a hybrid approach with grid-tied connections where feasible and off-grid PAYG solar elsewhere. The project uses blended finance combining UK aid grants, equity, carbon credits and output-based grants tied to verified energy access outcomes, and crowdfunding and green bonds. |

Notes: PAYG = pay-as-you-go; PPP = private-public partnership; RBF = results-based financing

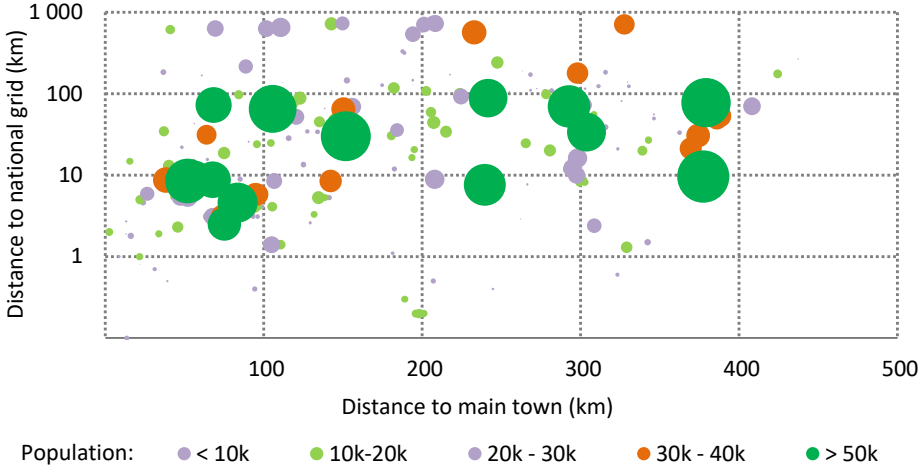
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### 3.4.3 Displacement settings

As of 2024, over 120 million people globally live in displacement settings, either as refugees or IDPs, with Africa hosting almost 300 settlements (UNHCR, 2024a) (Duccio Baldi, 2022). The situation is particularly acute in the Horn of Africa, which hosts 24 million displaced people, of which 19 million are IDPs (Xinhua, 2025). Access to electricity rates in displacement settings vary from camp to camp; however, overall estimates are as low as 7% to 10% (Duccio Baldi, 2022) (UNHCR, 2024a). Those households that have gained access have generally achieved only the basic bundle, which provides enough for basic lighting and phone charging (Fumagalli, 2024).

The ability to access funding and programmes aimed at increasing electricity access differs between IDPs and refugees. Under the African Union's Kampala Convention, ratified by 34 Africa countries as of 2024, IDPs are recognised as a state's citizen, enjoying full civil and political rights. This enables IDPs to participate in electricity access programmes in the same way as non-IDPs citizens (UNHCR, 2024b). With regard to refugees, while almost all countries recognise their legal status, the majority impose restrictions on the right to work and freedom of movement.

**Figure 3.11 ▷ Population size and distance of refugee settlements from the national grid and main town, sub-Saharan Africa**




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*While around half of refugee settlements are located in remote areas, 2.5 million people live less than 20 km from the national grid*

Source: IEA analysis based on UNHCR (2025).

Displacement settings are often treated as temporary, yet in practice many remain in place for decades, creating a mismatch between planning and reality. Beyond their temporary

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status, most displacement settlements are in remote locations, with roughly half located more than 20 km away from the national grid. Grid connections would represent the least-cost option for 2.5 million people living in displacement settings within 20km of the grid, but a lack of political will to recognise camps as non-temporary settlements makes this approach unlikely.

In many displacement settings – particularly those in remote areas – diesel generators remain the primary source of electricity for both residential and non-residential sectors, including the operations of humanitarian actors which commonly manage or provide services to these communities in partnership with local government entities. They are often the quickest solution, without requiring significant long-term contract commitments, but they are expensive, emissions-intensive and highly exposed to fuel price volatility. There is therefore a clear opportunity to scale up decentralised energy solutions, notably solar PV, both to expand electricity access for communities and achieve important cost savings for humanitarian operations. For example, the **International Organisation for Migration** (IOM) installed solar energy at all nine UN humanitarian hubs in Borno State, Northeast Nigeria. This involved hybrid solar power systems including 2 000 solar panels with an overall capacity of capacity of 1 250 kWp at hubs located in Maiduguri, Bama, Banki, Damasak, Dikwa, Gwoza, Monguno and Ngala (IOM, 2025).

However, private sector investment is limited due to high perceived risks and uncertainty over humanitarian funding (Moving Energy Initiative, 2019). The high upfront investment and longer payback periods associated with the provision of electricity from renewable sources, together with the with standard two- or three-year humanitarian funding cycles, pose a further barrier to private sector investment (GPA, 2020). Standard UN termination clauses included in long-term contracts add a further commercial risk for private electricity providers, as agreements may be discontinued prematurely if camps close or other developments significantly change the situation on the ground.

Official regulations often limit refugees from working – pushing them into the informal sector, with some camps having large informal economies. This presents two issues: firstly, those refugees who are earning income do so informally, and thus companies are unaware of their ability or willingness to pay for electricity services; secondly, refugees are often reliant on financial support from humanitarian operations and unpredictable remittance flows. These income streams are challenging for the private sector to base revenue expectations on. Financial guarantees to cover the risk of early termination offer a solution for the mitigation of this risk, encouraging private sector participation by enabling service providers to recover outstanding investment costs (GPA, 2021).

Support in the form of grants from the **Moving Energy Initiative** to **BBOXX** unlocked private sector investment in the Kakuma camp (Kenya). In the first months of operation there were no payment defaults – lower than Kenya's national average of 3% – and 90% of solar systems were used by refugee-owned businesses, with the company being able to expand its sales and continue its operations (Moving Energy Initiative, 2019) (Energy4Impact, 2019). More recently, **CEI Africa** has provided a grant of nearly USD 4.5 million to **Renewvia** to expand

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solar mini-grid power for refugees and host communities in Kakuma and Kalobeyei. Additionally, CEI Africa has awarded up to USD 4.2 million in RBF grant funding, the majority of which will be disbursed upon verification of new electricity connections (CEI Africa, 2025). Importantly, one-third of the RBF (USD 1.26 million) is structured as a forgivable loan, allowing for earlier disbursement (see Chapter 1 for discussion of RBF).

Displacement settings can present opportunities from economies of scale with the average size of a camp being above 24,000 people and programmes can also extend to neighbouring host communities (World Bank, 2022). Political willingness to include displacement settings in electricity access programmes plays a key role, particularly when aiming to create an enabling environment that attracts investment through clear regulations, targeted incentives and inclusive energy transition policies (see Box 3.2). Collaboration with humanitarian agencies is also essential to embed renewable energy into both emergency response and long-term development planning (NORCAP, 2025).

### Box 3.2 ▻ Innovative programmes supporting electricity access in displacement settings

Government and donor initiatives in Uganda, Ethiopia and Jordan highlight replicable approaches for financing electricity access in humanitarian settings and including displaced communities in national energy planning.

**Uganda:** Uganda stands out as Africa's largest refugee-hosting nation, with about 1.7 million refugees, and is known for its progressive integration policies. The government has prioritised including refugees in national development planning, especially through policies such as the **Sustainable Energy Response Plan for Refugees and Host Communities** (SERP), which outlines strategies for delivering crucial energy services to both refugees and host populations. These efforts are reinforced by inclusive laws granting refugees the right to work, move freely and access land for subsistence farming, creating an enabling environment that has attracted substantial donor support from organisations such as the World Bank, GIZ and the European Union. Notably, the **Energy Access Scale-up Project** (EASP), a USD 638 million programme, allocates 20% of its budget to districts with large refugee populations, exemplifying how Uganda scales up energy access while fostering long-term integration, self-reliance and resilience.

**Ethiopia:** Mercy Corps, through its **Enter Energy initiative**, is piloting a public-private partnership model for delivering long-term solar energy access to bring sustainable solar energy to displaced and host communities in Shedder Town, Somali Regional State, Ethiopia, benefiting 12 000 refugees and 6 000 citizens (as per last census in 2007). Previously dependent on expensive diesel generators and low-quality lighting, since May 2024, the community gained access to electricity via a solar mini-grid with battery storage, supported by 22 km of distribution lines, smart meters and remote monitoring systems. The project, implemented by the Ethiopian company Humanitarian Energy Plc – a joint venture between Mercy Corps and Rensys Engineering – offers affordable

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connection packages and pay-as-you-go (PAYG) tariffs approved by regulators. As of the first 12 months of operation, the mini-grid was supplying 24-hour renewable electricity to 1 161 customers, including 66 businesses and key services like a telecoms mast and health centre. Average monthly household consumption stood at 18.8 kWh, with demand growing at a rate of 6-8% per month. One in five customers of the mini-grid uses the electricity for income-generating activities, and all such users have reported increased earnings and improved productivity thanks to greater affordability and reliability of supply (Mercy Corps, 2025).

**Jordan:** Following the construction of a 12.9 MW facility – the largest in any refugee camp – in 2024, the Za'atari and Azraq camps (which host Syrian refugees) in Jordan received most of their electricity from solar PV. The plant was built in partnership with the Jordanian government and with funding from the Czech government and KfW; KfW also financed a second 46 MW solar plant in South Amman with the agreement that a share of the generation would be earmarked for Za'atari. As of early 2025, the facilities in the camps and South Amman were saving an estimated USD 12 million in electricity costs for humanitarian partners and avoiding 34 000 tonnes of $CO_2$ emissions per year. Following the fall of the Asad regime in December 2024, the population of the camps and thus electricity consumption could decrease if residents return home. However, because the solar plants are connected to the national grid, a reallocation of power is possible.

*Box written by the Global Platform for Action on Sustainable Energy in Displacement Settings (GPA).*

### 3.4.4 Small islands

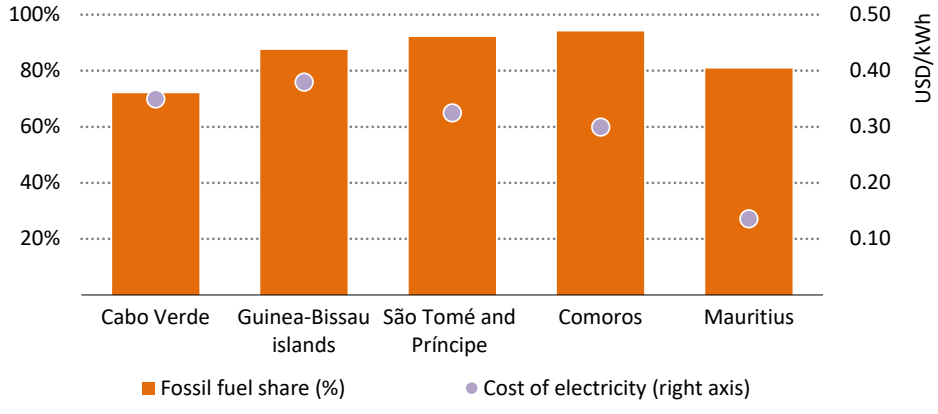
Taking the definition of the United Nations Conference on Trade and Development (UNCTAD) of an island population of less than five million people (UNCTAD, 2021), small island developing states (SIDS) in Africa have roughly five million inhabitants, primarily in Cabo Verde, Comoros, Guinea-Bissau, Mauritius, São Tomé and Príncipe, the Seychelles and Tanzania (Zanzibar, Pemba, etc.). Some island states have already achieved universal access, such as the Seychelles and Mauritius, primarily via fossil fuel generators, but for those islands that are part of a mainland country, access rates on islands tend to be lower. For example, the islands off Guinea-Bissau are estimated to have access rates lower than the national average of 45% (IEA et al., 2025) (The Macao News, 2025). Geographic isolation and high electricity prices due to imported fuel and small economies mean that SIDS in Africa face significant financial barriers to expanding affordable electricity access.

