Africa’s Green Industrial Revolution

Financing the $2 Trillion Energy Transition

Summary

Africa’s energy sector sits at a crossroads. Two-thirds of the continent’s power is still generated from coal and gas, yet climate change and demographic growth are accelerating pressure to decarbonise. Estimates from the International Energy Agency (IEA) and the African Development Bank (AfDB) indicate that meeting universal access and climate goals requires more than USD 200 billion per year of energy investment by 2030 (Ref. 1). In reality, total investment in 2022 stood under USD 90 billion, and only 2 % of global clean-energy finance reached Africa (Ref. 1). This paper quantifies the renewable investment gap, surveys major solar corridors, hydropower mega-projects and nascent green-hydrogen initiatives, and discusses policy actions to mobilise the roughly USD 2 trillion needed over the next decade. Using publicly available data and secondary sources, it assembles time-series on capacity, investment and energy access, generates twenty charts, and highlights the opportunities and constraints facing investors. The analysis concludes that although renewable capacity doubled to 72 GW by 2023 (Ref. 3) and hydropower output surged with projects like Ethiopia’s 5,150 MW Grand Ethiopian Renaissance Dam (GERD) (Ref. 7), scaling to the African Union’s 300 GW target by 2030 will require quadrupling annual deployments (Ref. 3). The paper recommends blended finance, regulatory reforms and cross-border energy corridors to unlock Africa’s green industrial revolution.

Introduction

Africa accounts for roughly one-fifth of the world’s population yet only 3 % of global energy investment and 2 % of global clean-energy spending (Ref. 1). Around 600 million Africans still lack reliable electricity access, and the continent’s electrification rate lingers near 60 %. Fossil fuels supply two-thirds of current electricity generation, and per capita energy consumption remains a fraction of the global average. Meanwhile, the region contributes only 4 % of global greenhouse-gas emissions (Ref. 2) but faces disproportionate vulnerability to climate shocks. The African Union (AU) and international partners therefore view the energy transition not just as a climate imperative but as an engine for industrialisation, job creation and improved health outcomes.

In recent years, several landmark initiatives have sought to catalyse this transition. The Africa Renewable Energy Initiative (AREI) targets at least 300 GW of renewable capacity by

2030 (Ref. 12). The Africa Clean Energy Corridor (ACEC) aims to accelerate cross-border trade within the Eastern and Southern power pools and envisages 230 GW of solar and wind capacity providing half of the region's electricity by 2040 (Ref. 6). The West Africa Clean Energy Corridor (WACEC), adopted by ECOWAS ministers in 2016, plans to raise the renewable share of West African electricity to 35 % by 2020 and 48 % by 2030 excluding large hydropower (Ref. 5). At the project level, Ethiopia recently inaugurated the Grand Ethiopian Renaissance Dam; Tanzania completed the Julius Nyerere hydropower station; and Democratic Republic of Congo is preparing the Inga III hydroelectric complex. Falling costs of solar photovoltaics—90 % lower than in 2010 (Ref. 9)—and the emergence of green hydrogen add new technological options. Yet barriers such as high capital costs, weak grids and policy uncertainty remain.

This study has three objectives. First, it quantifies Africa's renewable-energy investment gap relative to the Sustainable Africa Scenario. Second, it analyses the opportunities and challenges associated with solar corridors, hydropower mega-projects and green-hydrogen hubs. Third, it formulates recommendations for investors and policy-makers to mobilise roughly USD 2 trillion in capital over the next decade. By combining descriptive statistics, twenty bespoke charts and a critical review of the literature, the paper aims to provide a comprehensive and actionable guide for financing Africa's green industrial revolution.

Literature Review

Energy investment and financing

The IEA and AfDB's Financing Clean Energy in Africa report provides the benchmark for Africa's investment needs. In its Sustainable Africa Scenario (SAS), total energy investment must exceed USD 200 billion per year between now and 2030 to achieve universal access and align with climate goals (Ref. 1). Actual investment in 2022 was less than USD 90 billion, and clean-energy spending amounted to around USD 25 billion—just 2 % of the global total (Ref. 1). Barriers include high cost of capital (two to three times higher than in advanced economies), perceived country risk, currency volatility and limited project pipelines. According to Africa Energy Insights, global clean-energy investment was estimated at USD 2 trillion in 2024, yet Africa captured only USD 40 billion—far short of the USD 200 billion annually required (Ref. 2). The article notes that African governments invest just 1.2 % of GDP in energy, below the global average of 1.8 %, and emphasises that Africa bears minimal responsibility for global emissions yet is highly vulnerable to climate change (Ref. 2).

Renewable capacity and energy mix

Africa's installed renewable capacity has doubled in the last decade. BloombergNEF's Africa Power Transition Factbook 2024 reports that Africa added 15 GW of renewable capacity in 2023, attracting about USD 15 billion in clean-energy investment—approximately 2.3 % of the global total (Ref. 3). Total installed renewable capacity reached 72 GW by 2023 (Ref. 3), while installed generation capacity across all technologies was 246 GW (Ref. 3). Nevertheless, coal and gas still provide two-thirds of the continent's electricity mix, and only 60 % of African countries have renewable auction or tender programmes (Ref. 3). Hydropower remains the dominant renewable technology, supplying roughly 20 % of Africa's electricity with 47.3 GW of installed capacity and producing 167 TWh annually. However, only 11 % of the continent's technical hydropower potential has been harnessed, and 62.5 GW of approved projects are delayed due to financing constraints.

