GSMA Intelligence

Rural renewal: telcos and sustainable energy in Africa

November 2024

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www.gsmaintelligence.com

info@gsmaintelligence.com

Authors
Tim Hatt, Head of Research and Consulting
Emanuel Kolta, Lead Analyst, Network Sustainability and Innovation

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The renewables deficit

The economics of rolling out networks in rural areas for the telecoms industry have long proved challenging. The difficulties centre on running a high fixed cost business against a lower revenue base, considering the low population density compared to cities and suburban areas.

Beyond the financials, there are the obvious environmental ramifications of the energy challenge. In aggregate, mobile and fixed networks operated by telecoms operators account for around 1% of global electricity consumption. This is roughly the same proportion as cloud data centres. In absolute terms, it equates to about 300 terawatt hours per year. Rising data traffic from the 5G mix effect in the subscriber base, enterprise digitisation, exposure to volatility in wholesale energy markets, and an uneven transition to renewables all place continued pressure on energy use looking ahead to the next five years.

In Sub-Saharan Africa, renewables account for just over 20% of electricity generation from the grid, but their share of the power draw for mobile operators is only about half of that. This underscores the gap between use and an already low supply of renewables in the region.

Energy efficiency in Africa

To examine the state and outlook for energy use among African telecoms operators, GSMA Intelligence ran a data gathering exercise involving most of the largest telecoms operators in the region. The analysis is a regional extension to the GSMA Intelligence Telco Energy Benchmark study, and aims for a more granular analysis of energy use and distribution across site portfolios between urban, suburban and rural areas.

The exercise included seven operator groups (Airtel Africa, Axian, Ethio Telecom, MTN, Orange, Safaricom and Vodacom), 34 countries and 45 individual mobile networks run by the aforementioned operators. The data accounts for operator market share of around 75% in Sub-Saharan Africa and 55% in Africa overall.

Operators in Africa are running at a lower level of energy efficiency in their mobile networks than the average globally. The amount of energy needed to power data traffic is around 0.24 kWh per GB, compared to 0.17 kWh globally. This is due in part to lower traffic volumes, but it also reflects the (still) widespread use of 3G equipment, which has a much lower spectral efficiency than 4G and 5G.

Recommendations

Across the region, there are significant differences when it comes to progress on energy access. While countries such as Ghana, Kenya and Rwanda have made significant progress over the last decade and are on track to achieve universal energy access by 2030, countries such as DRC, Malawi and Chad still have energy access rates below 20%.

The next step is to develop more granular feasibility assessments for renewable energy deployments in the rural areas highlighted in this report. These are likely to involve a mix of financing partners, telecoms operators, tower companies, energy specialists and government.

Governments can help resolve some of the barriers to renewable deployments, in terms of land access and building rights, tax and overall incentives for foreign investors and development financial institutions (DFIs). We also see several situations that would benefit from government co-investment to help drive or top up private funding.

Governments in Africa can help enable investment in renewable energy developments through the following specific actions:

- Zero-rating of import duty on green energy equipment and accessories to support the transition to green energy solutions.
- Encouraging net metering, where the credit received when energy is fed back to the national grid can be utilised to cover energy use of other sites elsewhere in the country.
- Offering subsidies or tax incentives, where possible, for green energy solutions to reduce investment and operational costs.
- Designating telecoms infrastructure as critical national infrastructure for prioritisation of access to the national grid and other energy sources.
- Reforming energy market designs and speeding up permissions for renewables and grid projects.
- Incentivising financial institutions to structure innovative financing for green energy projects by mobile operators – by reducing interest levied or permitting green bonds, for example.

Mobile operators can help by modernising their networks to use more energy-efficient architectures, and collaborating with international DFIs and other investors.

With the advent of 5G, network sunsets have become a question of when, not if. Various factors have encouraged operators to shut down older technologies and migrate spectrum resources to newer technologies. These include declining user traffic and the high cost of maintenance on legacy networks; the need for sufficient spectrum resources to bolster 4G/5G coverage; and 3G being a highly energy-inefficient technology.

Operators can also help by sharing tower location data for integrated energy planning. Renewables investment projects need to take into account future energy demand as network upgrades will mean higher energy requirements. Granular data at the site level is a crucial guide for would-be investors as it allows them to direct renewable builds to the areas of a country where the need is most acute.

1
The rural energy challenge

1.1 The strain on P&L

The economics of rolling out networks in rural areas for the telecoms industry have long proved challenging. The difficulties centre on running a high fixed cost business against a lower revenue base, considering the low population density compared to cities and suburban areas.

GSMA Intelligence analysis indicates that the greatest differential for rural versus urban areas comes from costs related to laying fibre for backhaul (mitigated in some cases by satellite or ethernet), followed by energy and towers (see Table 1).

Table 1: How much more it costs to run a mobile base station in a rural area

	Share of cost – urban environment	Cost premium for remote versus urban environment
Towers and civil works	48%	+27%
Active network costs	12%	0%
Energy	30%	+37%
Backhaul	10%	+110%
Total	**100%**	**+35%**

Figures are indicative for an operator running a base station in remote areas with low population densities.
This is a global average, so numbers will vary by region.

Source: GSMA Intelligence

A base station in a remote rural area costs, on average, 35–40% more for an operator to run than in a city, though this can be higher in some countries. This places significant strain on the profit & loss (P&L) from the higher opex, which ultimately acts as a brake on the free cashflow driving future network investment.

The higher energy costs largely come from having to use diesel where grid access is often patchy or non-existent, meaning low electrification rates. This is true in all regions, but more pronounced for mobile operators where rural population proportions are highest – in Africa, India and other parts of Asia.

In Sub-Saharan Africa, electrification rates are now at just over 50%. This is even lower in several countries within the region. The numbers have not changed significantly, reflecting the energy infrastructure gaps that affect large geographic swathes of countries in the region – even those that are high-growth economies.

1.2 Environmental ramifications

Beyond the P&L, there are the obvious environmental ramifications of the energy challenge. In aggregate, mobile and fixed networks operated by telecoms operators account for around 1% of global electricity consumption (see Table 2). This is roughly the same proportion as cloud data centres. In absolute terms, it equates to about 300 terawatt hours per year. Rising data traffic from the 5G mix effect in the subscriber base, enterprise digitisation, exposure to volatility in wholesale energy markets, and an uneven transition to renewables all place continued pressure on energy use looking ahead to the next five years.

Table 2: Mobile operators account for 1% of global energy usage

	Electricity usage		CO_2 footprint	
	Terawatt hours (2022)	Percentage of global total (2022)	Megatonnes of CO_2e (2022)	Percentage of global total (2022)
Mobile networks (excluding operator data centres)	168	0.6%	64	0.2%
Fixed line networks	132	0.5%	50	0.1%
Total mobile and fixed line networks	300	1.1%	114	0.3%
Operator data centres	19	0.07%	7	0.02%
Hyperscaler and other data centres	319	1.2%	120	0.3%
Total data centres	338	1.3%	128	0.3%
Global total (all industries)	**26,799**	**100%**	**37,857**	**100%**

Source: GSMA Intelligence

1.3 Solving the energy challenge in Africa

African operators and other industrial energy users will feel the brunt of the above trends more than most for three main reasons:

- a reliance on energy imports, and price volatility
- low electrification and grid availability in rural areas, leading to continued use of diesel
- a lack of renewables supply and transmission network infrastructure.

Each of these works against the transition to net zero, creates an unsustainable operator cost structure that hinders network investment, and slows progress towards digital inclusion and digitisation.

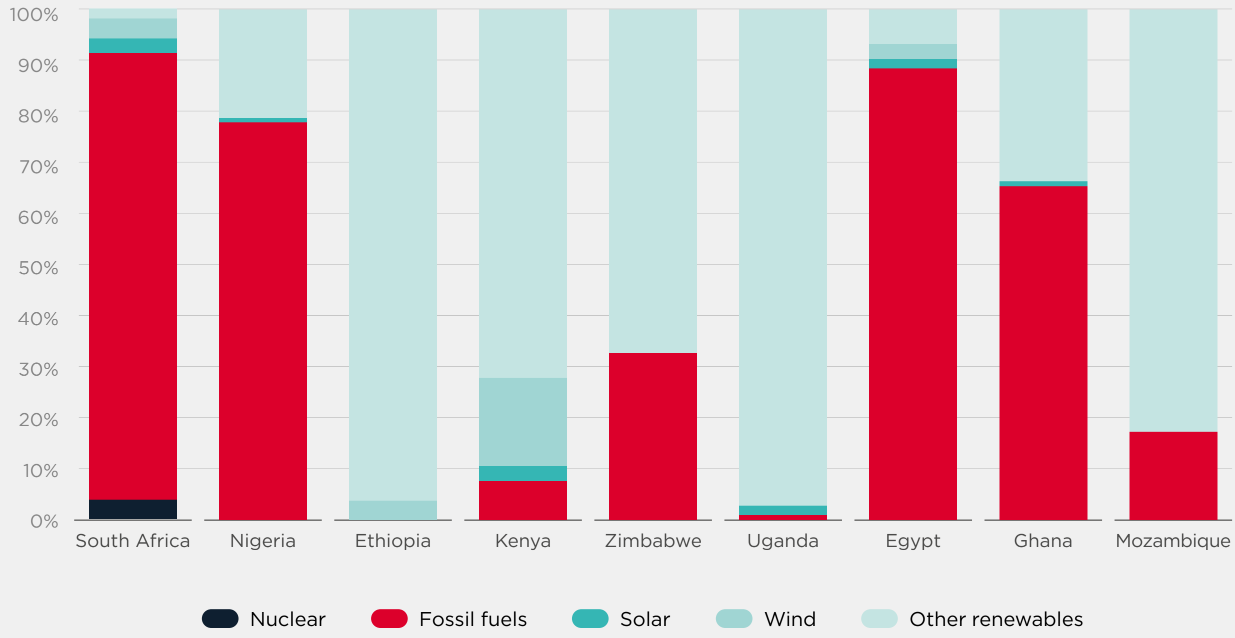
All roads lead to renewables and having a new mechanism for deploying and financing their generation and transmission, using mobile operators and (in some cases) tower companies as anchor tenants.[1]

Based on the most recent data from the US EIA,[2] overall renewable energy as a share of total electricity generation is now at just over 20%. While that share is rising, it remains low compared to other regions and obscures variation between countries. The renewables figure is also dominated by hydropower, with solar and wind (2% and 3% of electricity generation, respectively) considerably lower.

Comparing countries brings this variation to light (see Figure 1). On the one hand, countries such as Kenya and Ethiopia have forged leading positions in renewables by leveraging hydropower and natural exposure to sunlight. On the other hand, the most populous countries – principally Nigeria and South Africa – continue to rely on fossil fuels, which account for more than 75% of electricity generation.