Electricity in African SIDS is generally provided via imported diesel, with fossil fuels accounting for 72% of electricity generation in Cabo Verde (LowCarbonPower, 2022) and almost 90% in São Tomé and Príncipe (see Figure 3.12). This makes countries highly vulnerable to fuel price fluctuations and supply disruptions. Cabo Verde spends around 7.5% of its GDP importing fuel (IMF, 2024), with additional costs from the need to redistribute the fuel around the archipelago. Similarly, São Tomé and Príncipe spends almost USD 40 million

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a year on imported fuel, primarily for electricity generation (AfDB, 2024), accounting for close to 30% of all merchandise imports in 2023 (World Bank, 2024a).

**Figure 3.12 ▷ Electricity price and fossil fuel share of electricity generation in selected African SIDS, 2024**




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*Electricity prices for African SIDS are around 25% more than the average price in African countries, except Mauritius where household electricity prices are heavily subsidised*

Sources: IEA analysis based on ESI (2025), ARME (2025), and AEP (2022).

Implementing subsidies to tackle the high price of diesel can prove costly for governments, with Mauritius' outlay increasing by almost 170% in 2024 due to spikes in diesel prices (Government of Mauritius, 2025). The majority of SIDS have targeted increasing their share of renewable power generation, generally to 50% by 2030. Financing projects is a challenge, for example finding a financial institution that is ready to take the risk of funding a pilot project for a nascent technology, such as floating solar PV, in one of the world's smaller and poorer countries. Costs for projects can also be inflated by climate change-induced risks. Given the small size of their economies, SIDS suffered the largest relative losses from natural disasters between 2000 and 2015 and a single natural disaster can have devastating impacts, wiping out entire economic sectors and eroding the development gains accumulated over decades (OECD, 2018). Given this, SIDS face higher insurance premiums, which both directly drive up the cost of energy projects and reduce government spending power for investment in energy infrastructure (Hagenlocher, et al., 2020).

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### Box 3.3 ▷ Integrating climate adaptation and resilience into electricity access finance for SIDS

Extreme weather events such as storms, wildfires, floods, droughts, monsoons and extreme temperatures affect energy production and infrastructure. Climate change is expected to intensify the frequency and severity of these hazards, posing an immediate concern for SIDS. Direct economic losses to SIDS from extreme weather events totalled USD 42 billion from 2000 to 2022, of which USD 18 billion can be directly attributed to climate change (ODI, 2024). This makes climate adaptation, the process of adjusting to the effects of climate change, an important part of electricity access planning in SIDS.

Beyond adaptation to climate impacts, building forward-looking climate resilience into existing and new assets is a critical consideration for energy systems. Resilience can be understood across three key dimensions: robustness to long-term climate shifts, the ability to maintain operation during immediate shocks, and the capacity to recover quickly from disruptions. Solutions for adaptation and resilience can be complementary.

Off-grid technologies can enhance the resilience of electricity supply by providing decentralised backup power for the continuation of critical services such as healthcare and water supply when centralised grids fail. However, off-grid solutions themselves are vulnerable to climate hazards, so resilience needs to be integrated during the design and investment stages. Comprehensive physical risk assessments can ensure that energy assets are installed outside high-risk areas, infrastructure can withstand local hazards, and assets are regularly maintained to identify vulnerabilities early. The IEA and OECD Climate Hazard Exposure Tracker and the World Bank's Resilience Rating System and Resilience Booster Tool can guide this process.

One of the main challenges in funding resilience and adaptation is the difficulty of quantifying the return on investment. Benefits such as avoided losses, improved system reliability and faster recovery do not represent immediate cost savings that are reflected in the electricity bill. Tools such as the GOGLA Off-Grid Solar Resilience and Adaptation Framework can build a business case by quantifying the contribution of off-grid solar systems to resilience with output- and outcome-level indicators (GOGLA, 2025).

In additional to SIDS, small islands exist within African countries; for example, Ghana's Volta River has 150 island and lakeside communities that have long been excluded from the national grid. Despite the funding challenges, a major mini-grid project for the Volta River communities demonstrates the potential for targeted solutions that are well adapted to the local context and supported by concessional finance. The Ghanaian government, together with AfDB, Climate Investment Fund and the Swiss State Secretary for Economic Affairs (SECO), launched a USD 70 million initiative to provide electricity to the communities via solar-powered mini-grids and lithium-ion battery storage and backup diesel generations (Energy News Africa, 2025). The project is a key part of Ghana's strategy to achieve near-

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universal electricity access by 2030 (AEP, 2019). The first phase has already connected thousands of residents, and on project completion will have an installed capacity of 4.5 MWp providing access to over 80 000 people. To ensure the long-term maintenance and sustainability of the project, the Public Utilities Regulatory Commission (PURC) has been asked to incorporate the mini-grids into the national grid tariff arrangements.

**Table 3.2 ▷ Financing solutions to provide electricity access in SIDS**

| Country | Company | Details |
|---|---|---|
| **Seychelles** | Qair (French independent renewable power producer) | In April 2023, the Seychelles Public Utilities Corporation signed a power purchase agreement (PPA) with Qair to develop a 5.8 MWp (megawatt peak) floating solar PV installation in Providence lagoon, Mahé Island, Seychelles. The winning tariff bid for the PPA was USD 0.095 per kWh, offering significant savings compared to the cost of fossil fuel-based generation in Seychelles. Despite not being widely used in Africa, floating PV can serve as a key tool in providing more affordable electricity in SIDS, especially given space constraints. |
| **Global (SIDS relevant)** | Global Environment Facility (GEF) | GEF has introduced a dedicated funding window to support SIDS that are not classified as least developed countries (LDCs), including Cabo Verde, Mauritius and the Seychelles. Non-LDC SIDS often struggle to compete for climate funds due to higher per-capita GDP, despite facing similar or greater climate risks than LDCs. Each eligible non-LDC SIDS can access at least USD 3 million in adaptation finance under this window. |
| **Indonesia** | Mini-grid is owned and managed by a community enterprise: Village-Owned Enterprise (*Badan Usaha Milik Desa)* | Mata Redi, a rural village on Sumba Island, Indonesia, became a model for community-led renewable electrification with the installation of a solar and battery mini-grid as part of the UK-Indonesia MENTARI programme. An inclusive system allowed residents to pay in instalments and manage outstanding electricity bills flexibly. The MENTARI programme subsidised the connection cost at IDR 500 000 (approximately USD 35) per household. Tariffs for ongoing electricity provision were designed to be affordable and aimed to remain below the local utility (PLN) prices, ensuring accessibility for the community – even after subsidy withdrawal. |

## 3.5 Improving gender balance in electricity access finance

In many African countries, women are the providers and managers of household energy, with many also engaged in energy-consuming businesses and community networks (Energia, 2017). They therefore play a crucial role in advancing electricity access, both as consumers of new electricity services and as drivers of growing demand either through entrepreneurial activities or through their roles in the community.

Evidence also shows the positive impact on women once electricity access is provided. Some studies estimate that women's job opportunities increase by 23% due to time saved on household tasks (Nithio, 2023). Access to electricity can also open up new avenues for female entrepreneurship in electricity supply chains, in operations and maintenance, and in productive uses of electricity. This is most evident in agriculture – the largest sector on the

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continent, which is dominated by women – and access to electricity opens new opportunities to improve productivity or diversify their farms. However, access to finance remains a key obstacle to taking advantage of these benefits.



### 3.5.1 Gender gap in access to finance

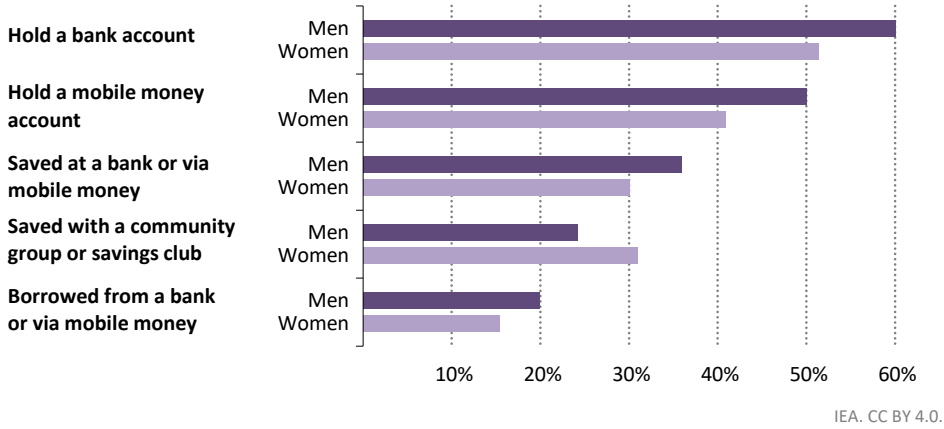
Women-owned micro, small and medium-sized enterprises (MSMEs) in Africa had an estimated financing gap of USD 42 billion in 2019 (latest available data) (IFC, 2025a). MSME financing is already challenging, with a mismatch between company financing needs and products offered by commercial banks. In Nigeria, less than 1% of commercial bank loans go to MSMEs, compared with an average of 15% in other developing countries (World Bank, 2024b). Within this 1%, only 11% were directed to women-led businesses. As a result of this inability to access finance, many women rely on their own savings to fund the early business development phase, including the running of pilots that could help attract small-scale equity investors. This represents a major barrier, particularly in rural areas where savings are low.

The drivers of this inequitable access to finance are both demand-side and supply-side. Literacy rates are notably lower among women, particularly in rural areas, with a 20-percentage point difference between men and women in some countries (AFI, 2024). Women are also significantly less likely to participate in the formal banking sector, with only 50% of women reporting having a bank account, compared with 60% of men (see Figure 3.13) (World Bank, 2025). Partly as a result of this lower familiarity with the formal financial sector, there is significant evidence that women entrepreneurs self-censor when considering how to raise capital for their businesses, meaning that even in cases where they may be able to access finance from other sources, such as a commercial bank, they rely on their own savings instead (AfDB, 2020). This self-censorship has been noted across businesses regardless of their credit-worthiness and in the absence of discriminatory lending practices, suggesting it is not exclusively the result of financial institutions' practices (IMF, 2020).

On the supply side, there are severe restrictions linked primarily to credit assessments and collateral. Many women-led businesses face higher interest rates due to challenges in assessing their credit history, which can be limited due to a lack of previous engagement with the banking sector and prohibitive collateral requirements. When lending to MSMEs, most commercial banks in Africa will require collateral of a higher value than the loan being issued. However, women often have very restricted access to collateral, even when equal inheritance rights or ownership rights are enshrined. Immovable property and land are still most banks' favoured form of collateral, which disadvantage women since ownership rates are notably lower: continent-wide, only 13% of women own a house, compared with nearly 40% of men (Brookings, 2018). Women are also more likely to save informally, in movable assets and traditional wealth storage mediums such as livestock and gold.

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**Figure 3.13 ▷ Financial inclusion metrics by gender, Africa, 2024**




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*Women experience lower financial inclusion, being more likely to use community financing such as savings groups, although it has improved thanks to mobile money accounts*

Source: World Bank (2025).

### 3.5.2 Steps to improve access to finance

Women-led businesses are present in both the supply of electricity access – such as SHS distributors – and in demand creation – such as productive uses of electricity. In both areas, women's role in key economic activities such as agriculture and as managers of household electricity makes them well positioned to develop businesses tailored to consumer needs, Key to driving more finance into these women-led businesses is creating a strong enabling environment via supportive regulations and the development of more granular sex-disaggregated data. This builds a foundation for women-targeted approaches by both private and development financiers, such as gender-lens financing or adapted lending practices.