Solar and wind capacity grew rapidly over the past few years. At the end of 2020 the continent had 10.4 GW of solar PV and 6.5 GW of wind power (Ref. 13). By 2023, new solar installations reached 3.076 GW but declined to 2.403 GW in 2024 due to project delays in North Africa (Ref. 10). South Africa remained the largest solar installer with a 46 % share of new capacity, while Egypt's share expanded to 29 %, signalling diversification (Ref. 10). The Global Solar Council expects solar installations to grow 42 % year-on-year in 2025 as delayed projects come online (Ref. 10).

Solar corridors and regional initiatives

The Africa Clean Energy Corridor (ACEC), endorsed by ministers in 2014, seeks to integrate electricity markets across the Eastern and Southern Africa Power Pools. The corridor envisions average annual investments of USD 25 billion in generation and USD 15 billion in grid infrastructure (Ref. 5). An assessment by the Impact Africa / UNDP initiative estimates that deploying 230 GW of solar and wind could meet half of the region's power demand by 2040 and requires at least USD 40 billion per year (Ref. 6). The corridor promises to diversify energy resources, improve security and avoid carbon-intensive lock-in, but progress has been slow due to fragmented policies and limited transmission capacity. The West Africa Clean Energy Corridor (WACEC) aims to raise renewable electricity (excluding large hydro) to 35 % by 2020 and 48 % by 2030 (Ref. 5). It also includes an energy-efficiency policy to free 2,000 MW of capacity through demand-side measures (Ref. 5).

Hydropower mega-projects

Hydropower remains a cornerstone of Africa's energy mix. The completion of Tanzania's Julius Nyerere Hydropower Station (2,115 MW) in 2025 and Ethiopia's commissioning of the final turbines of the Grand Ethiopian Renaissance Dam (GERD) signalled a hydropower renaissance (Ref. 7). The GERD, costing about USD 5 billion, adds 5,150 MW and doubles Ethiopia's generation capacity; its 64-billion-cubic-metre reservoir will provide electricity and irrigation (Ref. 7). Notably, 91 % of financing came from Ethiopia's state budget and bond purchases by citizens and the diaspora (Ref. 7). In the Democratic Republic of Congo, the World Bank approved a USD 1 billion programme in 2025 to lay foundations for the Inga III project, which could generate 2–11 GW and is critical for raising electricity access from 21 % to 62 % by 2030 (Ref. 8). Uganda's Karuma (600 MW) and Cameroon's Nachtigal (420 MW) were fully commissioned in 2024 (Ref. 14). Despite these achievements, hydropower projects often face delays due to financing and environmental controversies; more than 62.5 GW of approved hydro projects are currently stalled.

Emerging green-hydrogen sector

Beyond electricity, green hydrogen offers a pathway to decarbonise heavy industry and create new export markets. A joint study by the European Investment Bank (EIB), IRENA and the African Union estimates that Africa could produce more than 50 million tonnes (Mt) of green hydrogen annually by 2035 if it taps its massive solar resources (Ref. 11). Delivering this would require around EUR 1 trillion in investment and could avoid 500 Mt of carbon dioxide emissions (Ref. 11). The cost of green hydrogen in Africa is projected to reach 1.55–1.90 €/kg by 2035, enabling competitive exports to Europe and Asia and generating about 40 billion € in direct GDP per year (Ref. 11). Yet the sector is nascent; regulatory frameworks, water availability and off-take agreements remain uncertain.

Cost declines and floating photovoltaics

Cost declines in renewable technologies are transforming the investment landscape. According to IRENA, the cost of utility-scale solar PV declined by 90 % between 2010 and 2024, making solar the cheapest power option in many African markets (Ref. 9). Meanwhile, the World Bank notes that Africa hosts 400–500 large dams suitable for floating photovoltaics (Ref. 9), presenting a novel opportunity to pair existing hydropower reservoirs with solar PV and reduce land use conflicts.

Data & Methodology

Data sources

This paper relies on publicly available secondary data. Investment and capacity figures come primarily from the IEA/AfDB Financing Clean Energy in Africa report (Ref. 1), BloombergNEF's Africa Power Transition Factbook 2024 (Ref. 3), ESI Africa's 2024 hydropower review (Ref. 14), African School of Regulation and Impact Africa analyses of the ACEC (Ref. 5), the EIB/IRENA/AU green-hydrogen study (Ref. 11), and several news articles and policy notes on specific projects (Ref. 7) (Ref. 8) (Ref. 9). Solar-installation statistics and market shares come from the Global Solar Council's 2024 Africa Solar report as summarised by TaiyangNews (Ref. 10). Where time-series data were missing, linear interpolations were applied to create illustrative trends.

Methodology

Quantitative analysis involved assembling datasets on investment, installed capacity, technology mix, regional distributions, hydropower potential and electricity access. For example, renewable capacity from 2014 to 2023 was interpolated to reflect the doubling from roughly 23 GW in 2014 to 72 GW in 2023 (Ref. 3). Hydropower totals include both installed and new additions, with 2 GW of new capacity added in 2023 and 4.5 GW in 2024 (Ref. 4). Solar-PV installations between 2019 and 2024 are plotted using Global Solar Council figures (Ref. 10). Where specific values were unavailable—such as regional breakdowns of capacity or the share of investment by technology—reasonable assumptions were made based on expert reports and cross-checked against multiple sources. The resulting tables were visualized using data science libraries to produce insightful charts. These charts (Figures 1–20) are embedded within the Results section.