Figure 1 Generation of renewable energy is rising but not in the largest countries

Percentage of total electricity generation, 2022



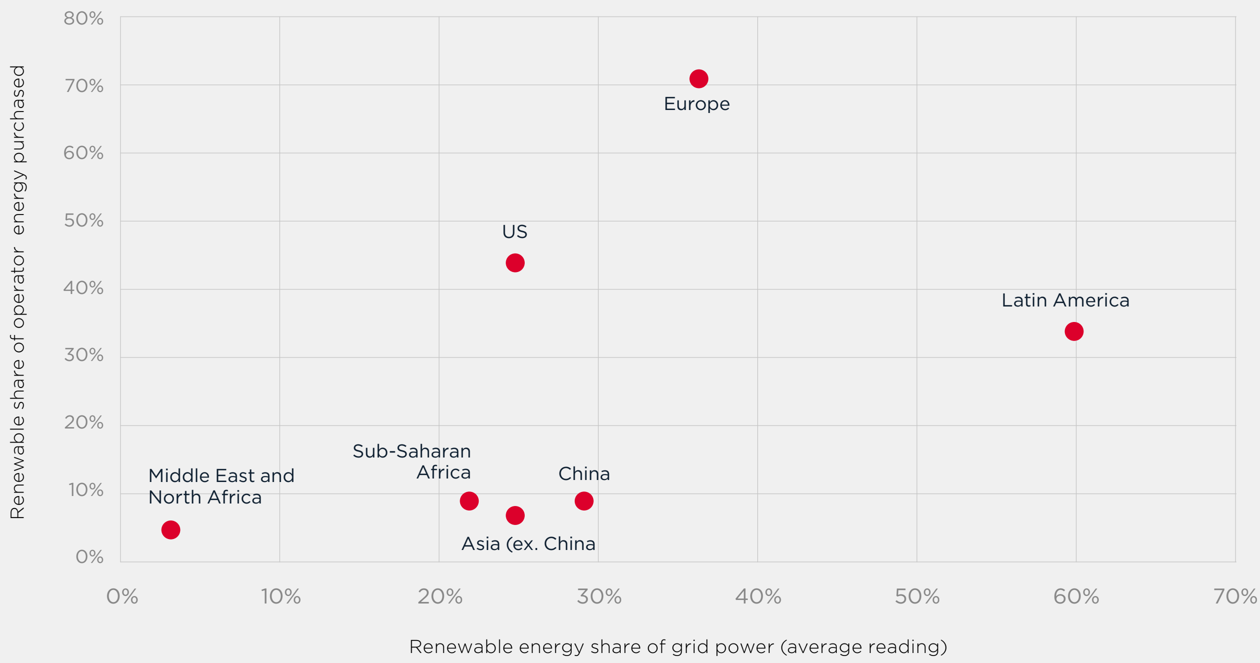
Data covers on-grid renewables
Source: US Energy Information Administration, 2022

1 For more details, see "The role of mobile coverage data in integrated energy planning: The case of the Democratic Republic of Congo", GSMA, August 2022
2 Average of South Africa, Nigeria, Ethiopia, DRC, Kenya, Zimbabwe, Uganda, Egypt, Ghana and Mozambique.

Figure 2 shows the telecoms sector's use of renewables against availability via the national grid in each region. There is a general correlation between availability and use of renewables, but operators in leading regions (Europe and the US) skew high relative to other industries because they supplement grid power with renewables drawn from power purchase agreements (PPAs). The opposite is true in most of Asia, the Middle East and North Africa.

In Sub-Saharan Africa, renewables account for just over 20% of electricity generation from the grid, but their share of the power draw for mobile operators is only about half of that. This underscores the gap between use and an already low supply of renewables in the region.

Figure 2 The telecoms sector's use of renewables has a heavy regional bent



Note: Data is based on operator survey. Figures for entire global operator base may differ.
Source: GSMA Intelligence

2
Energy analysis of African operators

2.1 Scope of research data

To examine the state and outlook for energy use among African telecoms operators, GSMA Intelligence ran a data gathering exercise involving most of the largest operators in the region. The analysis is a regional extension to the GSMA Intelligence Telco Energy Benchmark study, and aims for a more granular analysis of energy use and distribution across site portfolios between urban, suburban and rural areas.

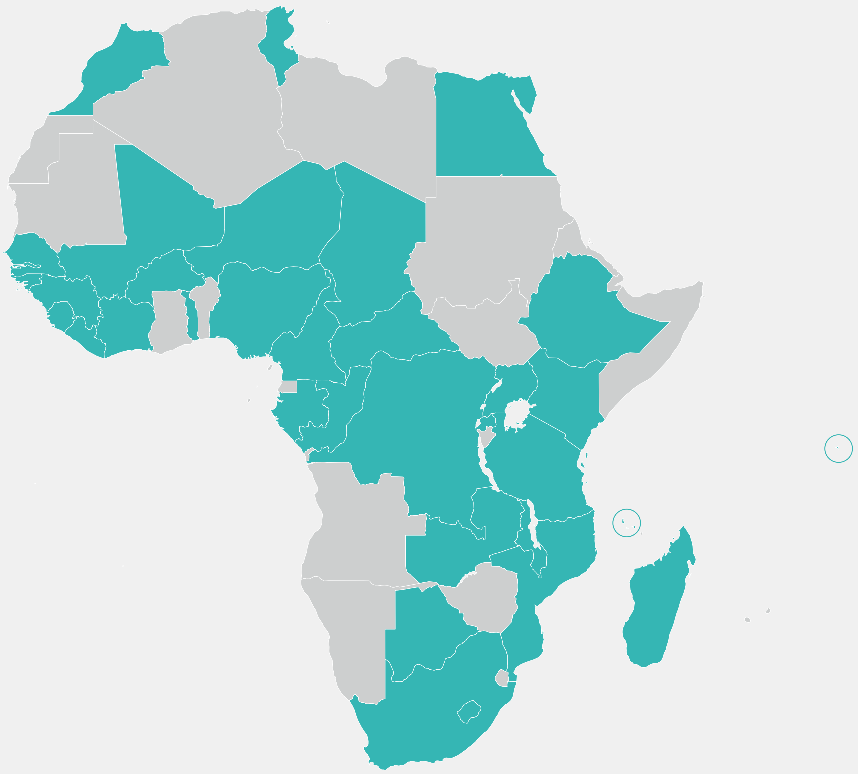
The exercise comprised the following:

- seven operator groups – Airtel Africa, Axian, Ethio Telecom, MTN, Orange, Safaricom and Vodacom
- 34 countries[3]
- 45 individual mobile networks (run by the above operators).

The data accounts for operator market share of around 75% in Sub-Saharan Africa and 55% in Africa overall. While it may not form a complete picture, the data offers a robust sample that can provide a strong read-across for the rest of the continent and for companies in other regions facing similar challenges in engineering rural deployments for renewable energy.

3 Botswana, Burkina Faso, Cameroon, Central African Republic, Chad, Comoros, Congo Republic, Côte d'Ivoire, Democratic Republic of the Congo, Egypt, Ethiopia, Gabon, Guinea, Guinea Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Morocco, Mozambique, Niger, Nigeria, Rwanda, Senegal, Seychelles, Sierra Leone, South Africa, Tanzania, Togo, Tunisia, Uganda and Zambia.

Figure 3 **Geographical coverage of data used in this analysis**



Source: GSMA Intelligence

Table 3: Mobile network footprint covered by the analysis

	Sample group	Africa overall	Representation (percentage of region)
Mobile networks	45	121	37%
Market share (mobile subscribers, millions)	736	1,331	55%
Base station sites (thousands)	168		
of which: directly controlled by operators	38%		
of which: controlled by tower companies	62%		
Mobile technology (percentage of total sites that support a given mobile technology generation)			
2G	100%		
3G	95%		
4G	83%		
5G	2%		

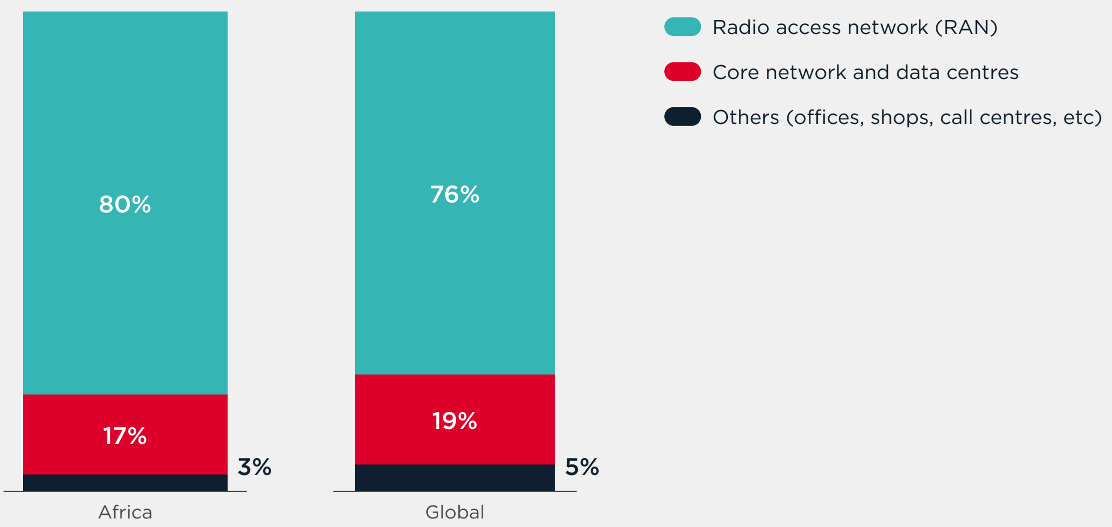
Source: GSMA Intelligence

2.2 Operator energy use in Africa

Networks in Africa have similar structures and characteristics to networks globally in terms of how they consume energy, but they also have attributes specific to Africa. Factors such as local energy infrastructure availability, regulatory environment, customer behaviour, climate and population density all shape the operational framework for how mobile operators design and run a network.

Mobile networks across Africa tend to consume more energy in their radio layer (RAN) than the global average (see Figure 4). This is largely due to lower population density, vast coverage areas and lower data traffic per connection. Network operators need to provide coverage over large areas, and the energy consumption for maintaining coverage is a fixed energy cost. African networks use significantly less energy in their core networks and data centres on account of the lower penetration of 4G and 5G technologies, and the lower levels of adoption of cloud services.

Figure 4 **Energy use in mobile networks**



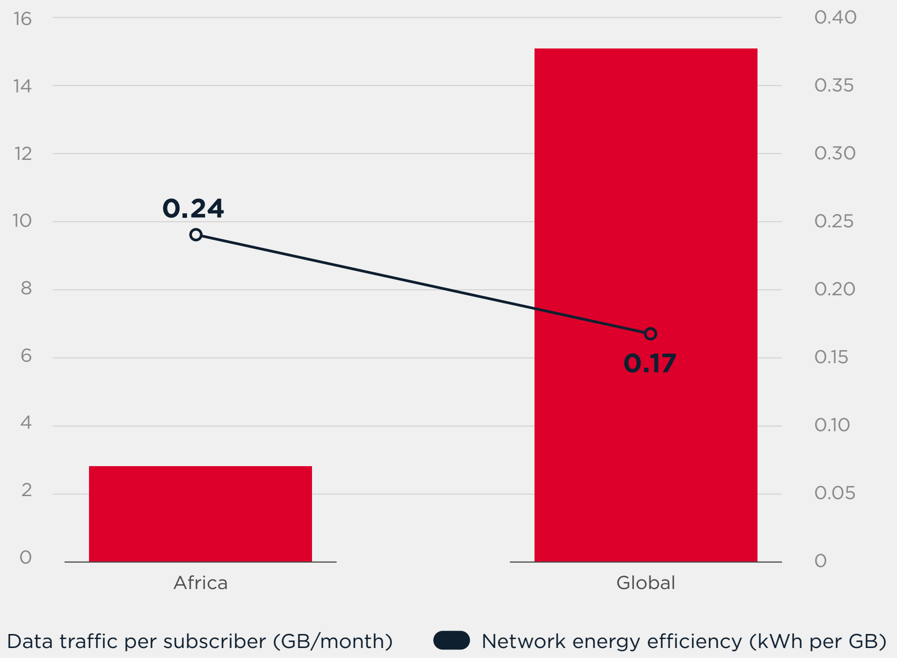
Source: Telco Energy Benchmark 2024 (65 mobile networks) and GSMA Intelligence study of 45 African mobile networks.

2.3 Levels of energy efficiency

There are several ways to measure energy efficiency depending on whether an assessment is made of an operator's customer base, tower portfolio or even revenues. The baseline metric is the core amount of electricity needed to power data traffic, expressed as kWh per GB to allow like-for-like comparisons.