#### *Enabling environment: Data and regulatory changes*

Several countries in Africa still do not enshrine equal access to property, inheritance and the banking system in their legal framework. For example, in six African countries, women require their husband's consent to open a bank account (Banque de France, 2023). Beyond the legal framework, regulations can also be created to promote financial inclusion, often starting with a review by the central bank. The National Bank of Ethiopia launched a Women's Financial Inclusion Scorecard, with support from the World Bank, in March 2025, which allows financial institutions to assess how well they are servicing female clients. Central banks can also introduce MSME and gender targets for lenders, as in Egypt, where banks are required to establish MSME financing units, with a target that women-owned MSMEs should make up 20-25% of total MSME lending portfolios (Energia, 2023). Given the limits that collateral requirements impose on many female entrepreneurs, governments can also pass regulations to introduce moveable collateral registries that help establish the value

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of collateral other than land. At least 15 countries in Africa have these registries (Women's World Banking, 2022), but in most cases these registries remain underused, indicating further support from regulators and central banks, or capacity building programmes at banks, may be needed (CGAP, 2025) (IFC, 2025b).

Better data is needed on women as users of financial services and on the preferred financing approaches of women-led businesses. The lack of sex-disaggregated data means not enough is known about the preferences of women-led businesses: why they self-censor when accessing finance, what financial products they would prefer, and where non-financial support might be necessary. Improved sex-disaggregated data would therefore open new opportunities both for electricity developers, who could better assess the needs of women-led businesses, and for financial providers, who could design more targeted products.

### *Gender-lens financing solutions*

There is a strong business case for financial institutions to expand their product offering to support female entrepreneurs. Women are playing a larger part in the financial system, with women's account holding in sub-Saharan Africa increasing by 12% since 2017 thanks largely to the proliferation of mobile money account options, which represent an opportunity for financial institutions to broaden their client base (Klapper, 2024). Multiple studies show that women have higher repayment rates for microfinance loans, resulting in fewer non-performing loans (Aktaruzzaman & Farooq, 2023). That being said, financial offerings for women-led businesses may need to include tailored non-financial support in order to allow women to fully take advantage. While there are multiple approaches, examples include:

- **Capacity building:** The **AfDB's Affirmative Finance Action for Women in Africa** (AFAWA) seeks a comprehensive approach, offering both capacity building services for women entrepreneurs as well as a risk-sharing mechanism, the AFAWA Guarantee for Growth, to support on-lending from local financial institutions to women-led businesses. G7 leaders pledged USD 251 million to back AFAWA in 2019, aimed at unlocking USD 3 billion in private sector funding.
- **Improved credit-scoring instruments:** Given that risk assessments present one of the most frequently cited hurdles in improving women-led MSME finance, innovative credit assessment tools can be implemented as part of financing instruments. **Nithio** uses an AI-enabled credit scoring tool and then provides a discount on the interest rates charged to electricity distributors when they achieve pre-established targets for connecting women-led households and women-owned businesses.
- **Raising dedicated funds at banks:** In 2022, **NMB Bank** in Tanzania launched the Jasiri Gender Bond – the first of its kind in Africa. The bond dispersed TZS 74.2 billion (USD 32 million) in three quarters, providing loans to over 3 200 women-owned MSMEs at rates of 14% compared to the market average of 19% (NMB Bank, 2023).

There is evidence that by leveraging alternative data, banks can reduce collateral requirements with no impact on repayment risks or non-performance of loans. An example of this is the introduction of cashflow-based lending, as has occurred in Nigeria, where the

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six largest commercial banks are all offering collateral-free business loans of up to NGN 20 million (USD 13 400 in October 2025) with tenors of between 6 and 24 months (World Bank, 2024b). Under this approach, analysis of the business cashflow, as opposed to credit history and collateral, is used to determine the viability of an application and the size of loan to offer. These loans can be combined with programmes specifically targeting women-led businesses, such as at Access Bank, where women-led SMEs are also offered a preferential interest rate. Between January 2021 to August 2023, Access Bank reported repayment rates of cashflow-based loans of 99%, with 30% of business loans distributed to female customers (World Bank, 2024b). Replicating these approaches in other markets could improve women's access to capital, supporting not just an expansion in electricity access, but also helping drive broader, more gender-equal socio-economic development.

## 3.6 Maximising the impact of concessional resources

Concessional resources from international public finance providers and philanthropies play a crucial role in tackling some of the challenges outlined in the chapter. These funds can absorb more risk and contribute financing to non-commercial activities, such as technical assistance or financial support to low-income households. Given macroeconomic challenges, shrinking domestic budgets and reductions in development aid, it is imperative to adopt a more catalytic and strategic approach to the use of limited concessional funding. This includes addressing elevated risk levels and creating an enabling environment for private **investment**. Key focus areas for concessional funds are outlined in Table 3.3.

**Table 3.3 ▷ Summary of strategies for concessional capital providers**

| Category | Key action | Challenges addressed |
|---|---|---|
| Investment areas | Direct funding to the neediest populations | Scarcity of capital |
| | Close the affordability gap through subsidies | Pricing barriers |
| | Enhance capacity for data collection and reporting | Weak institutional capacity<br>Lack of data |
| | Provide technical assistance and capacity building to create an enabling environment for investor participation | Weak institutional capacity<br>Regulatory risk |
| Financial instruments | Move away from senior debt towards higher risk-taking positions | Offtaker risk<br>Regulatory risk |
| | Encourage experimentation of innovative deal structures | Offtaker risk |
| | Scale up support for affordable risk mitigation mechanisms | Currency risk<br>Political risk<br>Regulatory risk<br>Offtaker risk<br>Pricing barriers |
| | Consider exit strategies for concessional capital providers | Scarcity of capital |

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### 3.6.1 Priority investment areas for concessional capital providers



*Direct funding to the neediest populations*

Concessional capital plays a vital role in expanding electricity access to populations living in the most challenging environments – areas where private investors are least likely to engage due to elevated financial and political risks. However, current finance flows remain unevenly distributed across the region, with roughly 50% of funding concentrated in just six countries: South Africa, Mozambique, Kenya, Senegal, Angola and Nigeria. To maximise the impact of available financing, the focus should be shifted toward the most underserved populations.

For some of the most complex settings – fragile and conflict-prone states, informal settlements, displacement settings and small islands – while grid extension may be technically feasible, they are often deprioritised due to high costs, logistical hurdles and a lack of political will. Decentralised clean energy solutions offer a viable alternative. However, private sector involvement remains limited due to high perceived risks and uncertain returns. Concessional financing, particularly through de-risking instruments such as financial guarantees will be essential to unlock investment in these complex environments.

Concessional capital providers can also pioneer gender-lens financing solutions, cognisant of the additional challenges women face in gaining access to financing. Within their own programmes, they can also endeavour to strengthen sex-disaggregated data, the lack of which acts as an impediment to closing the gender gap in access to electricity finance.

*Close the affordability gap through subsidies*

Targeted supply-side subsidies from concessional capital providers can lower the CAPEX for the production and distribution of electricity. For mini-grids, an additional 30% supply-side subsidy would make the basic bundle affordable for a total of 145 million people, representing an increase of 63 million. The same subsidy amount would make the essential bundle affordable to 20 million. For SHS, an 50% supply-side subsidy would make the basic bundle affordable for a total of 60 million people, representing an increase of 45 million. The same subsidy amount would make the essential bundle affordable to 10 million people. Tailoring subsidy levels to system size and local income conditions helps ensure that energy access is inclusive and commercially viable.

Capital can also be directed to demand-side subsidies to reduce electricity costs for customers. Subsidies for connection fees are often not enough to maintain usage; subsidies for ongoing costs are also needed to increase the affordability of electricity costs and overcome household credit constraints and the inability to afford appliances. Setting subsidy levels appropriately requires robust analysis of both upfront and ongoing electricity costs, alongside detailed household income data, to ensure support reaches those most in need. Concessional capital providers can play a key role in this process – not only by offering financial support, but also by providing the technical assistance necessary to design and implement effective, data-driven subsidy schemes.

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The IEA has outlined several key considerations and recommendations when designing and implementing a subsidy scheme to improve the affordability of the energy transition, a full discussion of which can be found in *Strategies for Affordable and Fair Clean Energy Transitions* (IEA, 2024). Table 3.4 provides a summary.

**Table 3.4 ▷ Selected recommendations for electricity access-related subsidy design**

| Principle | Recommendation |
|---|---|
| **Affordability and targeting** | Use data-driven targeting to reach the poorest; avoid untargeted subsidises that benefit the wealthy |
| **Product/service eligibility** | Limit support to technologies meeting quality/service standards |
| **Subsidy level** | Match subsidy to affordability gap; use simple, transparent structure |
| **Delivery mechanism** | Prefer company-based RBF for scale/efficiency; direct transfers for specific cases |
| **Transparency and accountability** | Ensure transparent, accountable delivery; involve stakeholders |
| **Integration and sustainability** | Align with national plans; phase out untargeted subsidies; support market development |
| **Verification and feedback** | Implement robust verification and feedback systems |

### *Enhance capacity for data collection and reporting*

Access to high quality data is essential for investment decisions and project evaluation. Smaller developers, especially local start-ups, often lack resources to collect key performance metrics like load profiles and project impacts needed to meet investor expectations. Concessional capital providers can bridge this gap by offering technical assistance to generate investor-grade project data. Sector-wide data platforms can further enhance transparency. For example, **Prospect**, funded by the **Access to Energy Institute** and **GET.Invest**, provides open-source project-level data to support planning and investment.

At the deal level, data on pricing, financial structure, risk-sharing mechanisms and investment returns are often confidential or inconsistently reported. Blended finance often suffers from limited visibility not only of investment returns, but also of the performance and catalytic impact of concessional capital (Toledano, Camelo Vega, & Wilke, 2025). National-level data, such as the cost of capital, are also rarely available. To improve data reliability and availability, concessional capital providers can enhance data transparency on the transactions they participate in. They can lead by expanding initiatives such as the **Global Emerging Markets Risk Database** (GEMS), with standardised information on clean energy de-risking, default rates, capital mobilisation rates, concession levels and project returns.

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*Provide technical assistance and capacity building to create an enabling environment for investor participation*

Concessional capital providers can assist project developers to structure deals in line with commercial investor expectations and supporting governments with policy reforms and regulatory standardisation, for example standardising mini-grid regulations or allowing private investment in grid networks. Deepening local capital markets and promoting financial inclusion is another key role. For example:

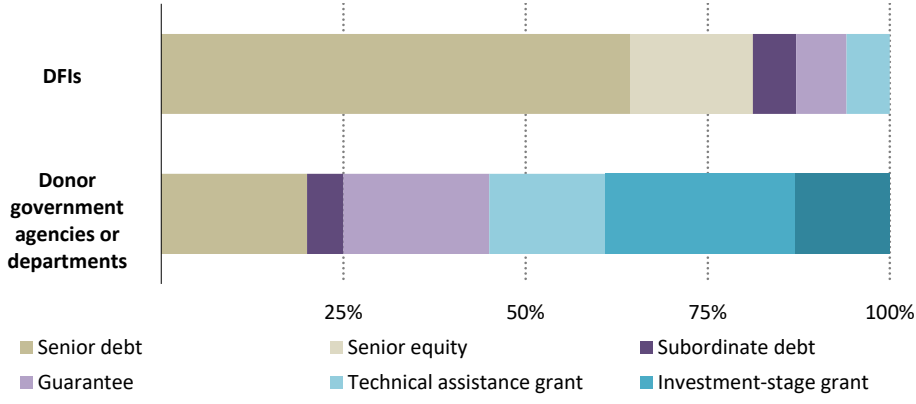
- **The Solar Financing Program by Uganda Energy Credit Capitalisation Company (UECCC)** is a Ugandan government-funded programme that provides concessional funding, partial credit guarantees, grants and technical assistance with the aim of enabling private sector participation in renewable energy development. UECCC provided catalytic support to 18 local financial institutions in Uganda to kick-start renewable energy lending (UECCC, 2022).
- **The GET.invest Enabling Domestic Green Energy Finance Programme (EDGE Finance**) works with domestic financial institutions to support local currency financing for green energy in sub-Saharan Africa. The programme provides free-of-charge support through tailored training to strengthen the expertise of companies and financial institutions in financing green energy and accessing concessional capital (GET.invest, n.d.). EDGE Finance is currently active in nine countries in sub-Saharan Africa (GET.invest, 2025). These engagements include coaching domestic financial sector actors ranging from commercial banks to microfinance institutions in Rwanda, Mozambique, Burundi and Nigeria, on renewable energy project finance (GET.invest, 2022).