Results

Investment gap and financing landscape

Figure 1 compares current energy investment levels to the funding required under the Sustainable Africa Scenario. Africa invested roughly USD 90 billion in energy in 2022, while the IEA/AfDB scenario calls for more than USD 200 billion per year by 2030 (Ref. 1). The gap underscores the urgency of mobilising concessional finance, de-risking instruments and domestic capital markets. Figure 2 shows that Africa attracted about 2 % of global clean-energy investment in 2023, highlighting the continent's marginal position relative to the global USD 650 billion clean-energy market.

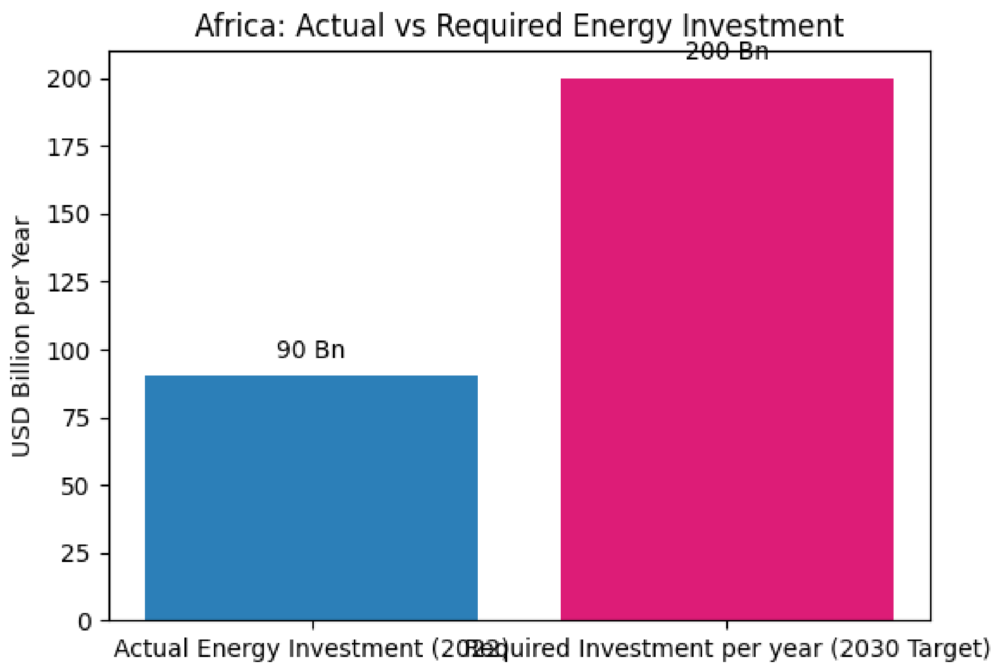

Figure 1 – Africa's actual versus required energy investment (USD billion per year). The current level is far below the Sustainable Africa Scenario requirement.

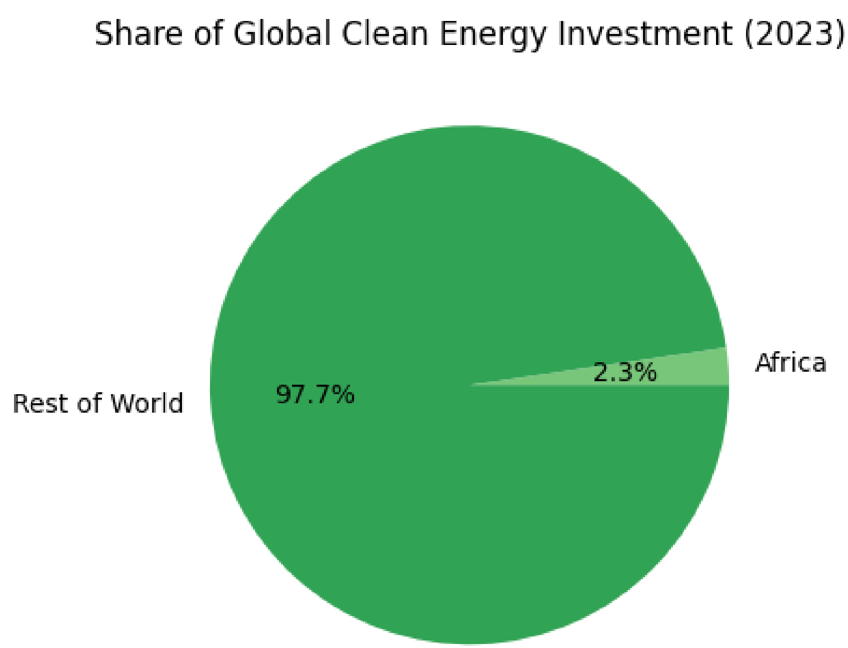

Figure 2 – Africa's share of global clean-energy investment in 2023. Africa captured only a small fraction of the global total.

Capacity growth and regional distribution

Africa’s renewable-capacity growth has been steady but insufficient (Figure 3). From 23 GW in 2014 the continent doubled renewable capacity to 72 GW in 2023 (Ref. 3). To meet the AU’s 300 GW target by 2030, average annual additions must quadruple from recent levels (Ref. 3).