Operators in Africa are running at a considerably lower level of energy efficiency in their mobile networks than the global average. The average African customer uses only around 3 GB of data per month on their mobile devices, compared to 15 GB globally. This reflects lower internet adoption and the patchwork of barriers behind that, including affordability and relevance (the usage gap). However, the amount of energy needed to power that data traffic is around 0.24 kWh per GB, compared to 0.17 kWh globally (see Figure 5).

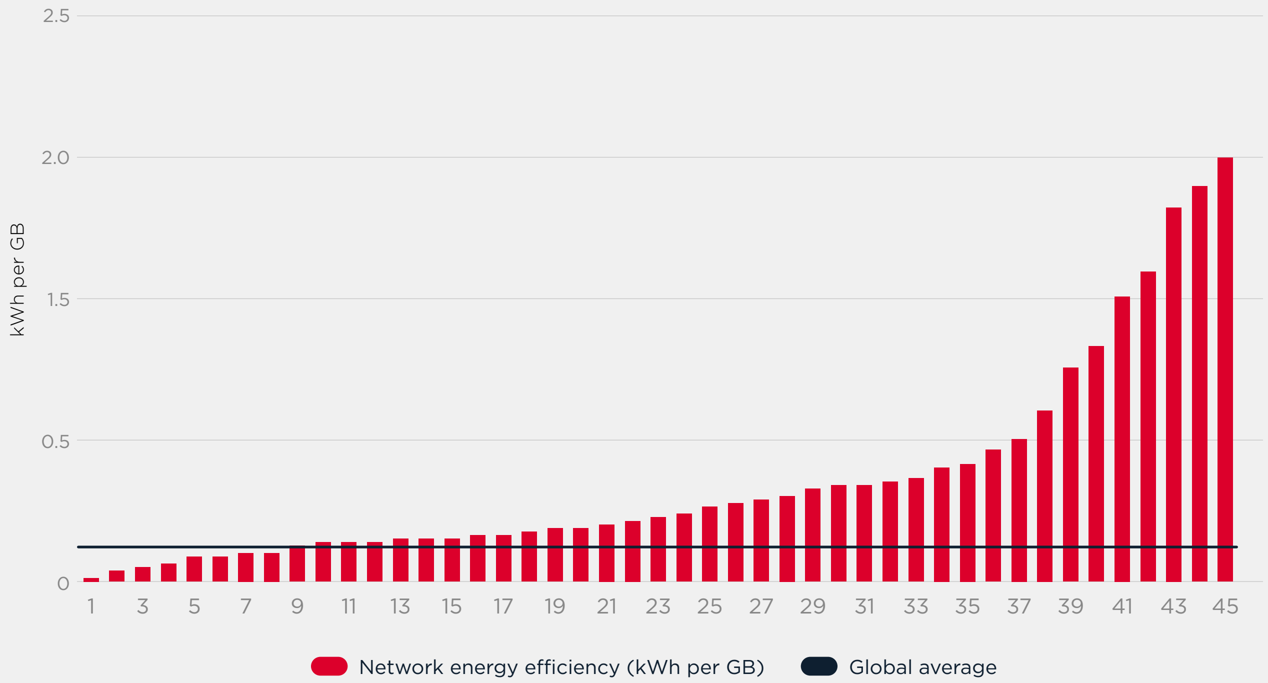
Figure 5 How African operators compare to the global average on energy efficiency



Source: Telco Energy Benchmark 2024 (65 mobile networks) and GSMA Intelligence study of 45 African mobile networks

There is significant variation among mobile operators in Africa on this measure. Figure 6 shows the energy efficiency of individual networks (anonymised). All but eight of the networks are less efficient than the global average. Variables impacting energy efficiency can be split into two main groups: those that operators can impact (such as which equipment or software they use) and those they cannot (such as climate and geography).

Figure 6 Significant variation in energy efficiency across African mobile networks



Source: Telco Energy Benchmark 2024 (65 mobile networks) and GSMA Intelligence study of 45 African mobile networks

Inefficiency partly reflects the continued use of 3G networks, which are far more energy-intensive than 4G or 5G networks because of the inferior spectral efficiency. However, a big part of inefficiency can be explained by a high proportion of base stations situated in off-grid, rural locations. A high fixed cost/allocation of energy is required to power base stations with low population densities. Use of diesel for these sites also predominates in many countries, underlining the need to transition to new models of renewable investment and access in these areas.

For the operators performing at or better than the global average, common strategies include migrating customers to newer technologies such as 4G or 5G, reducing site-level diesel consumption, and adopting advanced technologies for passive infrastructure. All of these contribute to improved energy efficiency.

2.4 Site locations and topography

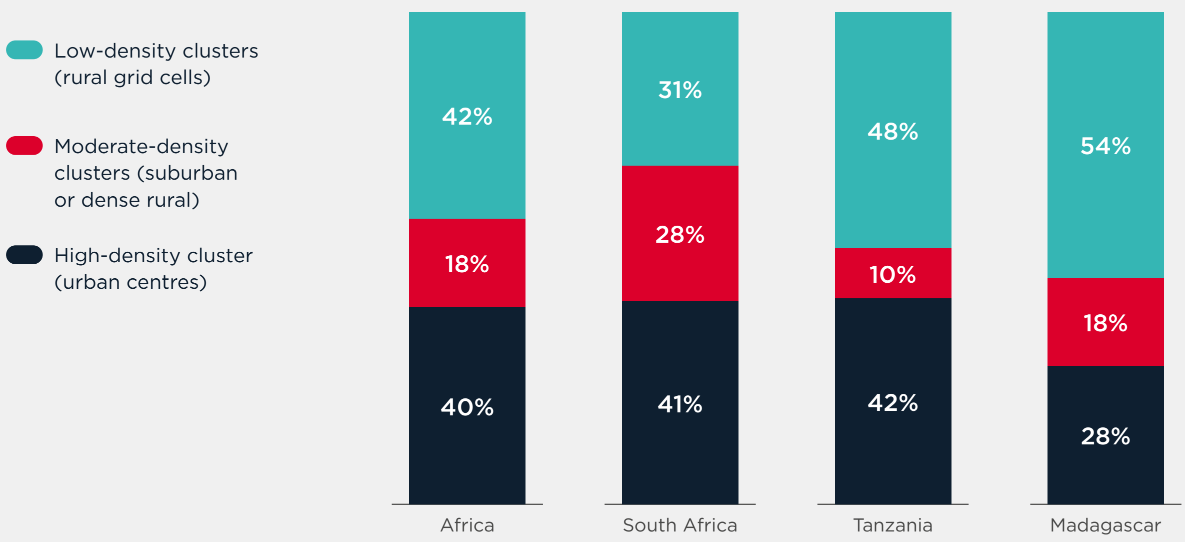
Since the RAN accounts for a significant proportion of the energy load, it is important to examine the structure and distribution of sites across a mobile network footprint. To gain a better understanding of Africa's networks, the GSMA Intelligence data-gathering exercise (run in partnership with operators) mapped the geographic distribution of sites within each country, how they operate, and the types of power source used. In geographical studies, a metric called the 'degree of urbanisation' is often used to classify areas along the urban–rural continuum into three categories:

- Sites in an urban, high-density environment – This category comprises contiguous grid cells with a density of at least 1,500 inhabitants per km^2. An urban centre has a population of at least 50,000.
- Sites in urban or suburban clusters with moderate population density – This category comprises contiguous grid cells with a density of at least 300 inhabitants per km^2 and a population of at least 5,000 in the cluster.
- Sites in rural areas – Most of these will have a density below 300 inhabitants per km^2.

Overall in Africa, 40% of base station sites are in dense urban centres, around 20% are in suburban areas and around 40% are in rural or remote areas (see Figure 7). The rural group is the one to pay attention to from an energy perspective because it has the lowest user density and greatest likelihood of being off-grid. The rural sites are also those that form the addressable base for new mini-grid models (discussed in the next section).

Examining the data by country reveals some variation. South Africa and Nigeria have amassed larger, more youthful and urban populations. This is reflected in their site portfolios being more concentrated in cities and suburbia. Tanzania, meanwhile, has around half of its mobile sites in rural areas.

Figure 7 Site locations in Africa



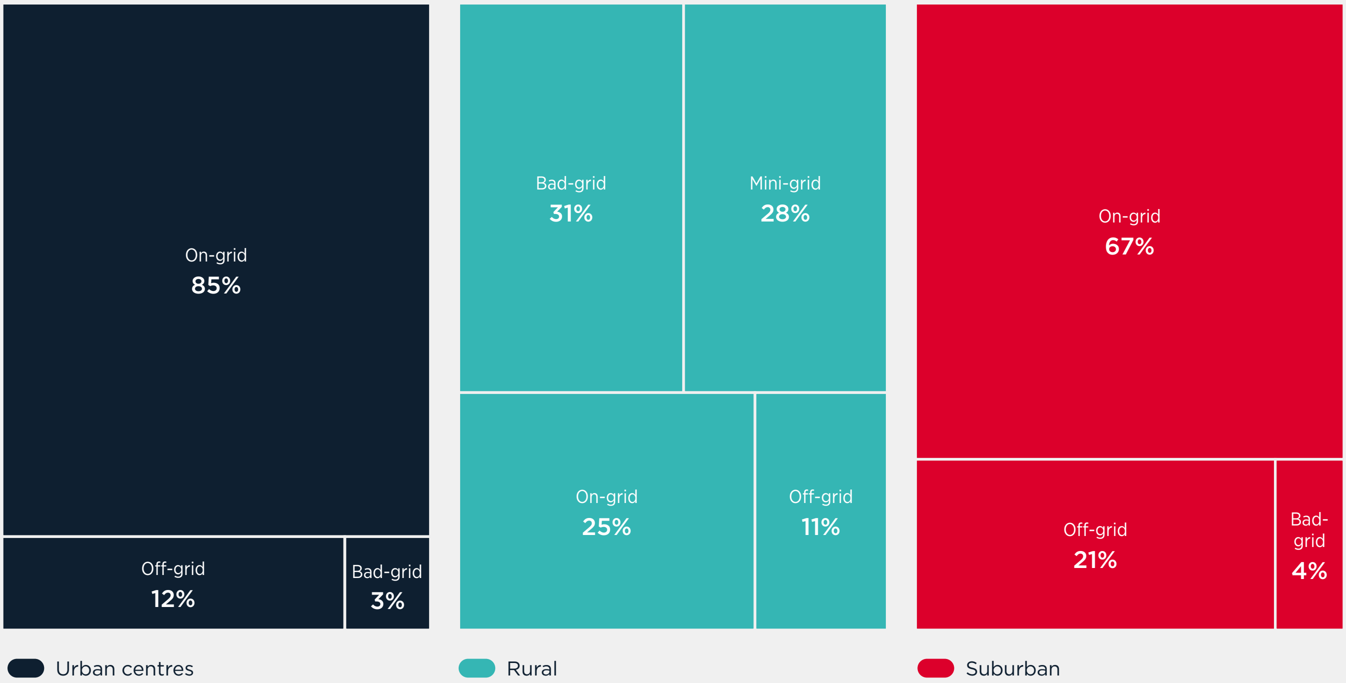
Source: GSMA Intelligence study of 45 African mobile networks

Telecoms operators around the world generally follow similar principles that guide network deployment strategy. They allocate scarce resources (equipment, labour, maintenance, spectrum) in the most efficient way in terms of return on investment, customer satisfaction, quality of service and regulatory coverage requirements. Operators therefore primarily focus their deployments on urban clusters and expand into moderate- and low-density areas in a phased manner, where the returns can compensate for the infrastructure capex and ongoing network maintenance costs.