### 3.6.2 Financial instruments for concessional capital to reduce project risk

Concessional capital providers can use a variety of financial instruments, often in combination, to improve a project's risk-adjusted returns and mobilise much-needed private capital. Over the past three years, donor government agencies or departments have supplied around USD 5.1 billion in concessional capital across all categories of blended finance transactions (Convergence, 2025). DFIs contributed approximately USD 3.5 billion in concessional capital, with a notable focus on risk-mitigation instruments such as guarantees and insurance. The remaining 80% of DFI contributions to blended finance transactions were provided on commercial terms, while concessional capital was typically provided by donor-funded concessional pools (Convergence, 2025).

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**Figure 3.14 ▷ Financial instruments used in blended finance by selected actors**




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***80% of DFI blended finance investment is in commercial debt and equity, while 60% of investment from donor government agencies or departments is in grants and guarantees***

Note: DFI = development finance institutions. Numbers cover global blended finance transactions, not energy-specific or Africa-specific transactions.

Source: Convergence (2025).

### *Move away from senior debt towards higher risk-taking positions*

Within any given financing structure, multiple different debt or equity positions are available to finance providers, which affect when a provider would be repaid in the event of a default. Senior debt positions are repaid first, hence carrying the lowest risk. This is followed by subordinated debt (sometimes known as junior debt), with equity positions (often also divided into tranches also based on seniority) repaid last.

When taking subordinated positions in a blended finance transaction, concessional capital providers agree to absorb initial losses if the investment underperforms. However, concessional capital is not always deployed in higher risk positions. Between 2022 and 2024, only 18% of concessional capital in all blended finance transactions was subordinated debt, while 49% was senior debt (Convergence, 2025). For more risk-averse DFIs, subordinated positions were even lower at around 6%. Scaling electricity access will require greater willingness to absorb risk, especially during project development and construction phases, where commercial investment is limited (ODI, 2025).

Expanding equity investment is another area where concessional capital can catalyse private sector involvement. As mentioned in Chapter 2, limited equity availability is a major barrier to scaling up decentralised solutions. While concessional capital providers have historically avoided higher-risk equity, initiatives like the **Zafiri fund** show the potential of patient equity, which will be essential for the expansion of electricity access. Another area suitable for higher-risk concessional capital is transmission and distribution. The extension of the

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national grid can be the largest-scale solution for roughly 45% of the population that still lack an electricity connection. However, utilities face financial challenges – low collection rates, high debt burdens, rising component prices and uncertainty around revenue recovery. Concessional capital can help absorb more risk, although its impact depends on supportive national policies and regulatory frameworks that enable private sector participation.



**Table 3.5 ▷ Case studies on maximising concession levels in capital stacks**

| Blended finance facility | Details | Innovations |
|---|---|---|
| Acumen – **Hardest to Reach Initiative (H2R)** | H2R is a near USD 250 million initiative focused on off-grid solar in 17 African countries. It includes two funds: the USD 57 million Catalyse Fund provides equity, debt, grants and technical assistance; the USD 312 million Amplify fund has equity tranches as impact-linked loans with grant-funded subsidies. | The two independent financing mechanisms address different capital gaps, with Catalyse for early-stage companies and Amplify for growth-stage companies. The impact-indexed loans in the Amplify Fund help expand last-mile investment into the hardest-to-reach communities. |
| Mirova – **Gigaton Fund** | The Gigaton Fund is a USD 282 million blended finance debt fund targeting SMEs in clean energy in sub-Saharan Africa. It includes a design stage grant for fund structuring and impact evaluation, multiple debt tranches and a partial portfolio guarantee by SIDA. The fund offers loan terms of up to 11 years, with amortisation aligned to cash flows. | The Gigaton Fund embeds gender into its investment process, assessing investees against the 2X Criteria and setting portfolio targets for women-led companies. The fund offers longer financing than typical lenders (up to 11 years), which is more aligned with SME cashflow timelines. |
| Climate Fund Managers – **Climate Investor One (CIO)** | CIO is a USD 1 billion blended finance facility for solar, wind and hydropower, including for energy access in Africa. It consists of a USD 50 million Development Fund, a USD 800 million Construction Equity Fund and a USD 800 million Refinancing Fund for operational projects. In 2024, the blended facility catalysed USD 365 million in debt and equity into supported projects. | CIO offers whole-of-life financing across its three funds, aligning capital with project risk levels at the development, construction and operational stages. This allows projects to access different instruments adapted to their stage of development. |

### *Encourage experimentation with innovative deal structures*

Concessional capital providers can encourage experimentation with financial instruments and structures that can demonstrate the viability of new approaches in different contexts, paving the way for replication and scaling up by commercial investors. For instance, the UNDP's **Climate Aggregation Platform** (CAP) supports the structuring and deployment of innovative business models in financial aggregation to accelerate energy access.

Interesting examples of aggregation in use or being piloted include the following:

- The **Demand Aggregation for Renewable Technologies** (DART) programme in Nigeria is a USD 25 million aggregated procurement financing initiative for solar companies working on rural electrification. All On, a Nigerian impact investing company, supported

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by GEAPP, provides debt funding for solar companies to purchase equipment. Procurement and logistics are centralised, standardised and aggregated, unlocking economies of scale for renewable energy developers. Depending on the component, DART has resulted in savings of 5-20% on CAPEX costs (AMDA, 2024).

- **Mirova SunFunder** is piloting an approach, thanks to a grant from CAP, to assess the feasibility of pooling carbon finance assets among mini-grid developers. It proposes aggregating carbon credits and Distributed Renewable Energy Certificates (D-RECs) that would be purchased by a special-purpose vehicle and then sold on to climate asset buyers. Developers would be offered partial upfront payments and deferred incentives tied to verified issuance of carbon credits. Modelling results show that aggregation would enable D-RECs to cover 5.79% of CAPEX, as opposed to 2.34% under a single developer (UNDP, 2024).
- **Solaris Offgrid** has created a receivables purchasing platform, Bridgin, where stand-alone system companies can upload a portfolio of receivables for investor selection. The platform uses inputs from developers' PAYG management platforms to allow investors to conduct due diligence on the receivables. As with traditional securitisation deals, the stand-alone system developer remains responsible for servicing clients, but the repayments go directly to the investor. Bridgin conducted a successful pilot in Kenya, with a positive feasibility study also carried out in Uganda.

### *Scale up support for affordable risk mitigation mechanisms*

Guarantees are a key credit enhancement tool that allow project developers to transfer project- and country-level risks to a third party. Concessional capital providers are well-positioned to scale up such risk mitigation mechanisms, improving the affordability and availability of financing. For example, **InfraCredit** in Nigeria offers local currency guarantees to boost the creditworthiness of infrastructure projects and to attract investment from domestic pension funds.

Currency risk, one of the most significant barriers for energy access, can also be mitigated via concessional tools. Increased local currency lending – either directly or through local financial institutions – can align project revenues with debt obligations. Local currency finance is more critical for distributed renewables, where smaller developers often lack access to affordable hedging tools. Concessional capital can help subsidise and scale up such instruments. The **European Commission Pricing Facility**, for example, enables **The Currency Exchange Fund** (TCX) to reduce interest rates on EUR 80 million of loans by using tools such as cross-currency swaps and forward contracts (TCX, 2025). In 2024, TCX supported a USD 2 million investment by Acumen's Hardest to Reach Initiative into **Yellow Malawi** – a last-mile SHS and smartphone provider (Acumen, 2024). Thanks to the facility, TCX lowered the cost of hedging in Malawian kwacha by 5%, helping Yellow Malawi reach 182 000 people, 80% of whom gained energy access (TCX, 2024).

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*Consider exit strategies for concessional capital providers*

Exit strategies for concessional capital providers are approaches to phase out below-market-rate financing and replace it with commercial capital once projects are operational and risks have reduced. Such approaches, often referred to as "exit mobilisation", allow commercial capital to play a larger role in electricity investments, while freeing up concessional capital to be reinvested in greenfield projects. Functioning capital markets are a prerequisite for exit mobilisation. While exit strategies are theoretically built into the development finance model, DFIs have developed a strong reliance on self-liquidating instruments and tend to hold investments to maturity, partly because alternative sources of liquidity are unavailable (Eighteen East, 2021). Concessional capital providers can help by supporting transparency and capacity building towards financial inclusion.

Beyond challenges from a market structure perspective, structures for exit on a deal level are not yet mainstream and in the case of electricity access projects can be complicated by the continued need for subsidisation to maintain affordability. That said, exit mobilisation could prove a useful tool for larger access-related projects, notably grid or mini-grid projects once they are operational and consumption levels have been proven.

Achieving universal electricity access will require a dramatic increase in investment flows, better-targeted public funding and greater mobilisation of private capital. While the grid provides the largest share of new connections, off-grid solutions are necessary to deliver affordable energy to rural areas and to more complex settings where grid extensions may not be possible. Scaling up access must go hand in hand with affordability measures, to ensure that communities can take advantage of electricity services once connections are made. Financing mechanisms must prioritise the most vulnerable populations, integrating subsidies, blended finance and innovative delivery models to reduce the cost burden on end-users. Energy access strategies should also support community-led solutions and local entrepreneurship, including from women-led businesses, to ensure long-term sustainability and socio-economic benefit. The pathway to universal electricity access is clear but achieving it demands co-ordinated action across governments, financial institutions, development partners and the private sector.

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# ANNEXES



# Methodology

This document outlines the methodological steps that the IEA has undertaken to:

- Track financing commitments in electricity access
- Assess affordability

## A.1 Tracking financing commitments in electricity access

The data presented tracks financing commitments for electricity access in sub-Saharan Africa. The data covers financing committed from international and domestic private providers, and international public providers. Input data from the IEA's investment model is complemented with data to track access-specific financial flows (particularly those in the off-grid sector) and instruments (such as market support and grants).

The tracking methodology can be broken down in three main steps:

- Finance commitments are tracked within the electricity sector; this includes both the technology split, investor, and instrument type.
- A portion of tracked total investment numbers is attributed to the residential sector, where households are the end users.
- A portion of the investment in the residential sector is attributed to providing first-time electricity access. This attribution occurs at the sector-level.

### *Measuring total finance commitments in the electricity sector*

Across the power sector, there are multiple types of investment data, covering both project- and corporate-level finance with varying levels of granularity available from data providers. Steps have been taken to ensure that the estimates are consistent and comparable across sources. Notably, this means that across sources we are tracking financing commitments – i.e. capital raised by private companies or committed by international public finance institutions. In practice, this financing will not all be spent or disbursed in the year it is committed.

Financing in the power sector covers grid connected power (both renewable and fossil fuel), grids networks, mini-grids, other off-grid, market support, and energy efficiency spending. For mini-grids and other off-grid solutions, both renewable and fossil fuel or hybrid solutions are considered. Market support includes energy sector policy, planning, and aid to energy ministries and other institutions for activities related to the SDG7; institution capacity building and advice; market building; and energy regulation, training, and research.