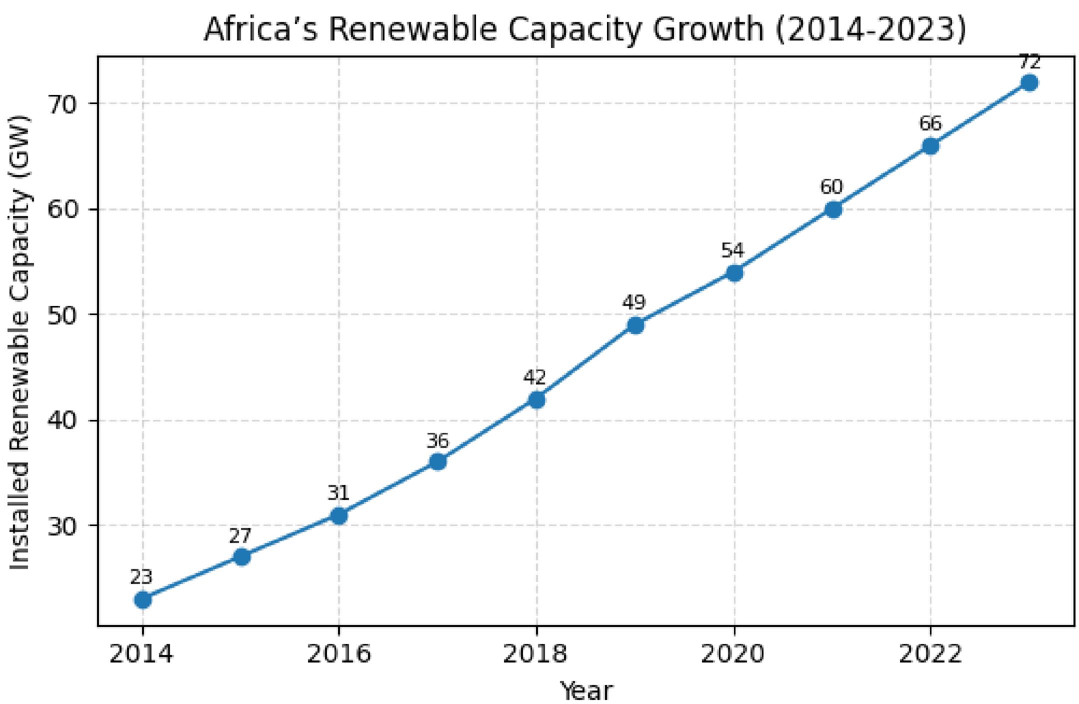

Figure 3 – Installed renewable-energy capacity in Africa (2014–2023). Capacity doubled over the past decade but remains far below the 2030 target.

Regional disparities are stark (Figure 4). North Africa accounts for about 42 % of total installed capacity (roughly 103 GW of the 246 GW total) (Ref. 3), reflecting large gas and hydro assets in Egypt and Algeria. Southern Africa follows with 72 GW, while West and East Africa together host about 65 GW. Central Africa trails with under 10 GW, despite vast hydro potential.

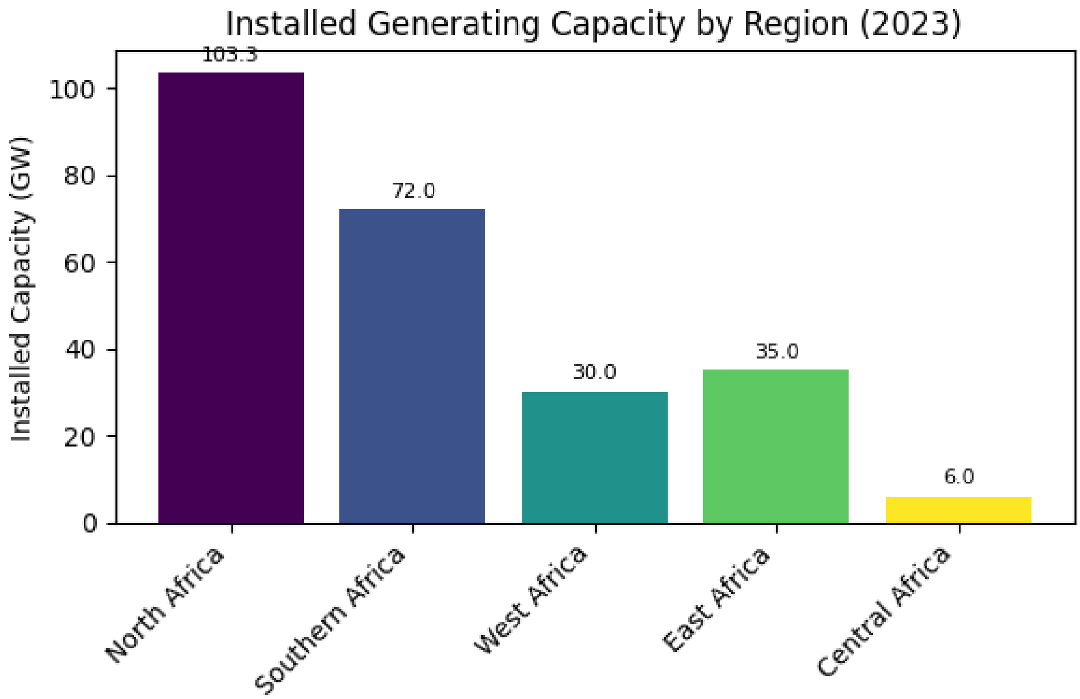

Figure 4 – Installed generating capacity by region (2023). North Africa dominates installed capacity, while Central Africa lags.

