Vodacom Report:
Decarbonising Africa's ICT sector

Chapter 5
Conclusion

April 2026

Further together

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Conclusion

Africa is faced with a historic low-carbon growth

Africa's abundant natural resources make it ideally positioned to take advantage of low-carbon growth opportunities to enable economic growth. Given its opportunities and challenges, Africa is at a crucial phase in its low-carbon journey. To achieve net zero greenhouse gas emissions, Africa needs to use fewer fossil fuel electricity sources. Decarbonisation could enhance energy security, advance socioeconomic development and improve environmental health. Renewable energy and energy efficiency technologies are critical to achieving low-carbon growth. However, Africa's economic, regulatory, and political challenges constrain investment and development in these technologies.

Despite these challenges, Africa's abundant solar and wind resources and increased availability of climate finance present significant net zero transition opportunities. We can realise these opportunities by developing supportive market conditions, advancing and scaling key technologies, developing the necessary skills and leveraging innovative financing.

Mobile network operators (MNOs) consume large amounts of energy and are key drivers of technological innovation. Thus, they play a pivotal role in Africa's transition to a low-carbon future. MNOs provide essential digital infrastructure that drives sustainable development in rural and urban areas. Reliable data and communication services have become vital for healthcare, education, business and everyday life. Because these services cannot be compromised in pursuit of decarbonisation, MNOs are critical to driving Africa's low-carbon growth.

MNOs face significant challenges and opportunities as they navigate the decarbonisation journey in Africa.

MNOs provide services that underpin technological and economic progress across Africa, yet they face significant challenges in their drive to decarbonise their operations. Through interviews and research, this report identifies and discusses many of these barriers and the opportunities to overcome them. The three main challenges MNOs face are:

- Weak and absent grid infrastructure
- The high carbon intensity of grid electricity
- The lack of economically viable, clean energy alternatives for powering mobile network infrastructure

These barriers are closely linked to broader regulatory, technical and financial issues, creating a complex landscape in the journey towards sustainable development.

Much of Africa's electricity grid infrastructure remains inadequate. Access to grid electricity is limited or non-existent in rural areas in particular. State-owned utilities face financial constraints and have limited skilled workers and institutional capacity. These utilities have little or no competition, and struggle with under-priced tariffs, poor collection rates and theft, weakening their financial positions. This leaves them unable to maintain or upgrade existing generation (facilities that generate electricity such as power plants), transmission (infrastructure to transmit electricity such as high-voltage power lines) and distribution (infrastructure that powers homes, including substations and transformers) assets. Expanding generation capacity and grid infrastructure to meet the demands of growing populations is thus out of reach. State-owned utilities cannot access the capital needed to increase generation capacity, improve the grid's reliability and provide electricity to underserved areas. Financial constraints faced by state-owned utilities, such as under-priced tariffs, poor collection rates, and theft, weaken their financial positions and limit their ability to upgrade infrastructure. Addressing these financial challenges is crucial for enabling utilities to invest in renewable energy and energy efficiency technologies.

Regulatory frameworks that govern the electricity sector often fail to prioritise or incentivise utilities to maintain the grid, use newer technology or expand the grid to reach more people. Effective regulatory policies are essential to ensure that utilities are motivated to invest in grid maintenance and expansion, thereby supporting the transition to low-carbon energy sources. While private participation in electricity markets is possible in certain African countries, regulatory policies frequently lack the clarity and support necessary to attract local and foreign investment in renewable energy projects. Compounding this issue, regulators often lack the business, technical, regulatory, policy and other skills and experience needed to tackle these complex challenges effectively.

Increased private sector involvement through policy reforms is crucial for enhancing generation capacity and improving grid infrastructure. Public-private partnerships (PPPs) and independent power producers (IPPs) can play a significant role in improving grid reliability and access, thereby supporting the decarbonisation journey.

These financial, skills and regulatory gaps have led to underdeveloped grids that cannot meet the growing energy demands of businesses and consumers.