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*Data sources used*

| Source | Description | Provider | Sector |
|---|---|---|---|
| AidData | Global Chinese Development Finance Dataset version 3.0. Covers China's overseas development finance | Includes Chinese central, regional, and local government agencies; state-owned enterprises, policy, commercial banks, and funds | All sectors |
| Bloomberg New Energy Finance | Renewable energy asset database | Private finance | Grid-connected renewables |
| Cleantech Group | I3 Market Intelligence. Tracks venture capital and private equity investments in clean energy-related companies | Private and public finance | Mainly used for mini-grids and off-grid; some data on grids, and grid-connected renewables |
| GOGLA | Investment data tracking capital raises by off-grid companies | Mainly private finance | Other off-grid |
| IJGlobal | Project finance data in energy and power sectors | Private and public finance | Mainly used for grid-connected power, grids networks, mini-grids, other off-grid |
| OECD | CRS database. Covers data reported by members of the OECD DAC and multilateral institutions | Public finance, mobilised private finance, and Climate Funds | All sectors |
| World Bank | PPI database. Covers contractual arrangements for public infrastructure projects in which private parties assume operating risks | Private and public finance | Mainly used for grid-connected power, mini-grids and other off-grid sectors |

To prevent duplication in data aggregation, steps are taken to identify and remove the double counting that might arise from the consolidation of different data sources, with considerations around the reporting of projects' year of commissioning, instrument used, investor and transaction type.

Other relevant information:

- For CRS the latest year is current year minus two. For AidData, the latest year covered is 2021.

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- The data includes transactions that have reached financial close and that can be considered as primary financing. The data does not track disbursements, domestic government financing through public budgets[1], or household spending.
- Investment data are given in each year's (nominal) US dollars.

*Classification of finance providers*

| | |
|---|---|
| **Public providers** | |
| Development Finance Institutions (DFIs) | Includes international financial institutions, multilateral development banks, national, regional, and local banks, housing finance companies, agricultural banks, housing banks and investment funds, as well as other entities with a mandate to finance a public policy on behalf of the State |
| Multilateral Climate Funds (MCF) | Green Climate Fund (GCF), Adaptation Fund, Climate Investment Funds (CIF), and Global Environment Facility (GEF) |
| Other international public providers | Governments (ministries, government agencies and funds), UN bodies, export-credit agencies (ECAs), banks, corporate, utilities, institutional investors |
| **Private providers** | |
| Banks | Primarily commercial banks |
| Corporates | Corporates, generally from the energy sector |
| Institutional and impact investors | Includes impact, institutional investors, private equity and venture capital investors. |
| Philanthropies | Includes foundations and family offices |
| Crowdfunding | Includes all major energy-related crowdfunding platforms |
| Other | Includes accelerators and incubators, angel investors, individual investors, privately-owned utilities and DFIs, and other uncategorised investors from the data provider |

## *Residential and Access shares calculations*

**Grid-connected power generation**: residential share is calculated based on IEA energy balances data. The access share is then calculated based on the annual increase in residential sector electricity consumption and average consumption of new residential grid connections.

**Grids**: residential share is calculated based on IEA energy balances data. The access share is based on estimates of new investments in grids, and the share that is directed towards low-voltage distribution lines.

[1] Data on domestic government financing is tracked separately due to double counting in data collection, and limited data granularity. These data are discussed in Chapter 1. Data was collected covering the national budgets of 23 countries: Benin, Burundi, Cameroon, Central African Republic, Chad, Côte d'Ivoire, Eswatini, Gambia, Ghana, Guinea, Kenya, Liberia, Mali, Mauritania, Namibia, Niger, Nigeria, Sierra Leone, Somalia, Tanzania, Togo, Uganda, Zambia.



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**Mini-grids**: residential share is calculated based on data from the Mini-Grid Assets database (provided by Carbon Trust), using the ratio between households connected to a mini-grid over the total number of customers (which includes businesses and the public sector). The IEA estimates the access share to be 100%.

**Stand-alone systems**: financing was allocated between the residential and services sectors in line with other IEA analysis. The access share is calculated based on data from sales databases of the Global Off-Grid Lighting Association (GOGLA) and complemented with analysis based on the Verasol database. Smaller solar systems of capacity lower than 10 Wp (i.e. solar multi light systems and solar lanterns) are excluded, in line with the IEA access accounting methodology.

**Market support**: the shares for residential and access are based on automated and manual checks on the project descriptions, primarily from the OECD CRS database.

**Energy efficiency:** considered to be fully attributable to the residential sector, but this sector is excluded from access calculations.

## A.2 Assessing affordability

This analysis aims at determining what proportion of the population can afford to consume electricity once they have a connection. Analysis is based on the IEA electricity bundles and covers only the population that does not currently have access to electricity. People are expected to gain electricity access via the grid, mini-grids or solar home systems, as laid out in the Accelerating Clean Cooking and Electricity Services Scenario (ACCESS).

A solution is considered affordable if its cost is lower or equal to 5% of the household income, which is assessed at the percentile level. The average income is calculated for each square of 2.4 km2, using Meta's Relative Wealth Index combined with national income distribution curves, GINI index and settlement-level household-size data.

The electrification technology allocation is based on the pathway laid out within the ACCESS scenario and the outcome of the least cost electrification solution carried by KTH through OnSSET.

### *Measuring the affordability of access via the grid*

To assess the affordability of establishing a new connection to the grid, the IEA looks at both connection charges and the costs of monthly electricity consumption.

**Connection charges:** Data were collected covering the lowest connection charge for a residential connection with a rated amperage greater than 3 A for the following 26 countries: Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Congo, Côte d'Ivoire, Djibouti, Ethiopia, Gabon, Gambia, Kenya, Liberia, Mauritius, Namibia, Niger, Nigeria, Rwanda, Seychelles, South Africa, South Sudan, Tanzania, and Uganda.

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**Monthly consumption:** Tariffs were collected from national energy ministries and utilities in the following 45 countries: Angola, Burundi, Benin, Burkina Faso, Botswana, Central African Republic, Côte d'Ivoire, Cameroon, Democratic Republic of Congo, Republic of Congo, Cabo Verde, Djibouti, Ethiopia, Gabon, Ghana, Guinea, Gambia, Guinea-Bissau, Equatorial Guinea, Kenya, Liberia, Lesotho, Madagascar, Mali, Mozambique, Mauritania, Mauritius, Malawi, Namibia, Niger, Nigeria, Rwanda, Sudan, Senegal, Sierra Leone, South Sudan, Sao Tome and Principe, Kingdom of Eswatini, Seychelles, Chad, United Republic of Tanzania, Uganda, South Africa, Zambia, and Zimbabwe.

Tariffs are defined according to monthly consumption levels. The monthly energy service used are: 5 kWh/month for the IEA "basic bundle", 40 kWh/month for the "essential bundle", and 100 kWh/month for the "extended bundle". The lowest tariff available is considered, including social tariffs or other discounted rates offered to new connections.

### *Measuring affordability of access via mini-grids*

To assess the affordability of mini-grids, the costs of electricity is based on current averages of subsidised and applied tariffs. Where national tariffs are not available, sub regional averages have been used. The mini-grid tariffs have been collected from operators and published reports for the following countries: Angola, Benin, Burkina Faso, Burundi, Cameroon, Chad, Ethiopia, Ghana, Ivory Coast, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mozambique, Nigeria, Rwanda, Senegal, Sierra Leone, Somalia, South Sudan, Tanzania, Uganda, Zambia, Zimbabwe.

The monthly energy service used are: 5 kWh/month for the "basic bundle", 40 kWh/month for the "essential bundle", and 100 kWh/month for the "extended bundle".

The monthly cost of each bundle is then compared to the income level of the households that will gain electricity through mini-grids. The share of people that can afford electricity via mini-grids is then computed, as well as the gap between an affordable share of income (5%) and the tariff, defined as the affordability gap.

### *Measuring affordability of access via solar home systems*

To assess the affordability SHS, the costs of electricity is based on current averages of subsidised and applied tariffs. Where national tariffs have not been collected, sub regional averages have been used. The SHS monthly tariffs have been collected from GOGLA, operators and published reports for the following countries: Uganda, Zambia, Ivory Coast, Mozambique, Nigeria, Kenya, Sierra Leone, Tanzania, Zimbabwe, Cameroon, Democratic Republic of Congo.

The monthly energy service used for the study are: 5 kWh/month for the "basic bundle", 40 kWh/month for the "essential bundle", and 100 kWh/month for the "extended bundle".

The monthly cost of each bundle is then compared to the income level of the households that will gain electricity through solar home system. The share of people that can afford is



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then computed, as well as the gap between an affordable share of income (5%) and the tariff, defined as affordability gap.

### *Calculating the impact of supply-side subsidies*

To understand the impact of supply-side subsidies, the IEA carried out sensitivity analysis of the share of grants in financing per technology on the levelised cost of access (LCOA). The LCOA is calculated as the entire cost of an off-grid energy asset (including CAPEX, lifetime OPEX, financing and decommissioning costs), divided by the number of households or clients it serves and the asset's useful life. This metric was selected as it provides a comprehensive measure of the cost of access projects. The financing costs are estimated based on IEA analysis on the composition of financing between grant, debt and equity combined with newly-modelled cost of capital data. LCOA calculations and assumptions vary between technologies:

- For mini-grids, CAPEX and OPEX values have been gathered from the Mini-Grid Asset database. Decommissioning costs have been estimated based on available data.
- For solar-home systems, CAPEX values have been gathered from GOGLA while inputs on energy service have been from VeraSol database. Decommissioning costs are assumed to be negligible.

The LCOA is then compared to the 5% affordability threshold of the income of the households that are expected to gain electricity through the different technologies. The population share that can afford electricity is then computed for both the "basic" and "essential" bundle.

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# Definitions

This annex provides general information on terminology used throughout this report including: units and exchange rates; electricity access bundles; definitions; regional and country groupings; and abbreviations and acronyms.

## *Units*

| | | |
|---|---|---|
| **Distance** | km | kilometre |
| **Energy** | EJ | exajoule (1 joule x $10^{18}$) |
| | PJ | petajoule (1 joule x $10^{15}$) |
| | TJ | terajoule (1 joule x $10^{12}$) |
| | GJ | gigajoule (1 joule x $10^{9}$) |
| | MJ | megajoule (1 joule x $10^{6}$) |
| | Wh | watt-hour |
| | kWh | kilowatt-hour |
| | MWh | megawatt-hour |
| | GWh | gigawatt-hour |
| | TWh | terawatt-hour |
| **Monetary** | EUR million | 1 euro x $10^{6}$ |
| | CFA billion | 1 CFA franc x $10^{9}$ |
| | CHF million | 1 Swiss franc x $10^{6}$ |
| | GBP million | 1 Pound sterling x $10^{6}$ |
| | GBP billion | 1 Pound sterling x $10^{9}$ |
| | GMD | Gambian Dalasi |
| | IDR | 1 Indonesian rupiah |
| | KES billion | 1 Kenyan shilling x $10^{9}$ |
| | LSL million | 1 Lesotho loti x $10^{9}$ |
| | NGN million | 1 Nigerian naira x $10^{6}$ |
| | NGN billion | 1 Nigerian naira x $10^{9}$ |
| | USD million | 1 US dollar x $10^{6}$ |
| | USD billion | 1 US dollar x $10^{9}$ |
| | TZS billion | 1 Tanzanian shilling x $10^{9}$ |
| **Current** | A | ampere |
| **Power** | Wp | watt peak |
| | W | watt (1 joule per second) |
| | kW | kilowatt (1 watt x $10^{3}$) |
| | MW | megawatt (1 watt x $10^{6}$) |
| | GW | gigawatt (1 watt x $10^{9}$) |
| | TW | terawatt (1 watt x $10^{12}$) |

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## *Exchange rates*

| Exchange rates (as of 31 August 2025) | 1 US dollar (USD) equals: |
|---|---|
| AOA KWANZA | 911.955 |
| BWP PULA | 13.387 |
| BIF FRANC | 2954.056 |
| CVE ESCUDO | 94.437 |
| XAF FRANC CFA | 562.666 |
| XOF FRANC CFA | 562.666 |
| KMF COMORIAN FRANCS | 421.999 |
| CDF CONGO FRANC | 2848.684 |
| DJF DJIBOUTI FRANC | 177.721 |
| EGP POUND | 48.596 |
| ERN ERITREA NAKFA | 15.038 |
| ETB BIRR | 141.587 |
| GMD DALASI | 71.911 |
| GHS CEDI | 11.400 |
| GNF FRANC | 8641.800 |
| KES SHILLING | 129.242 |
| LSL MALOTI | 17.650 |
| LRD LIBERIAN DOLLAR | 201.106 |
| LYD LYBIAN DINAR | 5.412 |
| MGA ARIARY | 4462.693 |
| MWK KWACHA | 1735.190 |
| MRU NEW OUGUIYA | 39.983 |
| MUR RUPEE | 46.062 |
| MZN METICAIS | 63.947 |
| NAD NAMIBIAN DOLLAR | 17.650 |
| NGN NAIRA | 1531.570 |
| RWF RWANDA FRANC | 1446.487 |
| STN NEWDOBRA | 21.129 |
| SCR RUPEE | 14.624 |
| SLE LEONE | 22.649 |
| SOS SHILLING | 571.500 |

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| | |
|---|---|
| ZAR RAND | 17.650 |
| SSP SOUTH SUDANESE POUND | 4534.056 |
| SDG SUDANESE POUND | 600.371 |
| SZL LILANGENI | 17.650 |
| TZS SHILLING | 2590.229 |
| UGX SHILLING | 3554.554 |
| ZMW KWACHA | 23.580 |
| ZWG ZIMBABWE GOLD | 26.720 |

Source: African Development Bank: exchange rates on 31 August 2025 applicable for the month of September 2025. https://www.afdb.org/en/documents/september-2025-exchange-rates

Note: The ZWG exchange rate comes from The Reserve Bank of Zimbabwe.