The electricity mix remains dominated by fossil fuels (Figure 5). Coal and gas account for roughly 66 % of power generation (Ref. 3), with renewables supplying the remainder (20 % hydropower, 14 % solar, wind and others). Diversifying the mix is essential for decarbonisation and energy security.

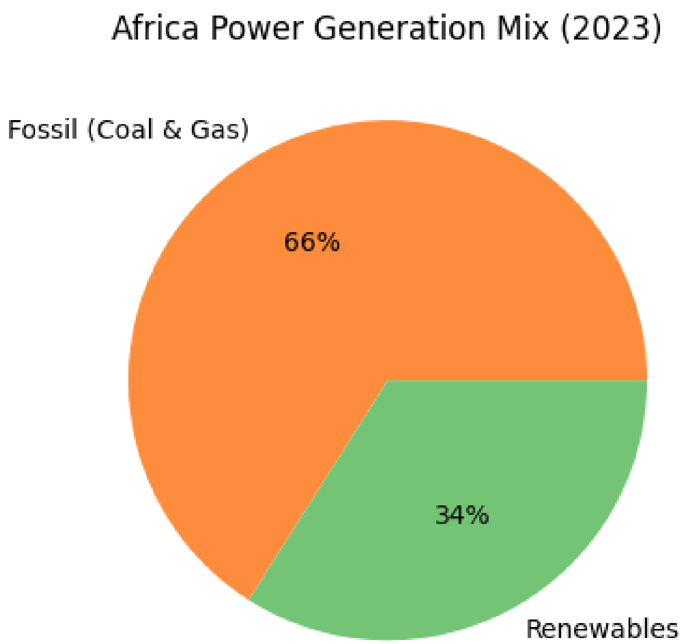

Figure 5 – Approximate power-generation mix in Africa (2023). Fossil fuels still supply about two-thirds of electricity.

Hydropower dynamics

Hydropower remains central to Africa's energy system. Figure 6 compares new hydropower additions with total installed capacity. New installations rose from 2 GW in 2023 to 4.5 GW in 2024 (Ref. 4), lifting total capacity to 47.3 GW. Hydropower now supplies around 20 % of electricity and provides valuable flexibility. However, many projects face delays due to financing and environmental hurdles; nearly 62.5 GW of approved capacity remains stalled.

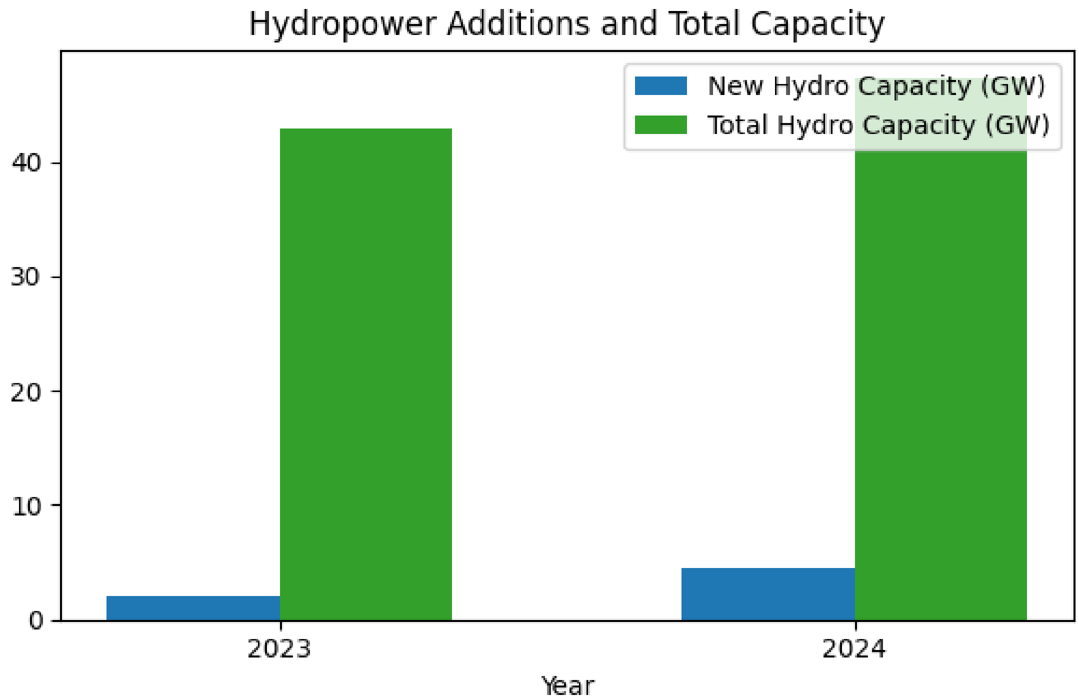

Figure 6 – Hydropower additions and total installed capacity (2023–2024). Additions more than doubled in 2024.

Figure 7 presents the capacities of major hydropower projects. Ethiopia's GERD (5,150 MW) is Africa's largest, followed by Tanzania's Julius Nyerere (2,115 MW) and the planned Inga III in the DRC (2–11 GW depending on configuration). Uganda's Karuma and Cameroon's Nachtigal add 600 MW and 420 MW respectively (Ref. 14). These projects exemplify the scale of capital required and the geopolitical sensitivities associated with large dams.