Figure 8 shows the distribution of mobile base stations on two levels: geographical split (urban/suburban/rural) and access to the electricity grid. The latter includes four further groups:

- **On-grid** – Sites powered directly by the national grid.
- **Mini-grid** – Sites powered by a localised grid that covers a specific and limited area, which could range from a few square kilometres to hundreds of kilometres. Mini-grids are often powered by solar or other renewables and may or may not be interconnected with the national grid.
- **Bad grid** – Sites that are on the national grid but have poor or intermittent access. This may mean sites only have a limited power supply each day, often requiring diesel backup in the event of an outage.
- **Off-grid** – Sites connected neither to the national grid or mini-grid. They therefore rely on a site-specific power solution, usually a diesel generator.

Figure 8 Mobile base stations in Africa: relationship between location and electrification



Source: GSMA Intelligence study of 45 African mobile networks

According to the data collected, around 68% of base stations are on-grid, 7% are powered by mini-grids, 9% are on bad grids and 16% are off-grid. The total number of mobile sites in Africa is estimated to be around 300,000. Working the numbers through and extrapolating the sample to Africa as a whole means that 32% of mobile base stations – approximately 96,000 – are either off-grid or on bad grids. These are the sites most in need of a more sustainable power solution.

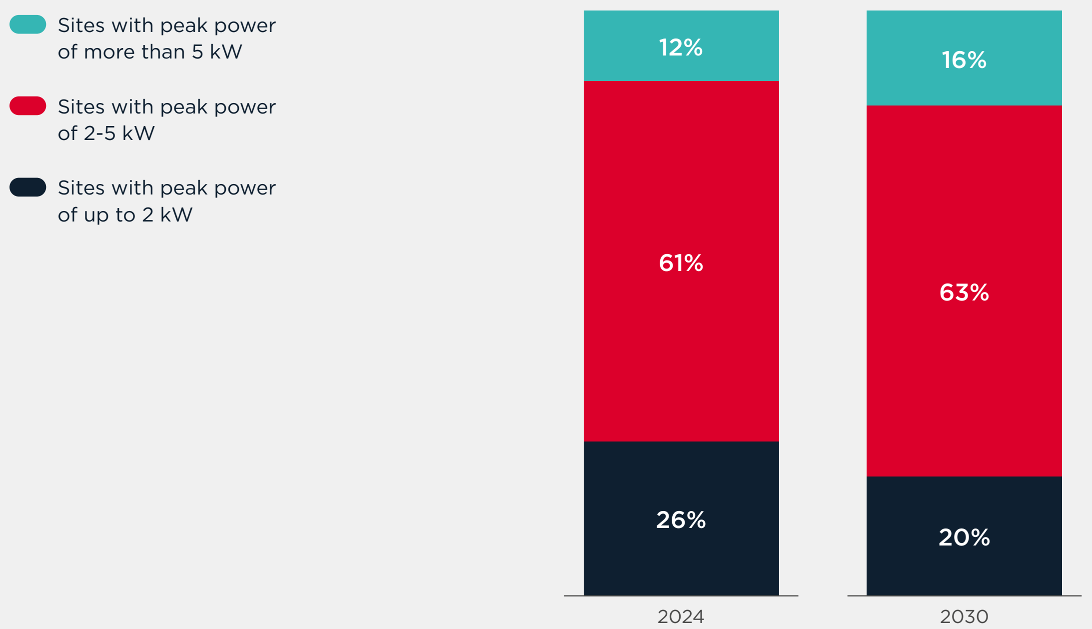
2.5 The outlook for operator energy use

The future view matters as it offers an indication of how operators expect their energy requirements to change over the rest of the decade. This, in turn, helps inform renewables strategy by targeting where renewable energy and battery storage solutions are sited and the capacity levels required.

In regional terms, Africa is expected to see the steepest growth in terms of data traffic, number of mobile subscribers and smartphone penetration, driven by economic and demographic factors. This is expected to lead to increasing energy requirements, reflected in site-level energy consumption (see Figure 9).

The average mobile base station worldwide consumes around 5 kW of power. This depends on technologies supported (2G, 3G, 4G or 5G), cell density, data traffic levels and patterns/requirements related to passive infrastructure (e.g. cooling, security). The segment that matters most is the sites that consume a high level of energy, which GSMA Intelligence defines as more than 5 kW. African operators report that around 12% of sites currently consume more than 5 kW. However, they expect this to rise to 16% by 2030. The trend is being spurred by rising data traffic use and urbanisation. The flipside is that a smaller share of the network will have low power requirements.

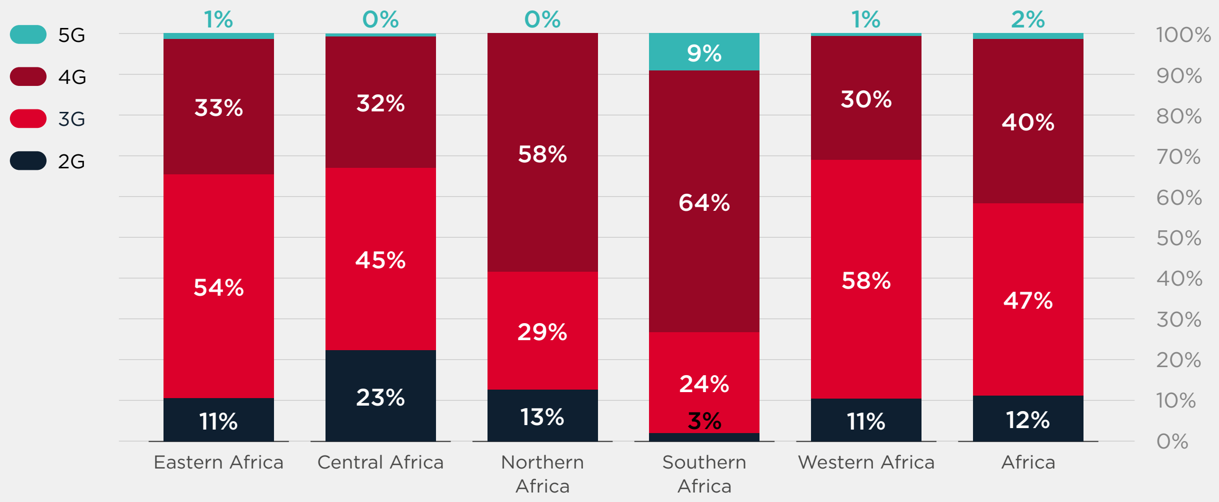
Figure 9 Sites by power requirement



Source: GSMA Intelligence study of 45 African mobile networks

Figure 10 shows that the majority of mobile users in Africa are still using 2G or 3G technologies, with just over a third of mobile connections using 4G/5G, even though 4G coverage reached 73% at the end of 2023.[4] The use of 4G/5G is predominant in Southern and Northern Africa but not in Central, Eastern or Western Africa. Even as of mid-2024, the combined proportion for 2G and 3G was 59%, which has a significant impact on energy efficiency. 3G was launched in 2001 and is the least energy-efficient cellular technology. Some 47% of the African connections base still depends on this 23-year-old technology.

Figure 10 Mobile connections by technology, Q2 2024



Source: GSMA Intelligence

One of the biggest bottlenecks has been 4G device availability. The migration to newer technologies is expected to increase overall energy efficiency in Africa due to new, cheaper devices. For example, Vodacom South Africa plans to cut the cost of access to smartphone features and accelerate the migration of users to 4G with the launch of a low-cost handset providing cloud-based access to popular applications. The device costs ZAR249 ($14) and provides what the operator describes as a smartphone-lite experience. Vodacom noted that the cloud phone launch was part of an ongoing drive to cut the cost of smartphone access and migrate customers from legacy networks to 4G.

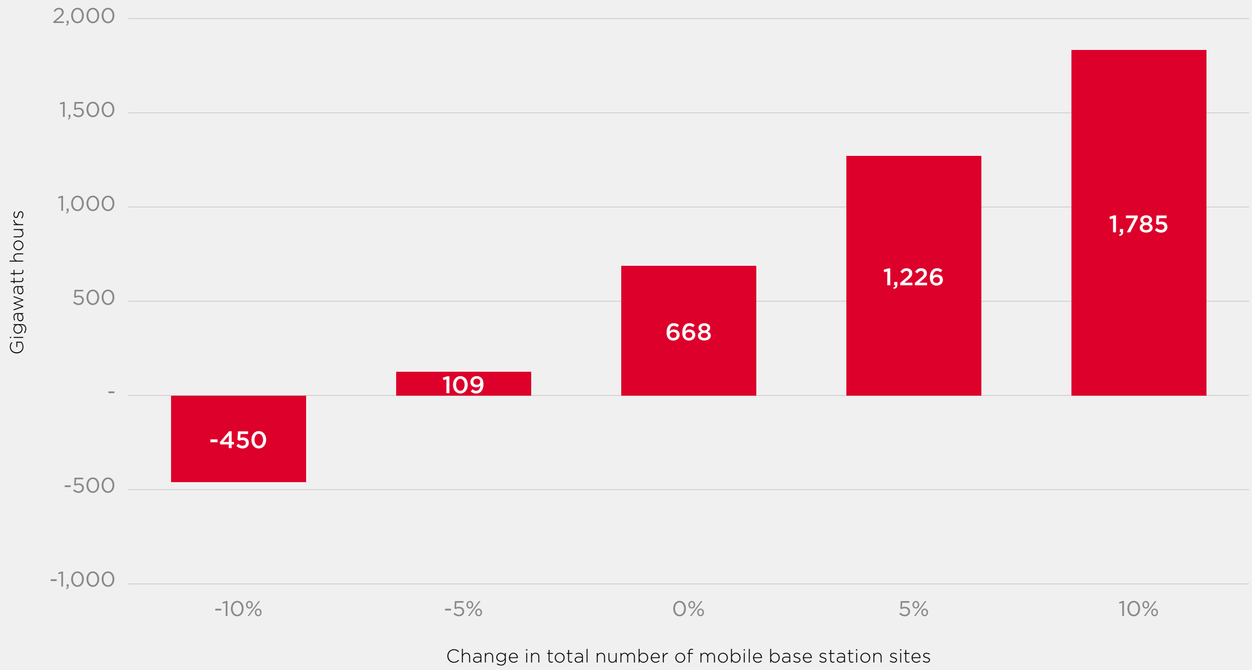
4 The State of Mobile Internet Connectivity Report 2024, GSMA, 2024

Implications for the net change in energy use

GSMA Intelligence calculations for the net change in energy use are shown in Figure 11, including a number of scenarios for site growth. Energy needs to increase in almost all scenarios. If tower numbers were, for example, not to change from today's footprint (0% growth), energy use would still rise by 2030 – by a net 668 GWh per year – because of the higher site-level energy consumption. In fact, even if towers declined by 5%, energy use would still rise.

The rises can – and hopefully will – be mitigated to some extent through operators installing more energy-efficient RAN equipment and using other technologies, particularly AI. However, the trajectory speaks to the urgent need to shift from fossil fuels to renewables to reduce CO_2 emissions.

Figure 11 Implied change in annual energy consumption from mobile networks in Africa: 2024 versus 2030



Note: Figures calculated based on operator expectations.
Source: GSMA Intelligence study of 45 African mobile networks

3
Infrastructure and financing strategies

Several models exist for financing renewables in rural areas. Africa is on the front line of virtually all of them. This analysis covers two of the most viable prospects, based on current trials and reporting:

- energy service company (ESCO)
- anchor business customer (ABC), with a telecoms operator or tower company as the anchor client.