As a result of grid infrastructure challenges, MNOs and many other sectors across Africa rely heavily on carbon-intensive diesel generators to ensure service continuity. MNOs use generators as backup power in on-grid areas and as primary sources in off-grid regions. Using generators increases operational costs and increases carbon emissions in countries with relatively less carbon-intensive grids (with a grid emission factor below ~0.8 kilograms of CO_2e of carbon emitted for every kilowatt hour produced (CO_2e/kWh)). As economies develop, business and industrial needs grow, and the regulatory environment struggles to keep pace. Inefficiencies persist, limiting the potential for economic and social progress.

Decentralised energy solutions, such as mini-grids and micro-grids, are essential for reducing reliance on carbon-intensive diesel generators in remote areas. These solutions provide cost-effective and sustainable alternatives for powering mobile network operator (MNO) base stations and other critical infrastructure.

Renewable energy and energy efficiency solutions require a high upfront cost, posing a major barrier to decarbonisation in Africa. Many businesses, including MNOs, struggle to secure affordable capital for such investments, as funding is often prioritised for income-generating projects rather than long-term operational savings. Despite environmental benefits and significant long-term cost reductions, financial constraints frequently deter businesses from adopting these technologies, even when they promise a positive return on investment. Innovative financing solutions like green bonds, concessional loans, and blended finance can help address financial barriers and improve returns for investors. These financing mechanisms can lower the cost of capital and make renewable energy projects more attractive to investors. Capacity-building programs are needed to enhance the technical skills and knowledge of key stakeholders involved in the decarbonisation process. These programs can help streamline project implementation, reduce costs, and ensure the successful deployment of renewable energy and energy efficiency technologies.

Despite these barriers, there are major opportunities to improve the financial landscape and drive renewable energy generation and grid infrastructure investment. Strengthening regulatory frameworks is key to attracting investment. Increased private sector involvement through policy reforms is considered necessary to enhance generation capacity and improving grid infrastructure. Establishing public-private partnerships (PPPs) between government entities, investors and large energy users such as MNOs can improve grid reliability and access. By leveraging financial innovations, PPPs can unlock capital for infrastructure projects, particularly in renewable energy.

Allowing independent power producers (IPPs) to sell power to MNOs and other parties over the grid through standardised power purchase agreements (PPAs) provides an excellent opportunity to boost renewable energy adoption, increase generation capacity and strengthen the electricity grid. PPAs help to provide IPPs with a stable revenue stream, which makes projects more attractive to investors and reduces financial barriers.

Where PPAs are not feasible, standardised, high-quality Renewable Energy Certificates (RECs) can play a crucial role by:

- Offsetting grid electricity consumption for MNOs and other businesses
- Incentivising the development of renewable energy capacity
- Supporting renewable energy projects that would not have been financially viable without revenue from REC sales, which promotes regional renewable energy adoption
- Enhancing energy security by reducing reliance on often-imported fossil fuel
- As a market-based mechanism, providing economic incentives that improve the financial viability of renewable energy projects, which drives further investment in the sector

Decentralised energy solutions avoid using a large single source of power and include on-site and mini-grid renewable energy generation. They provide an opportunity to reduce reliance on carbon-intensive diesel generators, which usually fill grid infrastructure gaps. Mini-grids and micro-grids, especially those with solar photovoltaic (PV) technology, present cost-effective solutions for powering MNO base stations in remote, off-grid areas. Using different types of batteries, such as sodium-ion, and a combination of diesel/renewable energy systems during transition phases can help to reduce costs and enhance the reliability of renewable energy solutions.

Rwanda is a notable example of how strategic government policy, PPPs and international support can improve energy access. By using grid and off-grid solutions, Rwanda increased its electricity access rate from 6% to 75% between 2009 and 2024. This achievement provides a model for other African countries and demonstrates the importance of strong government leadership, clearly defined institutional roles and private sector collaboration in reaching energy access goals.

The carbon intensity of electricity grids across Africa varies significantly, and many countries rely heavily on carbon-intensive coal, diesel and heavy fuel oils. South Africa derives 80% of its electricity from coal, with a high grid emission factor of over 1tCO_2e/MWh.