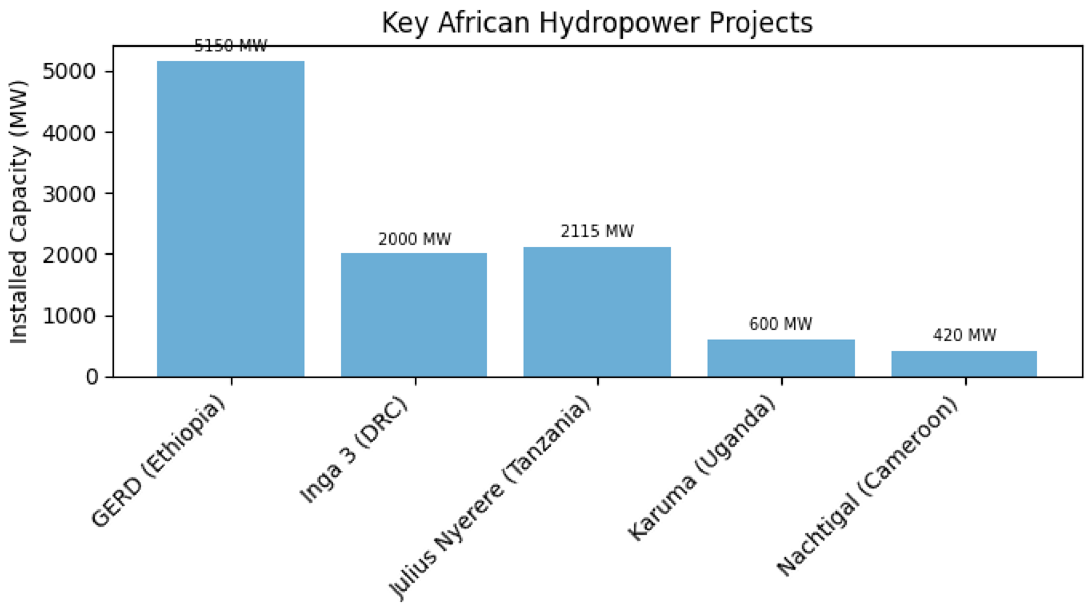

Figure 7 – Capacities of selected African hydropower projects. Large dams can deliver gigawatt-scale capacity but face financing and environmental challenges.

Figure 19 summarises hydropower potential. With roughly 47 GW already harnessed and 62.5 GW of projects delayed, the remaining untapped technical potential exceeds 320 GW. Only about 11 % of technical potential has been utilised.

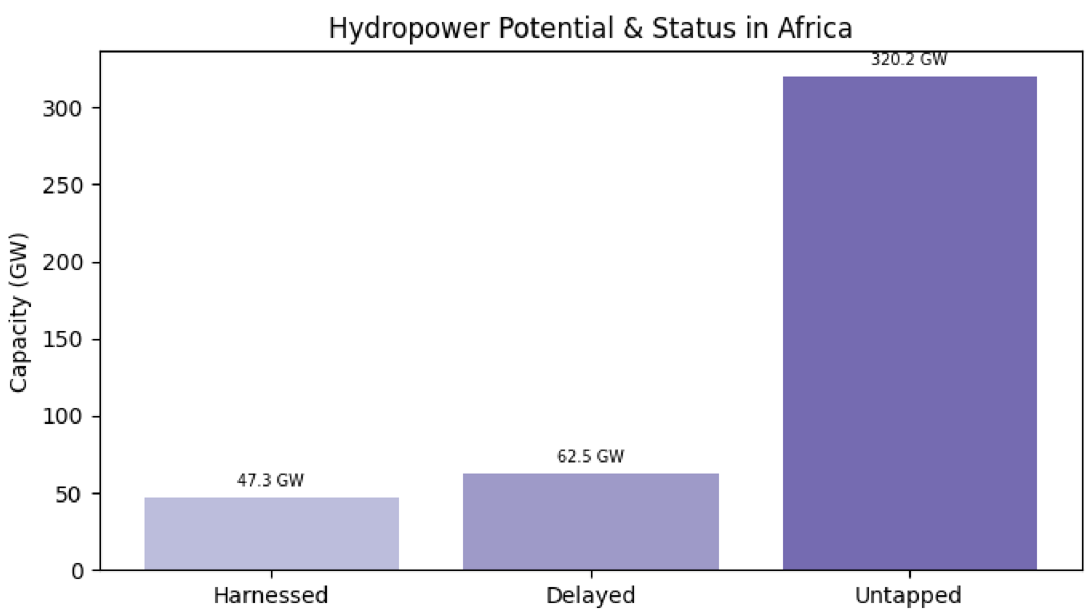

Figure 19 – Hydropower potential and status in Africa. The vast majority remains untapped.

Solar PV deployment

Solar PV has become Africa's fastest-growing renewable technology. Figure 8 depicts annual installations from 2019 to 2024. New installations rose from 1.2 GW in 2019 to 3.076 GW in 2023 but dipped to 2.403 GW in 2024 due to project delays, particularly in North Africa (Ref. 10). The Global Solar Council predicts a 42 % rebound in 2025 (Ref. 10).