### *Electricity access bundles*

The IEA defines access to electricity as a household receiving enough electricity to power at least a minimum level of services capable of growing over time. The IEA has defined three levels of services, associated with three "bundles":

- "Basic bundle": includes more than one light point providing task lighting, phone charging and a radio, or broadly equivalent to a range of around 50-75 kWh per household per year, depending on efficiency levels.
- "Essential bundle": includes four light bulbs for four hours per day, a fan for three hours per day, and a television for two hours per day, which equates to roughly 500 kWh per household per year.
- "Extended bundle": implies a refrigerator, four hours for lighting, four hours for TV, and six hours for a fan, which equates to roughly 1250 kWh per household per year.

### *Definitions*

**Access to electricity:** The IEA defines access to electricity as a household receiving enough electricity to power at least a minimum level of services capable of growing over time. The IEA minimum level of services is defined as the "basic bundle", which includes more than one light point providing task lighting, phone charging and a radio, or broadly equivalent to a range of around 50-75 kWh per household per year, depending on efficiency levels.

**Affordability:** Affordability is assessed as the share of households' disposable income spent on electricity service, namely monthly expenses plus, for the first year only, the capital expenditure of acquiring the technology. Electricity is considered affordable if related expenditure is below 5% of household income. For access via grid connections, where connection charges can represent a substantial initial expense, electricity is considered affordable if connection charges and monthly electricity bills account for less than 10% of



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household income for the first year, with all subsequent years measured considering only monthly bills and the 5% affordability threshold.

**Asset-backed security:** An asset-backed security (ABS) is an investment security that is backed by a pool of assets, e.g. loans (home, auto, student), leases, credit card debt, royalties, or other financial asset receivables.

**Back-up generation capacity:** Households and businesses connected to a main power grid may also have a source of back-up power generation capacity that, in the event of disruption, can provide electricity. Back-up generators are typically fuelled with diesel or gasoline. Capacity can be as little as a few hundred watts. Such capacity is distinct from mini-grid and off-grid systems that are not connected to a main power grid.

**Balance sheet finance:** Involves the explicit financing of assets on a company's balance sheet using retained earnings from business activities, including those with regulated revenues, as well as corporate debt and equity issuance in capital markets. To some extent, it measures the degree to which a company self-finances its assets, though balance sheets also serve as intermediaries for raising capital from external sources. This report also refers to 'Corporate finance' when describing balance sheet financing.

**Battery storage:** Energy storage technology that uses reversible chemical reactions to absorb, store and release electricity on demand.

**Bioenergy:** Energy content in solid, liquid and gaseous products derived from biomass feedstocks and biogas. It includes solid bioenergy, liquid biofuels and biogases. Excludes hydrogen produced from bioenergy, including via electricity from a biomass-fired plant, as well as synthetic fuels made with $CO_2$ feedstock from a biomass source.

**Blended finance:** A broad category of arrangements where development finance (concessional or non-concessional) mobilises non-concessional commercial finance that does not have a development mandate to finance sustainable development in ODA-eligible countries. These arrangements can be structured as debt, equity, risk-sharing or guarantee products. Specific terms of these arrangements, such as interest rates, tenor, security or rank, can vary across scenarios. Development finance and commercial finance can come from public and or private sector actors.

**Bond:** A financing instrument that represents a loan made by an investor to a borrower, which can be a corporate or a government. A bond is typically issued with an end date by which the principal of the loan is due to be paid back to the creditor (see bond maturity). Other than repayment of the principal, a bond also includes variable or fixed interest payments payable by the borrower or bond issuer to the creditor or bondholder.

**Bond maturity:** The date in which the borrower is due to pay back to the creditor all amounts detailed in the bond instrument, including principal and any outstanding interest payments.

**Bond yield:** The return an investor or bondholder expects to receive over the lifetime of the bond.

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**Borrowing costs:** Borrowing cost are the costs incurred by a company resulting from the borrowing of funds e.g. interest.

**Buildings:** The buildings sector includes energy used in residential and services buildings. Services buildings include commercial and institutional buildings (e.g. schools, hospitals, public offices.) and other non-specified buildings. Building energy use includes space heating and cooling, water heating, lighting, appliances and cooking equipment.

**Capital costs:** Costs to develop and construct a fixed asset such as a power plant and grid infrastructure or execute a project, excluding financing costs. For power generation assets, capital costs include refurbishment and decommissioning costs.

**Capital structure:** Capital structure is the combination of debt and equity used by a company to finance its overall operations and growth.

**Carbon capture, utilisation and storage** (CCUS)**:** The process of capturing carbon dioxide emissions from fuel combustion, industrial processes or directly from the atmosphere. Captured $CO_2$ emissions can be stored in underground geological formations, onshore or offshore, or used as an input or feedstock in manufacturing.

**Carbon credit:** A tradable certificate that allows buyers to claim the reduction or removal of one tonne of CO2 or its equivalent in other greenhouse gasses. The carbon credits are generated by projects that reduce or remove emissions against a counterfactual baseline.

**Clean energy:** In power, clean energy includes: generation from renewable sources, nuclear and fossil fuels fitted with CCUS; battery storage; and electricity grids. In efficiency, clean energy includes energy efficiency in buildings, industry and transport, excluding aviation bunkers and domestic navigation. In end-use applications, clean energy includes: direct use of renewables; electric vehicles; electrification in buildings, industry and international marine transport; use of hydrogen and hydrogen-based fuels; CCUS in industry and direct air capture. In fuel supply, clean energy includes low emission fuels, liquid biofuels and biogases, low-carbon hydrogen and hydrogen-based fuels.

**Coal:** Consists of both primary coal, i.e. lignite, coking and steam coal, and derived fuels, e.g. patent fuel, brown-coal briquettes, coke-oven coke, gas coke, gas works gas, coke-oven gas, blast furnace gas and oxygen steel furnace gas. Peat is also included.

**Concentrating solar power** (CSP)**:** Thermal power generation technology that collects and concentrates sunlight to produce high temperature heat to generate electricity.

**Concessional financing:** Resources extended at terms more favourable than those available in the market. This can be achieved through one or a combination of the following factors: interest rates below those available on the market; maturity, grace period, security, rank or back-weighted repayment profile that would not be accepted/extended by a commercial financial institution; and/or by providing financing to the recipient otherwise not served by commercial financing.

**Corporate venture capital:** Equity investments in start-ups that are developing a new technology or service by companies whose primary business is not venture capital nor other equity investments. In addition to playing the traditional role of a venture capital investor,



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corporate venture capital investors often provide support to the startups via access to their customer base, R&D laboratories and other corporate resources. Corporate venture capital is used by companies as part of their energy innovation strategies to enter new technology areas or learn about technologies more quickly than developing them in-house.

**Cost of capital:** The expected financial return, or the minimum required rate of return, to justify an investment in a company or a project.

**Credit rating:** An independent assessment of a government's creditworthiness in general terms or with respect to a particular debt or financial obligation, which is done by specialised credit rating agencies.

**Crowdfunding:** A method of raising small amounts of money from a large number of people to finance a specific project, business, or cause, typically through online platforms.

**Decentralised solutions:** Decentralized solutions, or decentralized energy systems, are small- to medium-scale power solutions, often renewable based, that generate electricity near the point of use, especially in areas beyond the reach of the central grid. They utilize renewable sources like solar, wind, hydro, bioenergy, and green hydrogen, often paired with energy storage and diesel generator as back-up. These solutions encompass stand-alone systems and mini-grids.

**Debt:** Bonds or loans issued or taken out by a company to finance its growth and operations.

**Debt issuance:** A financial obligation that allows the issuer to raise capital by agreeing to pay back the lender within a given time period accruing a fixed or variable interest rate. Bonds are among the most common forms of debt issuance by governments.

**Debt service:** The capital required to pay back the principal and make interest payments on outstanding loans for a particular period of time.

**Electricity demand:** Defined as total gross electricity generation less own use generation, plus net trade (imports less exports), less transmission and distribution losses.

**Electricity generation:** Defined as the total amount of electricity generated by power only or combined heat and power plants including generation required for own use. This is also referred to as gross generation.

**End-use sectors:** Include industry (i.e. manufacturing, mining, chemical production, blast furnaces and coke ovens), transport, buildings (i.e. residential and services) and other (i.e. agriculture and other non-energy use).

**Energy-as-a-service:** Business model in which a service provider offers various energy-related services. The customers pay the energy services subscribing to a service that includes energy supply, operation, maintenance, and sometimes the installation of renewable energy systems and storage. Service providers can be traditional energy service providers or new ones, such as information and communication technology companies.

**Equity:** The amount of money that would be returned to a company's shareholders if all the assets were liquidated and all of the company's debt was paid off. An equity investment is

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money that is invested in a company by purchasing shares of that company, either on the stock market for public companies or via private equity deals for non-listed companies.

**Financing commitments:** Capital raised by private companies or committed by international public finance institutions. In practice, this financing will not all be spent or disbursed in the year it is committed.

**Fossil fuels:** Consist of coal, oil and natural gas.

**Geospatial analysis:** Process of gathering, interpreting, and analysing data that is associated with specific locations on the Earth's surface. It involves using spatial information – such as coordinates, addresses, or regions – to uncover patterns, relationships, and trends. The IEA GIS modelling approach combines the most recent available country-level data with high resolution spatial data to determine electricity access solutions. It uses the OnSSETT modelling framework developed by KTH to build a geospatial dataset of socio-economic inputs to derive the electricity technology shares in the ACCESS.

**Geothermal:** Heat derived from the sub-surface of the earth, usually using a working fluid such as water and/or steam to bring the energy to the surface. Depending on its characteristics, geothermal energy can be used for heating and cooling purposes or be harnessed to generate clean electricity if the temperature is adequate.

**Grant:** The transfer of funds by development finance institutions or donors, usually with an obligation to spend the money on a contractually defined project or set of eligible expenses. Grant payments do not need to be repaid with money or equity as long as the contractual conditions are met.

**Green bond:** A green bond is a type of fixed-income instrument created to fund projects that have positive environmental and/or climate benefits.

**Grid:** The terms grids and networks are used interchangeably in this report and do not distinguish between transmission and distribution.

**Grid-connected power:** Grid-connected power includes power generation from renewables and fossil fuels. Grid-connected power generation from renewables includes power derived from bioenergy, geothermal, hydropower, solar photovoltaic (PV), concentrating solar power (CSP), wind and marine (tide and wave) energy for electricity and heat generation. Grid-connected power generation from fossil fuels includes power derived from coal, oil, and natural gas.