Fossil fuels pose a significant challenge for MNOs wanting to decarbonise their operations, especially due to the high energy needs of data centres and collective consumption of base stations. Developing a robust renewable energy market is key to reducing grid carbon intensity and supporting decarbonisation efforts. Implementing PPAs, RECs and green tariffs can promote renewable energy investments and facilitate the transition to cleaner grids. This shift aids in reducing emissions and strengthens energy security by cutting costs and reducing dependence on imported fossil fuels.

Wheeling and virtual wheeling allow IPPs to send electricity to end users through the national grid, allowing for generation sites to be placed in high-yielding, grid connectable locations. South Africa provides a leading example of innovative approaches to facilitating the uptake of cost-effective renewable energy through its Renewable Energy IPP Programme (REIPPP). This showcases how regulatory innovations can drive renewable energy adoption and reduce carbon intensity.

Weak grid infrastructure, the high carbon intensity of grid electricity and the lack of suitable clean energy alternatives are significant decarbonisation barriers faced by MNOs. However, these challenges also present transformation opportunities. MNOs can significantly advance their decarbonisation efforts, enhance energy security and support socioeconomic development through partnerships to improve grid infrastructure and promote renewable energy markets, and by adopting innovative clean energy solutions. Realising these opportunities and driving meaningful change in Africa's energy landscape will require unprecedented collaboration among various stakeholders.

Collaboration between MNOs and private and public sector stakeholders is key to overcoming regulatory, financial and technical barriers and realising decarbonisation opportunities.

To successfully navigate decarbonisation journeys and unlock socioeconomic and other opportunities, MNOs and other businesses need to collaborate strategically to address regulatory technical, and financial barriers.

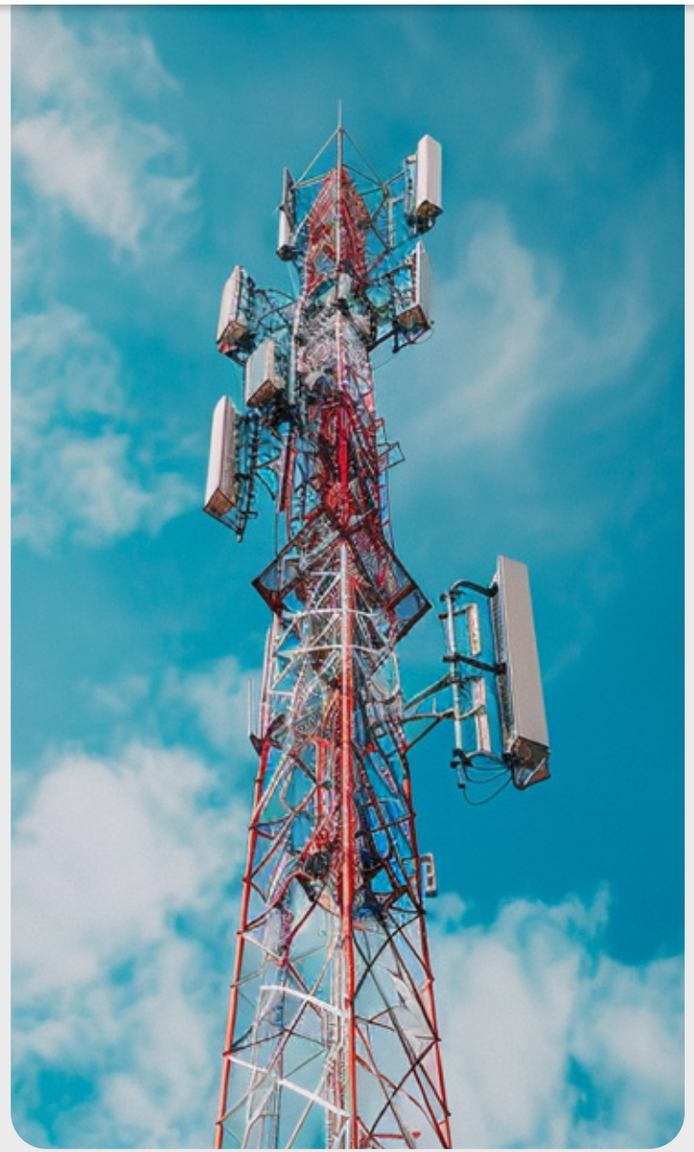
For example, PPPs can support investments in grid infrastructure improvements and renewable energy projects, helping to address financial constraints and unreliable power supplies. Power sector reforms, supported by advocacy efforts, can enhance the financial stability of electricity utilities and encourage private sector participation, helping to overcome regulatory and financial barriers. Partnering with mini-grid developers allows MNOs to power their mobile base stations in off-grid areas, helping to address the challenges of weak and absent grid infrastructure.