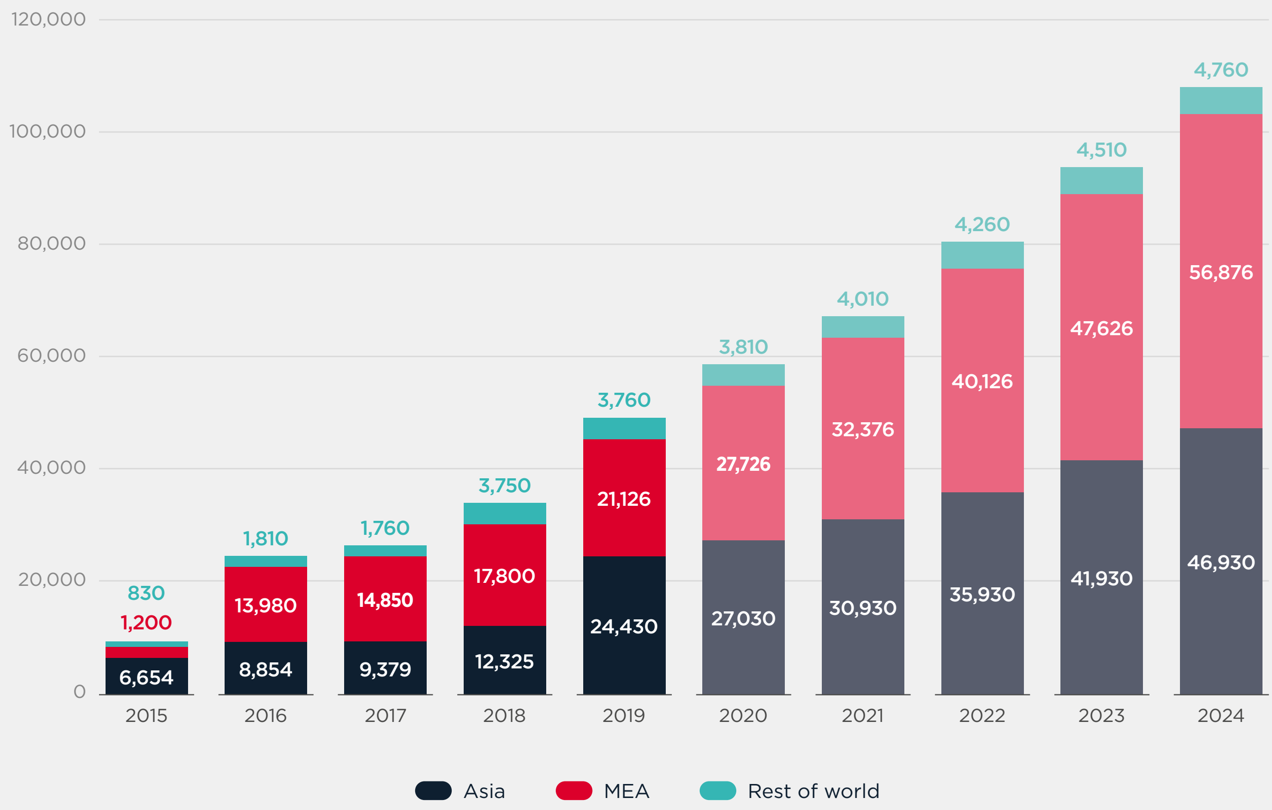
3.1 The ESCO model

In a similar way to how mobile operators may outsource to tower companies because of their specific skills in managing tower site requirements, there is an increasing trend to outsource the supply of reliable power at tower sites to ESCOs. Managing power at tower sites is subject to sector-specific generation, delivery and financing risks.

By outsourcing this to an ESCO through a power purchasing agreement (PPA), which includes penalties for non-performance, operators can offload some of the challenges associated with running towers in off-grid or bad-grid areas.

Figure 12 shows actual and projected growth of the ESCO market.

Figure 12 **ESCO-operated mobile towers (actual and estimated)**



Source: ESCO Report 2020, TowerXchange, 2020

ESCOs were traditionally engaged to manage fuel supply and operate diesel generators. In recent years, they have evolved to provide renewable energy installations. Contracts with operators tend to be long term (10 years or more); this is a key enabler for investments, as ESCOs can depreciate the renewable energy equipment over a longer period and generate attractive financial returns.

3.2 The ABC model

The ABC model has been considered for over a decade but has faced challenges in implementation, financing and stakeholder alignment. However, key trends over the last decade have enabled it to be scaled across more sites. These include the maturing mini-grid sector in Africa and the associated increase in financing; geospatial planning tools to identify optimal sites for deployments; growing mobile industry interest in decentralised renewable energy (DRE) solutions; and successful pilots and blueprints that can be replicated and scaled.

From a financing perspective, mini-grids using the ABC model, or potentially ESCO, have attracted interest from foreign investors – either infrastructure specialist funds or development finance institutions (DFIs). DFIs have asset allocations based on social and traditional return-on-investment (RoI) considerations. These groups can be donors or multilateral agencies such as the World Bank that have an interest in linking seed or extension funding to projects with the potential to catalyse socioeconomic or environmental benefits over a long period. Infrastructure and digital investments fit into this category in Africa (among other regions) as they offer a platform on which service innovation can thrive.

4
Case study: DRC

4.1 Market context and energy landscape

As the largest country in Sub-Saharan Africa by area, the Democratic Republic of the Congo (DRC) has exceptional natural resources. However, persistent conflicts and a challenging political and economic environment have made infrastructure development and private sector investment in the country difficult. With an electrification rate of just 19%, DRC has the second-highest number of people globally without access to electricity (around 77 million). Less than 2% of rural areas in DRC are electrified.[5]

La Société Nationale d'Électricité, the country's government-owned utility, has limited funds to allocate to grid expansion projects, complicated by the immense scale of the country and its dispersed population. National grid coverage is non-existent in rural areas, yet economic activity and potential electricity demand remain robust. According to the World Bank, estimated on-grid access from the state-owned utility SNEL is a mere 10%.[6] Kinshasa is the city with the highest access rate (44%), followed by Haut Katanga, Kongo Central and Sud Kivu province, with access rates between 10% and 30%. The remaining 22 provinces have access rates below 5%.

Even where households and businesses across have grid connections in DRC, they are not necessarily guaranteed reliable energy access, with daily load shedding in most areas of Kinshasa and other regions of the country. Under a business-as-usual scenario, around 84 million people (80% of the population) in DRC will still live without access to electricity in 2030.

Like other businesses and households in DRC, many mobile operators and tower companies rely on diesel generators as a source of reliable energy in off-grid areas or where there are recurrent grid failures. A GSMA study[7] estimated that 75% of mobile towers located in off-grid and bad-grid areas in DRC are powered by diesel.

5 "Africa's Largest Mini-Grid to Provide Affordable and Sustainable Electricity in DRC", World Bank, June 2024
6 Congo, Democratic Republic of – Access Governance and Reform for the Electricity and Water Sectors Project (English), World Bank, 2022
7 Renewable Energy for Mobile Towers, GSMA, 2020

The reliance on diesel carries significant cost and operating disadvantages for mobile operators and tower companies in DRC:

- **High and volatile costs** – Generating electricity with diesel generators typically costs three to four times more than grid-based electricity in the region, with even higher ratios in countries such as DRC, Ethiopia and Zambia. Prices also fluctuate depending on international price dynamics, countries' foreign exchange positions and government policies such as subsidies. Transporting diesel to remote sites can also be expensive, particularly in countries that face significant infrastructure challenges. Across many countries, the cost of buying and transporting diesel can account for 30–60% of a mobile operator's total opex.
- **Poor reliability –** Multiple generators need to be installed to guarantee continuous energy supply for network uptime.
- **Regular maintenance visits –** Diesel and filters need to be frequently replaced, which means remote sites have to be visited up to every 10 days.
- **Greenhouse gas emissions –** An average single-tenant tower site powered 24×7 by a diesel generator consumes about 28,000 litres of diesel per year.
- **Theft –** Up to 30% of diesel stock is stolen according to estimates by tower companies. A GSMA study has estimated that theft added 10–15% to the cost of supplying diesel to towers.

Impact on digital inclusion and mobile

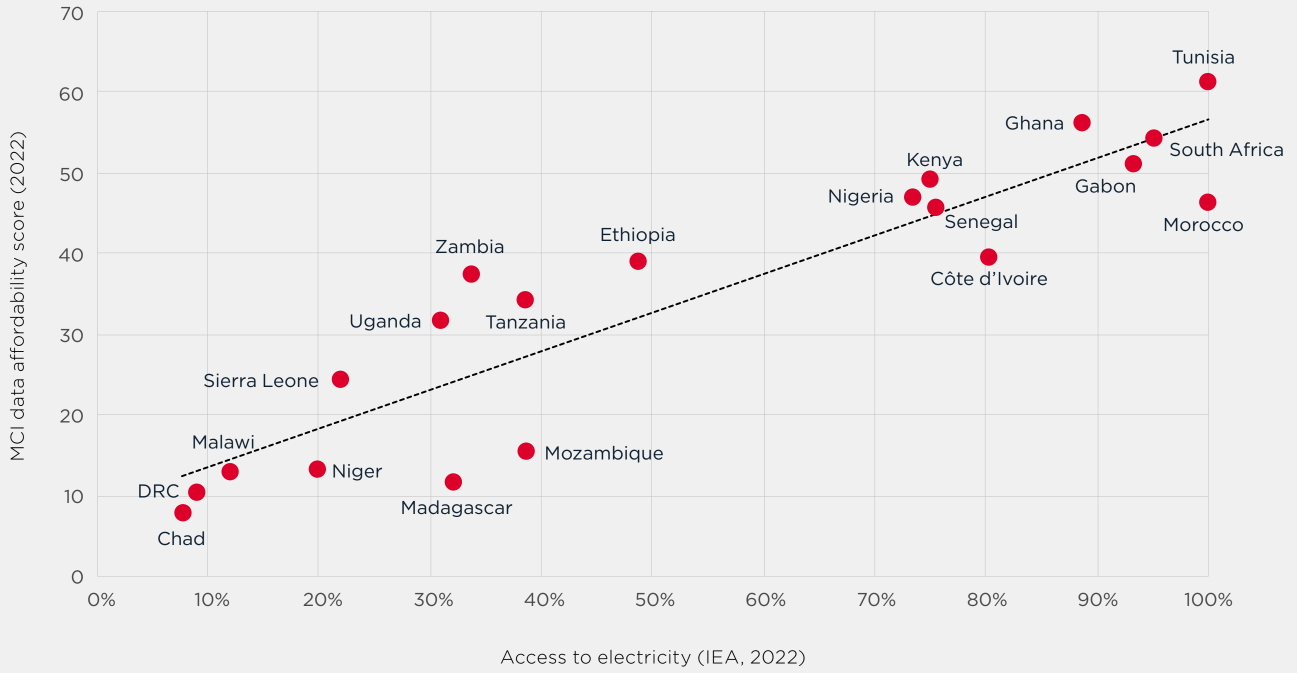
Unlike many other African countries, DRC still has a significant mobile coverage gap and a growing usage gap. While there has been rapid growth in mobile penetration, a significant share of the population remains unconnected, particularly in rural and low-income areas. DRC has a low score in the GSMA Mobile Connectivity Index[8] compared to regional peers, partly due to a lack of mobile infrastructure, but also high data costs, low consumer readiness, and insufficient content and services.

Lack of affordable, reliable and sustainable energy access affects these coverage and usage gaps in three ways:[9]

- **Limiting network deployments –** Some network deployments in rural areas can be prohibitive due to high energy costs. As mobile operators determine whether to invest in new deployments, high diesel costs (and the associated cost of transport, which often tends to be higher for remote rural sites) are a strong deterrent.
- **Costs passed to customers limit data affordability –** While data affordability has improved significantly, Sub-Saharan Africa is still the region with the least affordable data. Fewer than half of the countries in the region have met the UN Broadband Commission's target of 1 GB costing less than 2% of average monthly income. High energy costs for operators are often passed to consumers in the form of higher data costs. Countries with the most pronounced energy and infrastructure challenges also tend to have higher data costs (see Figure 13).
- **Customers' own energy access –** For existing customers (in the case of the usage gap) and potential customers (in the case of the coverage gap), the inability to regularly charge devices discourages mobile usage, and diminishes the commercial potential associated with mobile network expansion in more remote areas. Beyond lacking energy access, the quality and reliability of power supply also matters as grid outages and power surges can result in mobile devices breaking, and can discourage further mobile use by households and businesses.