**Growth equity:** While the boundaries are often blurred, a company that graduates from Series funding (often after a Series B round) raises growth equity. Growth equity rounds can be worth USD 100 million or more. Compared with Series rounds, growth equity is more like to have a single large investor, such as a corporation, bank or hedge fund, accompanied by secondary market groups. Companies raising growth equity typically already have a successful business model and are looking for capital to expand or restructure operations, enter new markets or finance a significant acquisition without a change of control of the business.



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**Guarantee:** An agreement that secures the repayment of a debt to a lender by a third-party if the borrower defaults. The third-party acts as a guarantor and assumes responsibility for the repayment of the debt if the original debtor defaults.

**Hydropower:** Refers to the electricity produced in hydropower projects, with the assumption of 100% efficiency. It excludes output from pumped storage and marine (tide and wave) plants.

**Industry:** The sector includes fuel used within the manufacturing and construction industries. Key industry branches include iron and steel, chemicals and petrochemicals, cement, aluminium, and paper, pulp and printing. Use by industries for the transformation of energy into another form or for the production of fuels is excluded and reported separately under other energy sector. There is an exception for fuel transformation in blast furnaces and coke ovens, which are reported within iron and steel. Consumption of fuels for the transport of goods is reported as part of the transport sector, while consumption of fuels by off-road vehicles is reported under the specific sector. For instance, fuels consumed by bulldozers as a part of industrial operations is reported in industry.

**Investment:** Investment is the capital expenditure in energy supply, infrastructure, end-use and efficiency. Fuel supply investment includes the production, transformation and transport of oil, gas, coal and low-emissions fuels. *Power sector* investment includes new construction and refurbishment of generation, electricity grids (transmission, distribution and public electric vehicle chargers), and battery storage. *Energy efficiency* investment includes efficiency improvements in buildings, industry and transport. *Other end-use* investment includes the purchase of equipment for the direct use of renewables, electric vehicles, electrification in buildings, industry and international marine transport, equipment for the use of low-emissions fuels, and CCUS in industry and direct air capture. Data and projections reflect spending over the lifetime of projects and are presented in real terms in year-2024 US dollars converted at market exchange rates unless otherwise stated. Total investment reported for a year reflects the amount spent in that year.

**Levelised cost of access** (LCOA): An indicator of the expected average cost for unit of time. It represents the total lifetime cost of maintaining a monthly reliable energy service, depending on the expected electricity consumption level of the clients. The LCOA is calculated as the entire costs of an off-grid energy asset, including CAPEX, lifetime OPEX, financing and decommissioning, divided by the number of households or clients it serves and the asset's useful life.

**Levelised cost of electricity** (LCOE)**:** An indicator of the expected average production cost for each unit of electricity generated by a technology over its economic lifetime. The LCOE combines into a single metric all the cost elements directly associated with a given power technology, including construction, financing, fuel, maintenance and costs associated with a carbon price. It does not include network integration or other indirect costs.

**Leverage:** Leverage, or gearing, is the relative amount of debt a company uses to raise capital needed to fund its activities.

**Liquidity:** The availability of liquid (cash) assets.

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**Loan:** A financial instrument whereby a party borrows money from another party, undertaking to repay the nominal amount borrowed (principal) and interest within a given time period.

**Long-term debt:** Long-term debt, also called non-current liabilities, are a company's financial obligations will mature after a year.

**Low-emissions electricity:** Includes output from renewable energy technologies, nuclear power, fossil fuels fitted with CCUS, hydrogen and ammonia.

**Mesh grid:** Decentralised network architecture with multiple decentralised solutions, including generation and storage. Within this network topology, households predominantly produce the electricity they consume and are liked with other households through a network allowing power to flow in multiple directions.

**Mezzanine finance:** A form of subordinate debt financing that allows lenders to convert their debt to equity in the case of default. The increased risk associated with being subordinate to secured lenders is typically compensated by higher interest rates and the option to receive equity instead of interest income.

**Mini-grids:** Small electric grid systems comprised of generation unit(s) and distribution lines, not connected to main electricity networks that link a number of households and/or other consumers. Mini-grids can eventually be connected to a main grid.

**Modern energy access:** Includes household access to a minimum level of electricity (initially equivalent to 250 kWh annual demand for a rural household and 500 kWh for an urban household); household access to less harmful and more sustainable cooking and heating fuels, and improved/advanced stoves; access that enables productive economic activity; and access for public services.

**Natural gas:** A gaseous fossil fuel, consisting mostly of methane. Occurs in deposits, whether liquefied or gaseous. In IEA analysis and statistics, it includes both non-associated gas originating from fields producing hydrocarbons only in gaseous form, and associated gas produced in association with crude oil production, as well as methane recovered from coal mines (colliery gas). Natural gas liquids, manufactured gas (produced from municipal or industrial waste, or sewage) and quantities vented or flared are not included. Natural gas has a specific energy content of 44.09 MJ/kg on a higher heating value basis. Natural gas data in cubic metres are expressed on a gross calorific value basis and are measured at 15 °C and at 760 mm Hg (Standard Conditions). Natural gas data expressed in tonnes of oil equivalent, mainly to allow comparison with other fuels, are on a net calorific basis. The difference between the net and the gross calorific value is the latent heat of vaporisation of the water vapour produced during combustion of the fuel.

**Net profit margin:** Financial indicator that measures the proportion of net income generated from total revenue, expressed as a percentage. It reflects the profitability and financial sustainability of a company after accounting for all operational costs, taxes, and interest.

**Nominal (terms):** Nominal (value or terms) is a financial and economic term that indicates the statistic in question is measured in actual prices that exist at the time. nominal value of



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any economic statistic means the statistic is measured in terms of actual prices that exist at the time.

**Nuclear power:** Refers to the electricity produced by a nuclear reactor, assuming an average conversion efficiency of 33%.

**Off-grid systems:** Mini-grids and stand-alone systems for individual households or groups of consumers not connected to a main grid.

**Offshore wind:** Refers to electricity produced by wind turbines that are installed in open water, usually in the ocean. Includes fixed offshore wind (fixed to the seabed) and floating offshore wind.

**Oil:** A liquid fuel. Usually refers to fossil fuel mineral oil. Includes oil from both conventional and unconventional oil production. Petroleum products include refinery gas, ethane, liquid petroleum gas, aviation gasoline, motor gasoline, jet fuel, kerosene, gas/diesel oil, heavy fuel oil, naphtha, white spirits, lubricants, bitumen, paraffin, waxes and petroleum coke.

**Pay-as-you-go** (PAYG): Involves a pricing model where customers are billed based on their actual usage or consumption of a product or service, rather than paying for a fixed charge upfront.

**Payback period:** Refers to the period of time required to recover the amount invested in a project from its benefits (cash inflows).

**People gaining access:** Is not the same as the change in people with clean cooking access, but rather an estimate of the number of people gaining clean cooking access due to new connections, excluding those born into households already with clean cooking access.

**Pooled vehicle:** A pooled (investment) vehicle is a fund created from capital aggregated from many individual investors that are used to secure full payment for investment.

**Power generation:** Refers to fuel use in electricity plants, heat plants and combined heat and power (CHP) plants. Both main activity producer plants and small plants that produce fuel for their own use (auto-producers) are included.

**Power purchase agreement** (PPA): A power purchase agreement is a legal contract between an electricity generator (provider) and a power purchaser (user).

**Productive uses of energy:** Energy used towards an economic purpose, such as agriculture, industry, services and non-energy use. Some energy demand from the transport sector (e.g. freight) could be considered as productive but is treated separately.

**Project finance:** Involves external lenders – including commercial banks, development banks and infrastructure funds – sharing risks with the sponsor of the project. It can also involve fundraising from the debt capital markets with asset-backed project bonds. They often involve non-recourse or limited-recourse loans where lenders provide funding on a project's future cash flow and have no or limited recourse to liability of the project parent companies.

**Real (terms):** Real (value or terms) is a financial and economic term that indicates the statistic in question has been adjusted to take into account the effect of inflation.

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**Renewables:** Include modern bioenergy, geothermal, hydropower, solar photovoltaics, concentrating solar power, wind, marine (tide and wave) energy, and renewable waste.

**Residential:** Energy used by households including space heating and cooling, water heating, lighting, appliances, electronic devices and cooking.

**Securitisation:** Securitisation is the financial process of pooling and converting future cash flows – such as receivables from solar PAYG systems – into tradable securities to raise immediate capital. This typically involves the creation of special purpose vehicle which raises capital via a tradable asset-backed security.

**Seed capital:** Typically, the first money raised by a start-up or enterprise that does not come from savings, friends or family. When seed funds are raised from "angel investors" or venture capital funds, a share of equity is usually expected to be granted to the investor, who is taking on more risk than later-stage investors are. Seed capital can pay for formation of the start-up, development of a business plan, initial operating expenses or R&D. Seed investors generally aim to develop a business idea to the point at which it can attract further funding, for example from venture capitalists or corporations with larger funds.

**Senior debt:** Debt with the first order of precedence for repayment in the event of default by the borrower, therefore carrying the lowest downside risk for the lender.

**Series A and B funding:** The stages of capital-raising that typically follow seed funding. Companies that raise "Series" rounds have usually demonstrated a viable business model. Investors in Series rounds include large venture capital funds, corporations, private equity firms and even individuals via crowdfunding. The first round of Series funding is Series A, and successive rounds are named B, C and D (rarely any higher). Each successive round typically involves a larger sum (starting at around USD 1 million up to USD 10 million for most Series A rounds) and focus more on market reach than product development. There is a significant overlap between rounds of Series funding higher than Series B and growth equity.

**Services:** A component of the buildings sector. It represents energy used in commercial facilities, e.g. offices, shops, hotels, restaurants and in institutional buildings, e.g. schools, hospitals, public offices. Energy use in services includes space heating and cooling, water heating, lighting, appliances, cooking and desalination.

**Short-term debt:** Short-term debt, also called current liabilities, are a company's financial obligations that are due to be paid within a year.

**Solar:** Includes solar photovoltaics (PV), concentrating solar power (CSP), and solar heating and cooling.

**Solar home systems** (SHS): Small-scale photovoltaic and battery stand-alone systems (with capacity higher than 10 Wp) supplying electricity for single households or small businesses. They are most often used off-grid but also where grid supply is not reliable. Access to electricity in the IEA's definition considers solar home systems from 25 Wp in rural areas and 50 Wp in urban areas. It excludes smaller solar lighting systems, for example solar lanterns of less than 11 Wp.



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**Solar photovoltaics** (PV)**:** Electricity produced from solar photovoltaic cells including utility-scale and small-scale installations.

**Sovereign debt:** Debt issued by a government as a form of raising capital, typically by issuing bonds, bills, debt securities, or contracting loans from other countries, multilateral organisations and development finance institutions.

**Stand-alone systems:** Small-scale autonomous electricity supply for households or small businesses. They are generally used off-grid but also where grid supply is not reliable. Standalone systems include solar home systems, small wind or hydro generators, diesel or gasoline generators, etc. The difference compared with mini-grids is in scale and that stand-alone systems do not have a distribution network serving multiple consumers.

**Subordinated debt:** Unsecured debt, which in the event of default by the borrower is only repaid to the lender after more senior loans or securities are paid.

**Total energy supply** (TES)**:** Represents domestic demand only, and is equivalent to electricity and heat generation plus the other energy sector, excluding electricity, heat and hydrogen, plus total final consumption, excluding electricity, heat and hydrogen. TES does not include ambient heat from heat pumps or electricity trade.

**Total final consumption** (TFC)**:** Is the sum of consumption by the various end-use sectors. TFC is broken down into energy demand in the following sectors: industry (including manufacturing, mining, chemicals production, blast furnaces and coke ovens); transport; buildings (including residential and services); and other (including agriculture and other non-energy use). It excludes international marine and aviation bunkers, except at world level where it is included in the transport sector.