Allowing IPPs to operate and enabling wheeling arrangements can facilitate greater access to renewable energy for MNOs. Permitting self-generation allows businesses to invest directly in their energy independence. Developing robust REC frameworks can help incentivise renewable energy projects, creating a market for clean energy and supporting decarbonisation efforts. Similarly, supporting research and development (R&D) in renewable technologies and fostering supply chains for alternative fuels, such as hydrogen and biofuels, can drive innovation and provide cleaner energy options.

Engaging in renewable energy markets through PPAs, RECs, and green tariffs can help to secure renewable energy and reduce reliance on carbon-intensive grids. Capacity building with development finance institutions (DFIs) and multilateral development banks (MDBs) can strengthen technical and institutional capabilities, helping overcome skills and regulatory barriers.

Glossary of acronyms

AfDB	African Development Bank
AI	Artificial Intelligence
BESS	Battery energy storage system
CAPEX	Capital Expenditure
DFIs	Development Finance Institutions
DRC	Democratic Republic of Congo
EDCL	Energy Development Corporation Limited
ESI	Energy Systems Integration
EUCL	Electricity Utility Corporation Limited
GHG	Greenhouse Gas
GSMA	Global System for Mobile Communications Association
HVAC	Heating, ventilation, and air conditioning
HVO	Hydrotreated vegetable oil
IEA	International Energy Agency
IPPs	Independent Power Producers
ITP	Independent Transmission Project
LCOE	Levelised cost of energy
MDBs	Multilateral Development Banks



MENA	Middle East and North Africa
MININFRA	Ministry of Infrastructure
MNO	Mobile Network Operator
MV	Medium Voltage
OPEX	Operational Expenditure
PPA	Power Purchase Agreement
PPP	Public-Private Partnership
PUE	Power usage effectiveness
PV	Photovoltaic
RECs	Renewable Energy Certificates
REG	Rwanda Energy Group
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
RURA	Rwanda Utilities Regulatory Authority
SHS	Solar Home Systems
SSA	Sub-Saharan Africa
TOU	Time-of-use
US$	United States Dollar
VWP	Virtual Wheeling Platform

Objectives of stakeholder interviews

The primary objective of the interviews was to gain a deeper understanding of barriers and solutions to decarbonisation in Africa, especially in the ICT sector. Interviews were semi-structured with specific questions tailored to the interviewee/represented organisation; questions were primarily based on what were known to be the primary barriers; however, interviewees were encouraged to discuss additional barriers that they were aware of, and what they saw as the best solutions to these barriers.

As the primary decarbonisation barriers and solutions were multi-faceted and sometimes geographically specific, interview questions asked focused on the sector that the interviewee was from, or the expertise that they were expected to have, and geographies for which they were knowledgeable, i.e. interviews took on different themes in relation to the decarbonisation challenge. As per the following section, we conducted interviews for the themes described in the below table.

African telco companies and industry bodies

Interview theme

Decarbonisation challenges and opportunities across the telco network: Interviews sought to generate an understanding of what the most material decarbonisation challenges and opportunities are across the network in relation to, e.g., supply chain, technical, infrastructure, regulatory, economic (e.g. affordability/the investment case), finance, green electricity market mechanisms, partnerships. Particular attention paid was to instances where material challenges have been successfully addressed so that these were considered for inclusion as case studies in the final report.