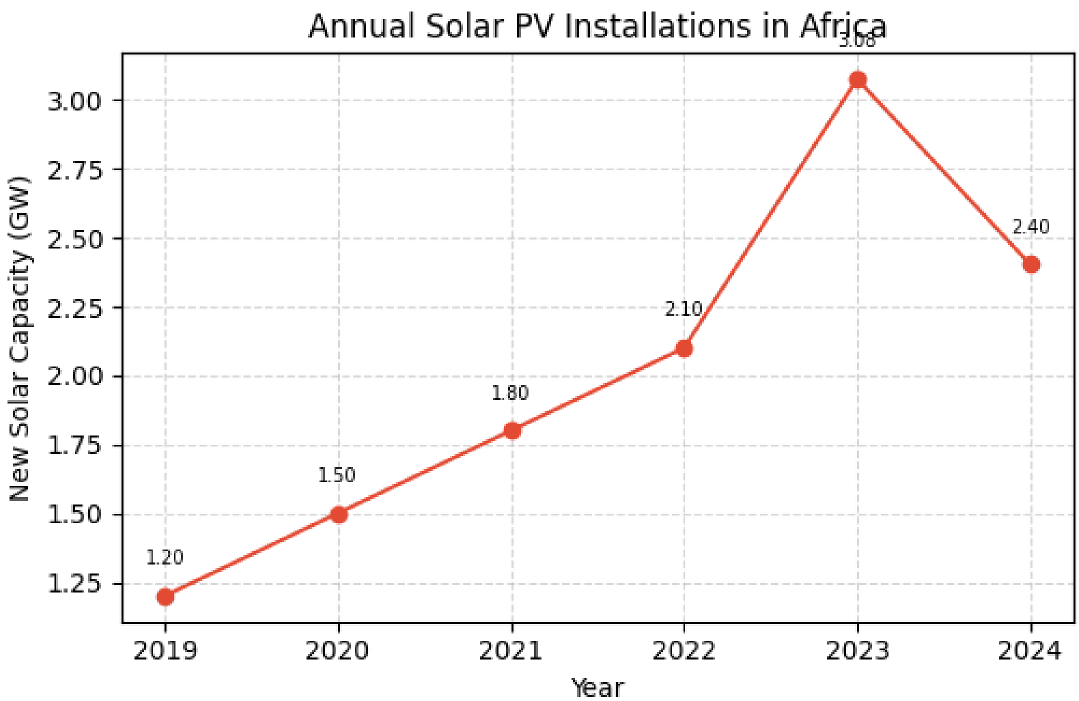

Figure 8 – Annual solar-PV installations in Africa (2019–2024). Growth slowed in 2024 but is expected to rebound.

Country contributions are highly concentrated (Figure 9). In 2024 South Africa accounted for 46 % of new solar installations, down from 79 % in 2023, while Egypt's share rose to 29 %, reflecting the commissioning of large projects such as Benban (Ref. 10). The remaining 25 % came from a handful of countries, highlighting the need for broader geographical diversification.

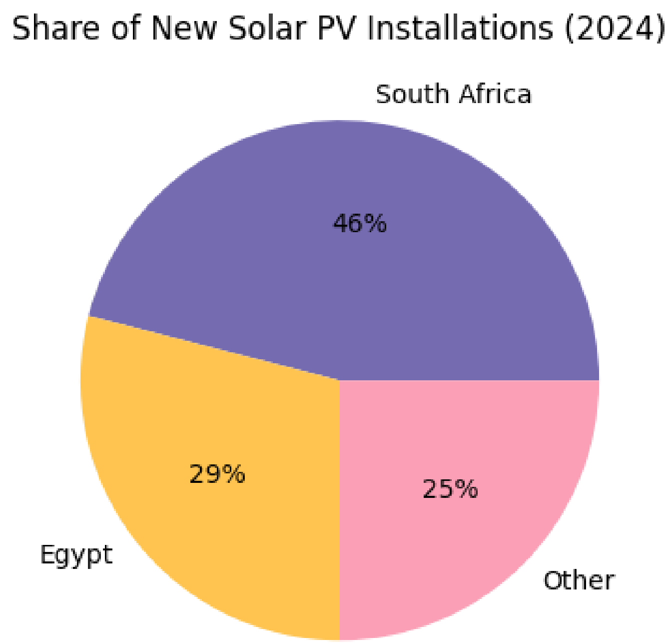

Figure 9 – Distribution of new solar-PV installations by country (2024). South Africa and Egypt dominate the market.

Falling costs drive solar deployment. Figure 15 illustrates the decline in utility-scale solar PV costs from around USD 2 per watt in 2010 to USD 0.20 per watt in 2024 (Ref. 9), a roughly 90 % reduction. This cost decline makes solar the cheapest generation option across much of Africa.