8 GSMA Mobile Connectivity Index
9 Why and how mobile operators are looking to renewables to power networks across Africa, GSMA, 2024

Figure 13 **Relationship between energy access and data affordability across selected African countries**



Note: The GSMA Mobile Connectivity Index data affordability score (0–100) is based on data costs as a percentage of monthly income.
Source: GSMA Mobile Connectivity Index, International Energy Agency

Despite the obvious advantages of renewable energy, mobile operators, ESCOs and DRE companies have struggled to scale renewable energy implementation models due to the high cost of capital associated with renewable energy projects in the country. This is partly driven by macroeconomic and foreign exchange issues, as well as perceived political and regulatory risks.

4.2 Implementation and financing models for renewable power

There is promising market potential for off-grid solar energy in DRC. More than 20 off-grid solar companies are registered in the country. These include Congolese companies such as Altech, GoShop and Weast Energie, and international companies such as Bboxx, Orange Energies and Nuru. DRC aims to connect 32% of the country to electricity by 2030.[10]

To strengthen the legal and regulatory framework and catalyse private and public investment flow into the sector (including off-grid solar energy), the DRC government established two agencies: ARE, which will be the autonomous regulatory agency; and ANSER, which is responsible for rural electrification throughout DRC's vast territory. Private sector-led, off-grid solar projects such as mini- and metro-grids are central to the government's strategy to accelerate access to electricity. However, private sector involvement in the electricity sector has so far been limited, with only 5% of the installed capacity produced by the private sector, mainly due to high country and regulatory risks, and the absence of reliable data on demand and consumer willingness to pay. A range of programmes by the World Bank, GEAAP and Beyond the Grid Fund for Africa are also aiming to support the government in scaling DRE solutions in the country.

The progressive enabling environment, interventions by the government and donor support have also enabled the emergence of scalable renewable energy solutions such as energy-as-a-service and ABC models for towers located in off-grid and weak-grid areas across DRC.

10 Democratic Republic of Congo Country Brief, GOGLA, 2022

ESCO model

In DRC, operators (particularly Vodacom and Orange) are exploring and implementing ESCO approaches. Several ESCO players are entering the market or already providing solutions. As early as 2017, GreenWish Partners, an independent renewable power producer in Africa, announced a partnership with Orange to implement clean energy solutions for 250 towers associated with Orange in DRC. The partnership was one of the first ESCO implementations in the country. It involved GreenWish and its operational partner Sagemcom deploying hybrid power generation systems that combine solar, battery and diesel fuel. Meanwhile, CrossBoundary Energy has recently announced a partnership with iSAT Africa to deliver renewable energy solutions for telecoms sites across DRC.

Many tower companies also now offer energy-as-a-service solutions. Between 2018 and 2022, American Tower Corporation invested approximately $345 million to reduce emissions and generate energy across sites in Africa, primarily focusing on solar arrays for onsite power and lithium-ion batteries for energy storage. Helios Towers, which has a strong footprint in DRC, is also investing in renewable energy solutions to meet its ambition to become a net-zero carbon emissions business by 2040.

ABC mini-grid model

In DRC, mobile operators are providing connectivity in the absence of grid-connected energy services. In these off-grid locations, there is an opportunity to deploy mini-grid systems with mobile operators and tower companies as anchor customers. The systems also supply power to local businesses and households. For mini-grid providers, having a mobile tower as an anchor client ensures there is constant energy demand, which helps balance energy load and improves the commercial viability of the entire project.

Examples of ABCs in action in DRC include the following:

- **Orange, Bboxx and GoShop**
  - In Bukavu, which faces frequent grid outages, Orange has partnered with a joint venture between Bboxx (a pan-African, off-grid solar provider) and GoShop (a solar engineering, procurement and construction company).
  - The joint venture built a hybrid mini-grid plant (85% solar) to supply energy to Orange's telecoms infrastructure, and connected more than 600 households around the tower to reliable electricity. The partnership also allowed for the integration of Orange Energies' smart metering platform and Bboxx Pulse (Bboxx's integrated operating system).
  - The merging of these technologies enables the monitoring of mini-grid performance and the remote management of customers, including collecting and managing payments through pay-as-you-go (PAYG) solutions. Bboxx and Orange hope to scale the model beyond Bukavu and replicate it across other tower sites in DRC.
  - For Orange, taking an integrated approach to energy and digital connectivity is vital, as the company sees a virtuous cycle between energy access, financial inclusion and digital connectivity. GSMA research on the value of PAYG solar for mobile operators confirms that a customer's transition to PAYG solar benefits mobile operators commercially through higher mobile money and mobile usage, and builds digital literacy and demand for digital services.[11]
- **Nuru**
  - Nuru currently powers 10 mobile operator towers across four operational assets and is collaborating with mobile operators such as Vodacom and tower companies including Helios Towers.
  - Having closed more than $40 million in Series B equity funding in 2023, Nuru aims to serve 35–40 towers in Goma, Kindu and Bunia by 2026.

11 See The value of pay-as-you-go for mobile operators

Donor financing initiatives

The World Bank-financed Electricity Access and Services Expansion (EASE) project, with a budget of $145 million, aims to increase access to electricity by expanding and rehabilitating mini-grids through both a public and private approach. Private companies (including green, mini-grid operators and solar home system distributors) will be supported to expand electricity access through the provision of a credit line ($10 million) and a subsidy/grant facility ($15 million). The credit line represents a refinancing mechanism for renewables that could be issued by local commercial banks, under the oversight of the Central Bank of Congo.[12]

As part of these efforts, the World Bank, Beyond the Grid Fund for Africa, and Power Africa are also collaborating with ANSER to implement the MWINDA fund to deploy a large-scale, results-based financing programme across the country. This seeks to build on the learnings from other programmes, such as DARES in Nigeria.

DRC will benefit from the recently announced Accelerating Sustainable and Clean Energy Access Transformation (ASCENT) programme. This aims to extend clean energy access to 100 million people in up to 20 countries across Eastern and Southern Africa over the next seven years. The ASCENT components will be organised into three pillars (see Figure 14).

Figure 14 Summary of the ASCENT programme pillars

	Pillar 1 Regional and National Platforms to Accelerate Energy Access	**Pillar 2** Expanding Grid Electrification	**Pillar 3** Scaling Distributed Renewables and Clean Cooking Solutions
Thematic focus areas	• Regional implementation support for enabling economies of scale and cost reduction strategies • Align regional and national planning processes and regulatory environment • Support government role in priority setting, integrated energy access strategies, least cost resource and geospatial electrification plans • Mobilize financing, at regional scale, by aligning national, donor and private sector interests • Aggregate climate benefits at regional level to mobilize climate/impact financing	• Planning and implementation of grid densification and extension • Designing and implementation of cross-border grid electrification in remote, border areas • Grid reinforcement and upgrading for Variable Renewable Energy integration for increased energy access and reliability • Utility strengthening and reform for financially viable and sustainable expansion of electrification • Support for enhancing affordability and inclusion for low-income, vulnerable, incl. displaced populations	• Explore and develop innovative region-level financial solutions to mobilize patient, private capital • Facilitate viability gap funding, results-based financing and small/catalytic grants for companies • Develop de-risking instruments for private companies operating at national and multi-country levels • Enable financing via regional and local financial institutions • Support enabling environment and bolster financial sector capacity to lend to private companies active in distributed renewable energy or Interested in entering the market

Source: Accelerating Sustainable and Clean Energy Access Transformation (ASCENT) MPA (P180547), World Bank

12 Off-grid Solar Market Assessment, Power Africa, 2019

5
Case study: Ethiopia

5.1 Market context and energy landscape

Ethiopia is one of the oldest independent countries in Africa and one of the fastest-growing economies. Its population of more than 118 million makes it the continent's second most populous country. Over the past 15 years, the economy has grown at an annual rate of 10%. Ethiopia has significant potential for green energy to aid the transition to zero emissions due to its abundant renewable energy resources, including hydropower, wind, solar and geothermal energy, coupled with a growing commitment to sustainability. It has an estimated potential to generate more than 45,000 MW of hydropower, 10,000 MW of geothermal power and 1,000 MW of wind power. Ethiopia's solar energy potential is also high, with an estimated 4–6 kWh per square metre daily.

Around half of Ethiopia's population still lacks access to reliable electricity.[13] Approximately 33% of the population is connected to the national grid, while an additional 11% have access through off-grid solutions such as mini-grids and solar photovoltaic (PV) systems.[14] About 80% of Ethiopia's population lives in rural areas, where access to electricity remains a challenge.[15]

This energy situation poses a challenge for companies operating in the country as it impacts the cost of doing business. This is reflected in high retail prices, which compound the challenge of service affordability.

The Ethiopian government has demonstrated its commitment to promoting sustainability and renewable energy. In 2011, it launched the Ethiopia Climate Resilient Green Economy (CRGE) strategy, which targets net-zero carbon emissions by 2025. Recent reforms have also made the country more appealing to foreign investment and facilitated public-private partnerships and PPAs. Over the next decade, the government aims to increase power generation capacity from 5,250 MW to 17,000 MW to meet domestic demand and export energy.

13 "Energizing Ethiopia: New World Bank Program Expands Access to Electricity", World Bank, April 2024
14 "Delivering an off-grid transition to sustainable energy in Ethiopia and Mozambique", BMC, May 2022
15 "Ethiopia to Exploit Full Potential of Solar Energy to Accelerate Energy Transition", All Africa, September 2024

Like other countries in the region, Ethiopia faces several challenges in implementing renewable energy projects:

- **Financial and economic challenges –** Financial risks, such as currency conversion issues and limited foreign investment, pose significant project barriers.
- **Infrastructure limitations –** Underdeveloped rural infrastructure and logistical challenges further complicate project implementation.
- **Technical and capacity barriers** – Insufficient skilled manpower and dated technologies hinder the development of renewable energy projects.

5.2 Implementation and financing models for renewable power

Ethiopia is targeting universal access to electricity by 2025, focusing on grid and off-grid solutions. The country is expanding its renewable energy sources, leveraging its vast potential in hydropower, wind, solar and geothermal energy. Hydropower is the dominant source, accounting for about 90% of the electricity generation mix.[16] [17] Wind and solar projects diversify the energy mix, including the Ashegoda and Adama wind farms and the planned solar PV installations.[18] [19] Geothermal projects in the Rift Valley have further contributed to the diversification. For example, Ethiopia is working with the International Solar Alliance to expand solar mini-grids and rooftop solar systems and to construct solar parks. It is also establishing a solar energy knowledge enhancement and training centre. These demonstrate Ethiopia's commitment to harnessing its solar potential, diversifying its energy mix, improving rural electrification and supporting climate goals.

ESCO model

Ethiopia's renewables strategy includes an initial batch of 400 sites using the Energy Service Company (ESCO) model to improve energy management and reduce operational costs. In addition to the 400 sites earmarked for this financial year, the mobile industry intends to engage with ESCO companies for an additional contract of 300 sites. The ESCO financial model helps mobile operators shift from a capex/opex model to an energy-as-a-service (EaaS) model. It allows them to outsource their energy needs strategically, reaping the benefits of renewable and energy-efficient systems and experience. The firms structure the transaction as a long-term lease.

The objectives of ESCO companies align with national development goals. They are committed to decarbonising tower operations through seamless renewable energy integration. Backed by financial institutions and strategic clients, they are shaping the energy landscape in emerging markets.