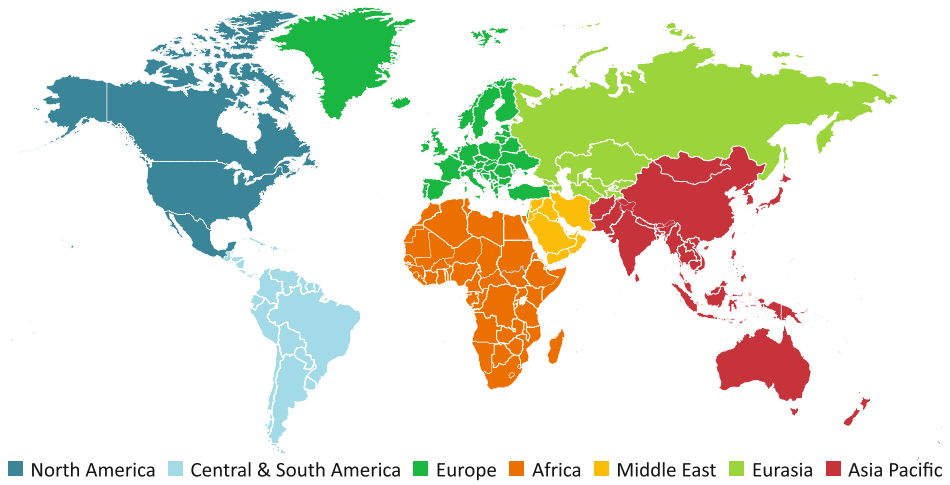
**Total final energy consumption** (TFEC)**:** Is a variable defined primarily for tracking progress towards target 7.2 of the United Nations Sustainable Development Goals (SDG). It incorporates total final consumption by end-use sectors but excludes non-energy use. It excludes international marine and aviation bunkers, except at world level. Typically, this is used in the context of calculating the renewable energy share in total final energy consumption (indicator SDG 7.2.1), where TFEC is the denominator.

**Weighted average cost of capital** (WACC)**:** The weighted average cost of capital is expressed in nominal terms and measures a company's required return on equity and the after-tax cost of debt issuance, weighted according to its capital structure.

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## *Regional and country groupings*

**Figure B.1 ▷ Main country groupings**




Note: This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

**Advanced economies:** OECD regional grouping and Bulgaria, Croatia, Cyprus[1,2], Malta and Romania.

**Africa:** North Africa and sub-Saharan Africa regional groupings.

**Asia Pacific:** Southeast Asia regional grouping and Australia, Bangladesh, Democratic People's Republic of Korea (North Korea), India, Japan, Korea, Mongolia, Nepal, New Zealand, Pakistan, The People's Republic of China (China), Sri Lanka, Chinese Taipei, and other Asia Pacific countries and territories.[3]

**Caspian:** Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan.

**Central Africa:** Cameroon, Central African Republic, Chad, Republic of the Congo (Congo), Democratic Republic of the Congo (DR Congo), Equatorial Guinea, Gabon and São Tomé and Príncipe.

**Central and South America:** Argentina, Plurinational State of Bolivia (Bolivia), Bolivarian Republic of Venezuela (Venezuela), Brazil, Chile, Colombia, Costa Rica, Cuba, Curaçao, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Nicaragua, Panama, Paraguay, Peru, Suriname, Trinidad and Tobago, Uruguay and other Central and South American countries and territories.[4]

**China:** Includes (the People's Republic of) China and Hong Kong, China.

**Developing Asia:** Asia Pacific regional grouping excluding Australia, Japan, Korea and New Zealand.

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**East Africa:** Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Seychelles, Somalia, South Sudan, Sudan, United Republic of Tanzania, Uganda, Zambia and Zimbabwe.

**East Africa Community:** Burundi, Kenya, Rwanda, South Sudan, United Republic of Tanzania, and Uganda.

**Economic Community of West African States** (ECOWAS): Benin, Burkina Faso, Cabo Verde, Côte d'Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo.

**Emerging market and developing economies** (EMDE): All other countries not included in the advanced economies regional grouping.

**Eurasia:** Caspian regional grouping and the Russian Federation (Russia).

**Europe:** European Union regional grouping and Albania, Belarus, Bosnia and Herzegovina, Gibraltar, Iceland, Israel[5], Kosovo, Montenegro, North Macedonia, Norway, Republic of Moldova, Serbia, Switzerland, Türkiye, Ukraine and United Kingdom.

**European Union:** Austria, Belgium, Bulgaria, Croatia, Cyprus[1,2], Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain and Sweden.

**IEA** (International Energy Agency)**:** Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Türkiye, United Kingdom and United States.

**Latin America and the Caribbean** (LAC)**:** Central and South America regional grouping and Mexico.

**Middle East:** Bahrain, Islamic Republic of Iran (Iran), Iraq, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic (Syria), United Arab Emirates and Yemen.

**Non-OECD:** All other countries not included in the OECD regional grouping.

**North Africa:** Algeria, Egypt, Libya, Morocco and Tunisia.

**North America:** Canada, Mexico and United States.

**OECD** (Organisation for Economic Co-operation and Development)**:** Australia, Austria, Belgium, Canada, Chile, Colombia, Costa Rica, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Türkiye, United Kingdom and United States.

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**Southern Africa:** Angola, Botswana, Kingdom of Eswatini (Eswatini), Lesotho, Namibia, and South Africa.

**Southeast Asia:** Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic (Lao PDR), Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam. These countries are all members of the Association of Southeast Asian Nations (ASEAN).

**Southern African Development Community:** Angola, Botswana, Comoros, DR Congo, Eswatini, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, United Republic of Tanzania, Zambia and Zimbabwe.

**Sub-Saharan Africa:** Angola, Benin, Botswana, Cameroon, Côte d'Ivoire, Democratic Republic of the Congo, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Ghana, Kenya, Kingdom of Eswatini, Madagascar, Mauritius, Mozambique, Namibia, Niger, Nigeria, Republic of the Congo (Congo), Rwanda, Senegal, South Africa, South Sudan, Sudan, United Republic of Tanzania (Tanzania), Togo, Uganda, Zambia, Zimbabwe and other African countries and territories.[6]

**West Africa:** Benin, Burkina Faso, Cabo Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo.

### *Country notes*

[1] Note by Republic of Türkiye: The information in this document with reference to "Cyprus" relates to the southern part of the island. There is no single authority representing both Turkish and Greek Cypriot people on the island. Türkiye recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Türkiye shall preserve its position concerning the "Cyprus issue".

[2] Note by all the European Union Member States of the OECD and the European Union: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Türkiye. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

[3] Individual data are not available and are estimated in aggregate for: Afghanistan, Bhutan, Cook Islands, Fiji, French Polynesia, Kiribati, Macau (China), Maldives, New Caledonia, Palau, Papua New Guinea, Samoa, Solomon Islands, Timor-Leste, Tonga and Vanuatu.

[4] Individual data are not available and are estimated in aggregate for: Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, Bonaire, Sint Eustatius and Saba, British Virgin Islands, Cayman Islands, Dominica, Falkland Islands (Malvinas), Grenada, Montserrat, Saint Kitts and Nevis, Saint Lucia, Saint Pierre and Miquelon, Saint Vincent and Grenadines, Saint Maarten (Dutch part), Turks and Caicos Islands.

[5] The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD and/or the IEA is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

[6] Individual data are not available and are estimated in aggregate for: Burkina Faso, Burundi, Cabo Verde, Central African Republic, Chad, Comoros, Djibouti, Gambia, Guinea, Guinea-Bissau, Lesotho, Liberia, Malawi, Mali, Mauritania, Sao Tome and Principe, Seychelles, Sierra Leone and Somalia.



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## *Abbreviations and acronyms*

| | |
|---|---|
| **ACCESS** | Accelerating Clean Cooking and Electricity Services Scenario |
| **AFD** | Agence Française de Développement |
| **AfDB** | African Development Bank |
| **AFI** | Alliance for Financial Inclusion |
| **AFUR** | The African Forum for Utility Regulators |
| **AI** | Artificial Intelligence |
| **BII** | British International Investment |
| **CAPEX** | Capital expenditure |
| **D-REC** | Distributed Renewable Energy Certificates |
| **DFI** | Development finance institution |
| **FCS** | Fragile or conflict-affected situations |
| **GCF** | Green Climate Fund |
| **GDP** | Gross domestic product |
| **GEAPP** | Global Energy Alliance for People and Planet |
| **GEF** | Global Environment Facility |
| **GEMS** | Global Emerging Markets Risk Database |
| **GIS** | Geospatial information systems |
| **GIZ** | Deutsche Gesellschaft für Internationale Zusammenarbeit |
| **I-REC** | International Renewable Energy Certificates |
| **IDP** | Internally displaced people |
| **IEA** | International Energy Agency |
| **IFC** | International Finance Corporation |
| **IMF** | International Monetary Fund |
| **IRENA** | International Renewable Energy Agency |
| **KPI** | Key performance indicator |
| **LCOA** | Levelised cost of access |
| **LCOE** | Levelised cost of energy |
| **LDC** | Least developed country |
| **LED** | Light-emitting diode |
| **LPG** | Liquefied petroleum gas |
| **M300** | Mission 300 |
| **MCFs** | Multilateral Climate Funds |
| **MDBs** | Multilateral development banks |
| **MGA** | Mini-Grid Asset database |
| **MIGA** | Multilateral Investment Guarantee Agency |
| **MSMEs** | Micro, small and medium-sized enterprises |
| **MTF** | Multi-Tier Framework |

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| | |
|---|---|
| **ODA** | Official development assistance |
| **OECD** | Organisation for Economic Co-operation and Development |
| **OnSSET** | Open-source spatial electrification tool |
| **OOF** | Other official flows |
| **OPEX** | Operating expenses |
| **PAYG** | Pay As You Go |
| **PPA** | Power purchase agreement |
| **PPP** | Public-private partnerships |
| **PUE** | Productive use of energy |
| **PURE** | Productive use of renewable energy |
| **PV** | Photovoltaic |
| **PVPS** | IEA Photovoltaic Power Systems Programme |
| **RBF** | Results-based financing |
| **REA** | Rural Electrification Agency |
| **SAS** | Stand-alone systems |
| **SEforALL** | Sustainable Energy for All |
| **SEFA** | Sustainable Energy Fund for Africa |
| **SHS** | Solar home systems |
| **SIDS** | Small Island Developing States |
| **SME** | Small and medium-sized enterprise |
| **SPV** | Special-purpose vehicle |
| **SSA** | Sub-Saharan Africa |
| **TCX** | The Currency Exchange Fund |
| **UA** | Unit of Account |
| **UN** | United Nations |
| **VAT** | Value-added tax |



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### *Chapter 3: Beyond new connections*

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## Financing Electricity Access in Africa

### World Energy Outlook Special Report

Access to electricity is a cornerstone for economic development, poverty reduction and social equity. However, almost 600 million people in Africa lack access to electricity today, with progress falling far behind targets set by both African governments and the international community. Reaching universal electricity access will require a rapid scale-up of investment and financing to USD 15 billion per year, enabling the expansion of generation capacity, grid networks and decentralised solutions while ensuring that progress remains inclusive and sustainable.

In a new flagship report, *Financing Electricity Access in Africa*, the International Energy Agency (IEA) undertakes its authoritative energy analysis to provide a comprehensive overview of the status quo of electricity access financing, including a first-of-a-kind tracking of public and private investment flows. Building on the analysis of the current landscape, this report offers deeper insights into how investment evolves to reach universal access – quantifying the scale of private and public financing required as well as the affordability challenges across the continent.

This report comes at a time when the international community is mobilising to provide additional financial support to tackle this key issue, under South Africa's leadership of the G20, Brazil's COP30 Presidency and the Mission 300 initiative. The IEA's analysis underscores how international finance, resources and technical expertise must be strategically directed to drive the electricity access transformation needed across the continent, supporting Africa's economic, social and environmental goals.