Tower Companies

Interview theme

Decarbonisation challenges and opportunities for Towers: Interviews focused on decarbonisation challenges and current/future opportunities in relation to on-grid, weak-grid, and off-grid towers. The implementation (and associated challenges) of solar and battery systems was an important focus area, however alternative off-grid renewable solutions, on-grid opportunities, market-based instruments for procuring renewables, partnerships potential, and energy efficiency (e.g. in relation to base station efficiency, transition of fixed network connections to fibre) were also discussed.

Data centre operators

Interview theme

Decarbonisation challenges and opportunities for data centres: Interviews focused on the deployment of low/zero carbon primary and back-up energy (mature and emerging technologies), opportunities/challenges associated with using renewable energy market mechanisms, and opportunities/challenges for improving the energy efficiency (PUE) of data centres in relation to equipment, software, cooling, design, etc.

Mini grid industry bodies/developers

Interview theme

Mini grids as decarbonisation opportunity for towers: Interviews focused on mini grids as both a decarbonisation opportunity for towers and as an opportunity for telcos to further their social impact and aid in a Just Energy Transition. Challenges and opportunities for mini-grid developers to develop mini-grids with a telecom tower were explored as well as Productive use of Energy opportunities for accelerating socio-economic development in rural communities. It is noted that the mini-grid sector face several challenges as a whole. The analysis did not focus on defining the more general challenges to deploying mini-grids as this is well documented and understood, although reference was made to it.

Utilities/utility related organisations/policy makers/advisors

Interview theme

Electricity access and decarbonisation challenges and opportunities associated with grid electricity: Interviews focused on three aspects important to decarbonisation i.e. improving grid reliability, increasing grid access, and greening the grid. Interviews sought to understand and clearly define the problem, and to identify potential solutions/opportunities (that ICT sector companies can realistically influence):

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i. **Grid connected areas:** The challenges/opportunities associated with electricity supply to grid connected assets i.e. poor reliability and quality of electricity supply, necessitating increased reliance on diesel gensets;
ii. **Improving electricity access through grid extension:** Challenges/opportunities for grid extension (that ICT sector companies can realistically influence); and
iii. **Greening the grid:** Opportunities/challenges for increasing renewable energy in the electricity mix, and procuring green energy over the grid (e.g. as supplied by IPPs) through market based instruments.

Regulators/legal experts

Interview theme

Decarbonisation challenges and opportunities associated with policy/regulatory regimes in Africa, especially in relation to private sector renewable energy generation: Interviews focused on the regulatory challenges to developing private sector renewable energy capacity in Africa, and to the challenges faced by corporates in directly/indirectly (i.e. through market mechanisms) procuring renewable energy. Particular attention was paid to cases where challenges have been successfully overcome so that these were considered for inclusion as case studies in the final report.

Finance providers

Interview theme

Challenges and opportunities associated with financing decarbonisation projects in Africa: Interviews focused on barriers to financing decarbonisation projects in Africa, and on 'off the shelf' and innovative financing solutions that have been developed/could be developed for addressing these barriers. Financing of both capex (e.g. solar) and opex (e.g. energy efficiency) interventions will be discussed. These interviews were the last to take place as financing related barriers had been raised in prior interviews, and these helped to inform interview questions/provide finance providers with valuable context.

Stakeholders interviewed

The table below displays the organisations interviewed, along with their corresponding stakeholder groups.

- Indicates the primary stakeholder group associated with each organisation or individual
- Signifies a potential secondary stakeholder group they may relate to

Interviewee	African telco companies and industry bodies	Tower Companies	Data centre operators	Mini grid industry bodies/ developers	Utility related	Regulators/legal experts	Finance providers	Suppliers/ Service providers
	Relevant stakeholder group							
Africa Forum for Utility Regulators					●	●		
Baker McKenzie					○	●	○	
GSMA	●					○		
HUAWEI								●
Nokia								●
NURU				●				
Standard Bank							●	
Vodacom OpCos (grouped)	●	○	○			○		
Other technology providers and industry stakeholders		●	●		●	●	●	●