ABC mini-grid model

The mini-grid model in Ethiopia focuses on providing decentralised energy solutions to rural and off-grid areas, where access to the national power grid is limited or non-existent. Like many African nations, the country has a significant rural population that lacks access to reliable electricity.

The mini-grid model in Ethiopia primarily relies on renewable energy sources such as solar, wind and hydropower. Solar PV systems are widely deployed due to their scalability and declining costs. Hybrid systems (solar combined with diesel backup) are standard in some rural regions of Ethiopia.

International financial institutions such as the World Bank and African Development Bank (AfDB) have funded mini-grid projects in the country. Participating private companies, in collaboration with the Ethiopian Electricity Utility (EEU), are key contributors to the mini-grid initiative, partnering with government bodies and international organisations to expand energy access in underserved areas.

16 Renewable Energy in Ethiopia, Wikipedia
17 Ethiopia – Country Commercial Guide, International Trade Administration
18 Renewable Energy Projects in Ethiopia, United Nations Framework Convention on Climate Change
19 Partnership Ready: Renewable Energies, GIZ, 2020

6
Case study: Nigeria

6.1 Market context and energy landscape

Around 85 million people in Nigeria (43% of the population) lack access to grid electricity, particularly in rural areas where diesel generators dominate, increasing both costs and pollution. The national grid, with a capacity of more than 12,500 MW, operates at only 3,500–5,000 MW due to infrastructure issues, while energy demand is nearly 200,000 MW. Nigeria relies on gas-fired plants for more than 70% of its electricity, with hydropower providing the rest. Renewables such as solar and wind are garnering attention due to the country's abundant sunlight and wind potential.

Nigeria's telecoms sector, with around 120 million mobile subscribers, consumes a significant amount of energy. With an estimated 30,000 telecoms towers (many dependent on diesel generators due to unreliable grid power), there are environmental and financial challenges from fuel costs. As part of sustainability efforts, telecoms operators are increasingly exploring renewable energy. This aligns with global sustainability goals and Nigeria's push towards green energy.

The country's solar energy potential is high, receiving an average of 5.5 kWh/m²/day. For telecoms operators, renewable energy offers cost savings of 30–50% and significantly reduces carbon emissions, aligning with corporate sustainability and Nigeria's climate goals. The government's target of 30% renewable energy by 2030 supports this shift.

Despite clear advantages, the upfront cost of renewable installations such as solar panels and batteries are high, compounded by macroeconomic challenges. Policy incentives are limited, and regulatory frameworks are underdeveloped, slowing adoption. Integrating renewables with existing telecoms infrastructure, especially in remote areas, presents further challenges; most projects are still in the pilot phase and non-scalable.

6.2 Implementation and financing models for renewable power

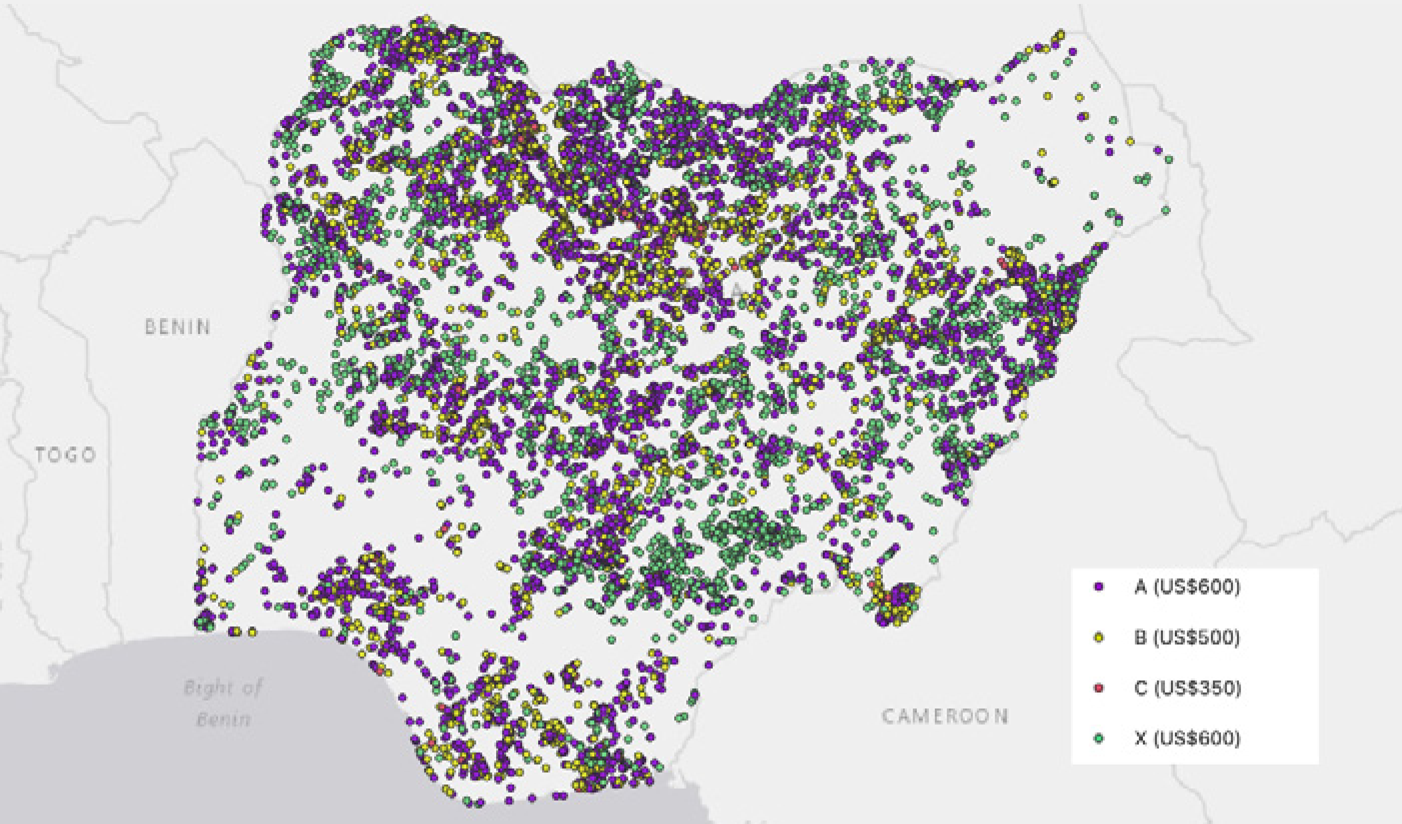
Energy-as-a-service (EaaS) model

The Nigeria Distributed Access through Renewable Energy Scale-up (DARES) project, approved by the World Bank, aims to provide more than 17.5 million Nigerians with new or improved access to electricity through distributed renewable energy solutions, including mini-grids and standalone solar systems. The project builds on the success of the Nigeria Electrification Project (NEP), which established 125 mini-grids and distributed more than 1 million solar home systems, giving more than 5.5 million Nigerians access to electricity and creating over 5,000 local green jobs.

The DARES project employs the EaaS model, where ESCOs design, install and maintain renewable energy systems, allowing telecoms operators and other clients to access clean power without the upfront costs.

Through PPAs, telecoms companies pay for the energy consumed, while development partners such as the World Bank and the Rural Electrification Agency (REA) provide financing. The use of GIS-based tools in site selection ensures optimal deployment of mini-grids, factoring in population density, solar potential and economic viability.

Figure 15 **Site locations targeted for funding by DARES**



Source: World Bank

The project includes multiple stakeholders:

- Telecoms operators and tower companies implement renewable energy solutions at tower sites and collect data on energy efficiency.
- ESCOs provide renewable energy solutions, including solar systems and energy storage technologies. For instance, 10 of 11 distribution companies in Nigeria that have indicated interest in participating in the DARES programme with more than 600 sites across 33 states submitted technical assessments.
- DFIs fund renewable energy initiatives through grants and concessional financing. Institutions such as the World Bank and REA of Nigeria are pivotal in mobilising finance for green energy projects.
- Government facilitates regulatory frameworks and incentives to promote renewable energy adoption.

The financing strategy for the DARES project is built on a combination of public and private funding. The World Bank has approved a $750 million International Development Association (IDA) credit for the DARES initiative, which aims to leverage more than $1 billion in private capital and substantial contributions from international development partners. These partners include the Global Energy Alliance for People and Planet, contributing $100 million, and the Japan International Cooperation Agency (JICA), providing an additional $200 million.[20]

The strategy incorporates the following components:

- **Blended finance model –** The project relies on a finance model that combines public sector grants and private investments. The approach encourages investment in renewable energy solutions for off-grid and underserved communities.
- **Performance-based grants (PBGs) –** The project uses PBGs as a central mechanism for incentivising private sector participation. These grants are awarded based on specific milestones, such as customer connections or energy capacity utilisation, ensuring efficient deployment of mini-grids and solar systems.
- **PPAs –** Under the EaaS model, ESCOs enter into PPAs with telecoms operators and other end-users, allowing them to pay for energy consumption without the upfront capital investment. The long-term energy agreements provide a stable revenue stream for ESCOs while ensuring affordable energy access for rural communities.

For telecoms operators, the primary driver is the financial benefit. The shift from diesel generators to solar-powered mini-grids cuts energy costs over the long term. However, the transition also aligns with Nigeria's climate goals of reducing carbon emissions and achieving 30% of its energy from renewables by 2030. Telecoms infrastructure, particularly base stations in off-grid areas, is vital to connect remote communities. Reliable, renewable power is essential to keep these stations operational. Furthermore, the government's push towards decentralising energy generation through mini-grids creates a significant opportunity to ensure telecoms services are powered sustainably, enhancing service delivery and network reliability.

20 World Bank Group

7
Learnings and outlook

As demand for digital services and more advanced technologies continues to increase across Africa, finding scalable, sustainable, reliable and affordable energy solutions for mobile operators and tower companies will be critical.

The learnings from this analysis should not be seen in isolation. The findings have read-across to other African countries facing high energy access gaps, and a more challenging enabling environment for digital connectivity and energy access providers. The World Bank and the African Development Bank, backed by DFIs, climate finance funds and impact investors, have announced Mission 300. This will provide at least 300 million African people with access to electricity by 2030. The World Bank and its partners have made immediate commitments of $5 billion to catalyse further funding focusing on green energy.

For countries with a delivery platform and geospatial market intelligence, the World Bank energy financing team can provide financing jointly for electricity and digital services. The World Bank has seen the maturing of the solar mini-grids solution, but this can also be scaled up to, for instance, 160,000 sites, as indicated by the Africa Mini Grid Developers Association (AMDA). The scale comes by leveraging the availability of different funding structures and types of financing, such as equity, loans and result-based grants, especially for rural areas. This is a fast-changing environment; the mantra is to move beyond business as usual.

7.1 Learnings on the ESCO model

Similarly to the mobile industry, other commercial and industrial (C&I) segments in Africa such as manufacturing, mining and brewing are increasingly opting for DRE solutions to meet their energy needs. This partly reflects grid-connected energy becoming more expensive as struggling utilities look to improve their finances (the reliability of these grid-connected energy services is not improving). It also reflects the corporate social responsibility (CSR) and environmental, social and governance (ESG) requirements of publicly traded companies, in terms of reducing emissions across supply chains.

These dynamics are a catalyst for the growth of EaaS companies providing renewable energy solutions focused on the C&I segment, which has benefitted from increased funding and merger and acquisition (M&A) activity.

While the cost of capital for renewable energy projects in Africa (which can be 2–3× higher than in advanced economies) continues to be a barrier to growth, EaaS and C&I solar solutions are set for a decade of growth and expansion.

7.2 Learnings on the ABC model

Many mini-grid companies view mobile operators and tower companies as demanding clients due to their service-level requirements, strict supplier contracts and the operational complexities associated with servicing tower assets. There are also some practical challenges associated with geography and population density, such as a settlement's distance from the tower, the wider terrain, and the prospective energy demand of households and businesses surrounding the tower. All of these are crucial to effectively sizing a mini-grid and operating a sustainable business model. Contrary to the ESCO model, mobile operators, tower companies and mini-grid providers also need to align interests and objectives since the aim is not just to power the mobile tower infrastructure, but also to support wider rural development by powering surrounding businesses and households.

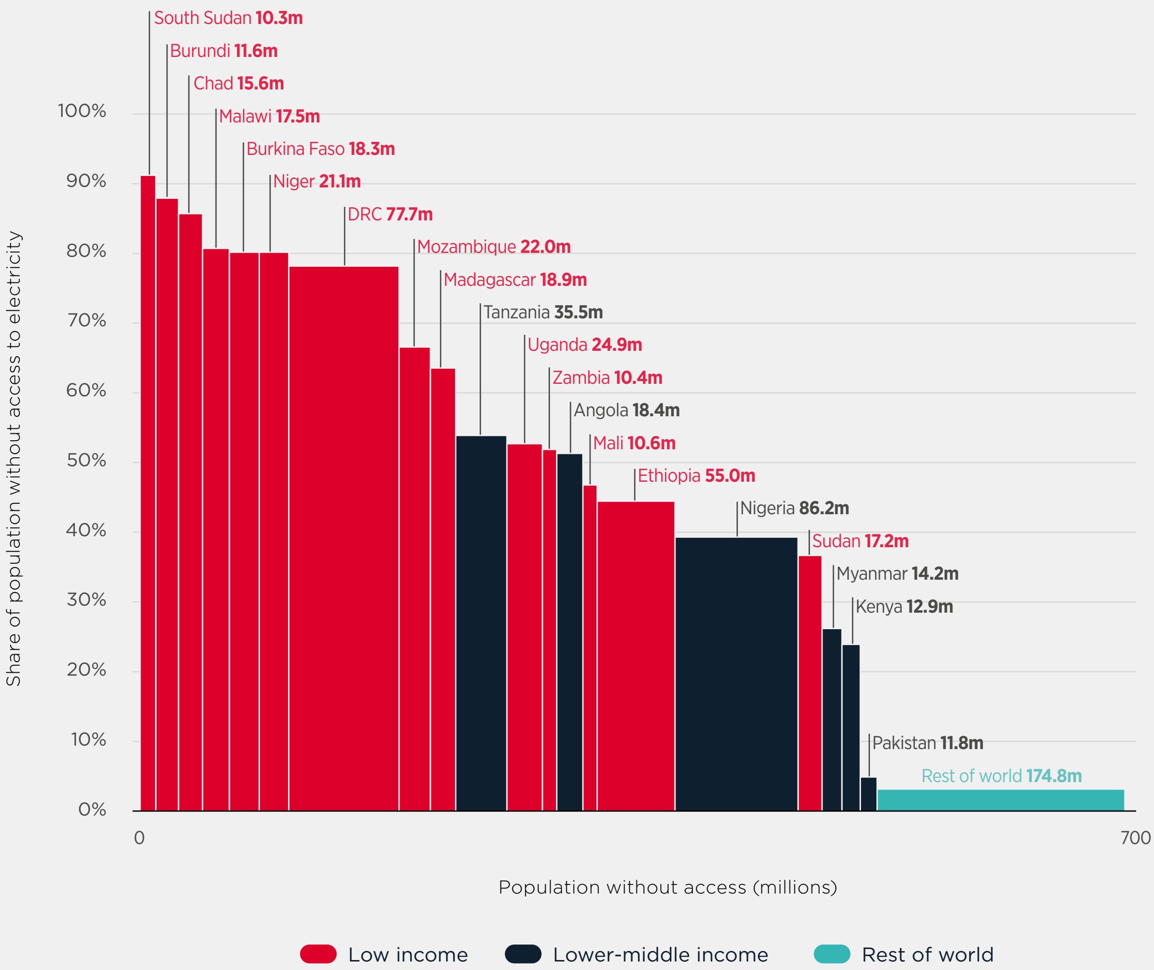
Incentivising energy builds where they can help drive use of other assets to earn revenue and ultimately drive economic growth is sometimes referred to as a productive energy use (PUE) scenario. The use of mini-grids can, for example, help power machinery or solar water pumps used by residents or smallholder farmers, which in turn helps solidify the demand base for the energy, in a virtuous circle.

7.3 Public policy recommendations

Sub-Saharan Africa accounts for more than 80% of the global population without energy access and 18 out of the 20 countries globally with the largest number of people living without electricity (see Figure 16).

Across the region, there are significant differences when it comes to progress on energy access. While countries such as Ghana, Kenya and Rwanda have made significant progress over the last decade and are on track to achieve universal energy access by 2030, countries such as DRC, Malawi and Chad still have energy access rates below 20%.

Figure 16 Share and absolute size of population without access to electricity in the top 20 access-deficit countries, 2022



Source: World Bank

The next step is to develop more granular feasibility assessments for renewable energy deployments in the rural areas highlighted in this report. These are likely to involve a mix of financing partners, telecoms operators, tower companies, energy specialists (including ESCOs) and government.

Governments can help resolve some of the barriers to renewable deployments, including land access and building rights, tax and overall incentives for foreign investors and DFI groups (donor financiers). We also see several situations that would benefit from government co-investment to help drive or top up private funding.

Governments in Africa can help enable investment in renewable energy developments through the following specific actions:

- Zero-rating of import duty on green energy equipment and accessories to support the transition to green energy solutions.
- Encouraging net metering, where the credit received when energy is fed back to the national grid can be utilised to cover energy use of other sites elsewhere in the country.
- Offering subsidies or tax incentives, where possible, for green energy solutions to reduce investment and operational costs.
- Designating free zones within a country that permit the building of solar or other renewable energy grids. This is a means of liberalising the energy sector. Mini-grids can be developed much faster, which can help make financing more attractive from groups such as the World Bank and DFIs.
- Designating telecoms infrastructure as critical national infrastructure for prioritisation of access to the national grid and other energy sources.
- Incentivising financial institutions to structure innovative financing for green energy projects by mobile operators – by reducing interest levied or permitting green bonds, for example.

More broadly, there is a need for governments, regulators and development finance institutions to pay closer attention to the intersections and synergies between the energy and digital sectors. This would benefit from promoting cross-governmental action plans and strategies that recognise energy is central to achieving digital objectives and that digitalisation is central to achieving energy objectives. This is particularly important in countries such as DRC, Nigeria and South Africa that have digital and energy infrastructure gaps and where the joint deployment of energy and digital connectivity can support and raise the return of investment of rural connectivity projects and support wider rural and national development efforts.

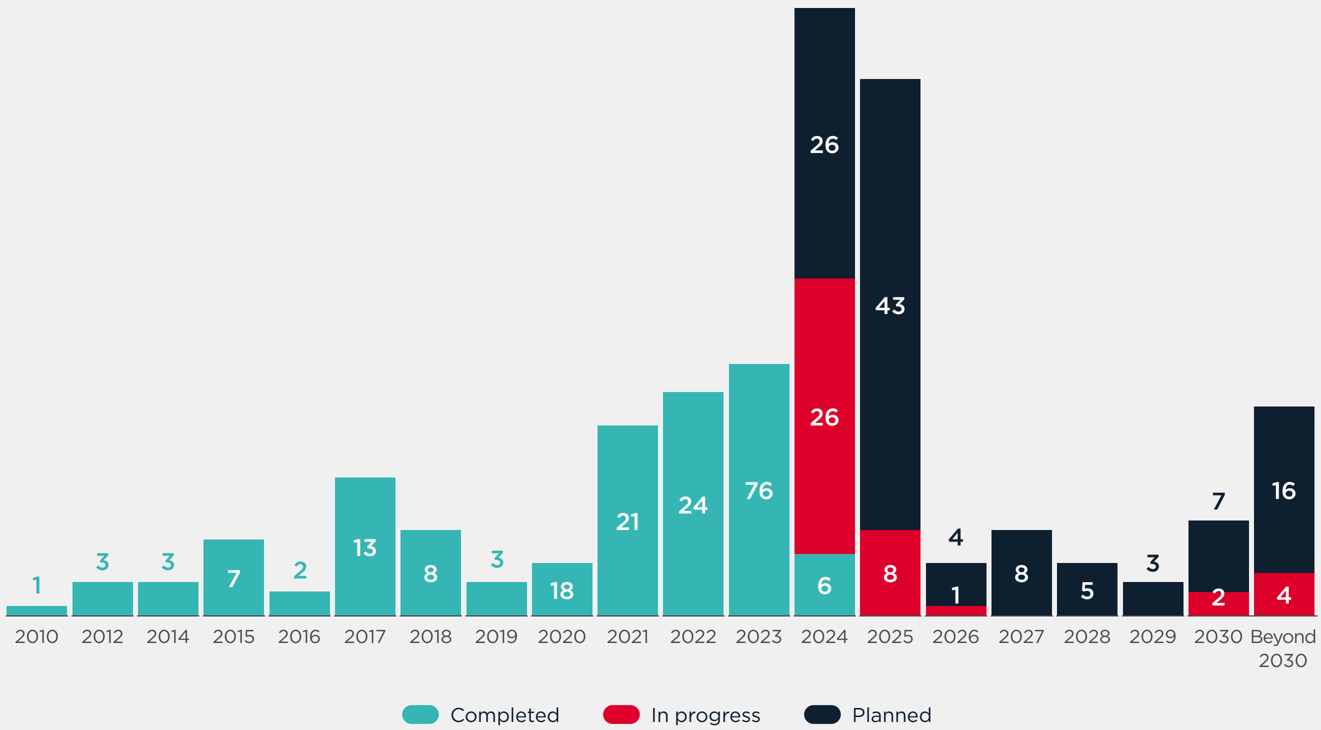
7.4 Recommendations for telecoms operators and industry partners

Mobile operators can help by modernising their networks to use more energy-efficient architectures, and collaborating with international DFIs and other investors.

With the advent of 5G, network sunsets have become a question of when, not if. Various factors have encouraged operators to shut down older technologies and migrate spectrum resources to newer technologies. These include declining user traffic and the high cost of maintenance on legacy networks; the need for sufficient spectrum resources to bolster 4G/5G coverage; and 3G being a highly energy-inefficient technology.

Globally, 3G sunsets surpassed 2G sunsets in 2023 and will continue to outnumber them going forward. 2024 and 2025 are poised to be big years for network sunsets. A total of 109 networks will be shut down during 2024/2025. Africa's continued heavy reliance on 3G is a major contributor to the energy inefficiency of mobile networks in the region, underscoring the need to transition to 4G and eventually 5G.

Figure 17 Network sunsets by completion year



Data as of 31 March 2024
Source: GSMA Intelligence

However, some people rely on these older networks. Even if they wanted to migrate, they may not be able to afford it. In some cases, the networks also continue to be used for machine-to-machine (M2M) applications. Policymakers and regulators in the industry can help. Options include licence holidays for spectrum supporting newer technologies and providing mobile operators with 25-year licences to allow for the amortisation of investments over a longer period. Both will contribute towards lower energy costs and consequently lower data costs.

Telecoms operators can play a role by sharing tower location data for integrated energy planning.[21] Projects also need to take into account future energy demand as network upgrades will mean higher energy requirements. Granular data at the site level is a crucial guide for would-be investors as it allows them to direct renewable builds to the areas of a country where the need is most acute. This can also help inform mobile operators' own infrastructure investment decisions, and help operators and tower companies benefit from large-scale donor funding programmes such as the recently announced RBF and debt funding wind.

21 The role of mobile coverage data in integrated energy planning: The case of the Democratic Republic of Congo, GSMA, 2022

gsmaintelligence.com