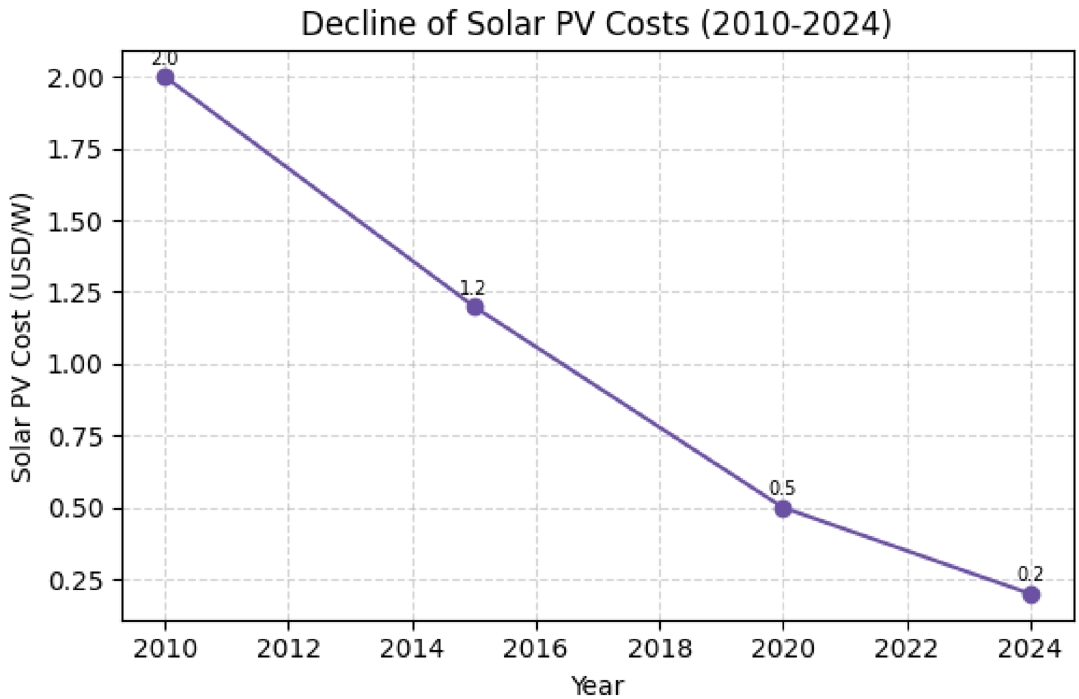

Figure 15 – Decline in solar-PV costs (2010–2024). Costs have fallen by about 90 %, transforming economic viability.

Moreover, Africa hosts 400–500 large dams suitable for floating photovoltaics (Ref. 9). Figure 17 shows that only a handful of floating-PV projects have been deployed, leaving hundreds of potential sites. Integrating floating PV with hydropower reservoirs can reduce evaporation losses, improve generation profiles and utilise existing infrastructure.

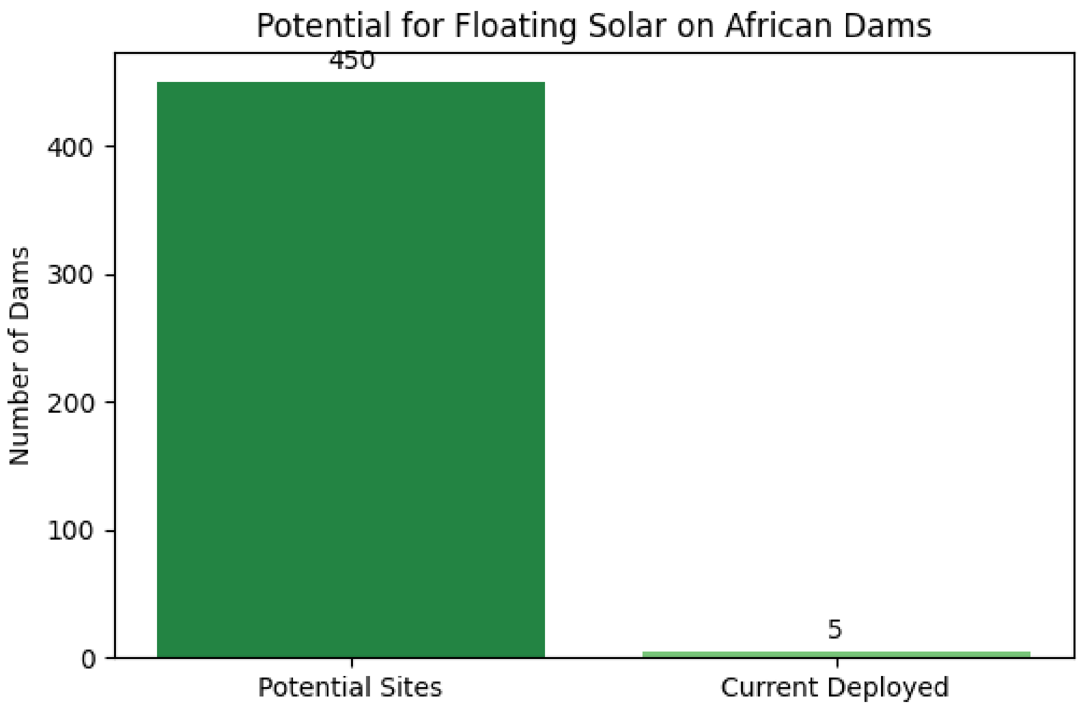

Figure 17 – Potential sites for floating solar on African dams. Hundreds of dams could host floating PV, but deployment remains nascent.

Energy corridors and regional targets

Figure 10 compares actual renewable capacity with ACEC targets. The AU's goal of 300 GW by 2030 contrasts with today's 72 GW. By 2040 the ACEC foresees 230 GW of solar and wind providing half of Eastern and Southern Africa's generation (Ref. 6). The gap underscores the need to quadruple annual additions (Ref. 3).

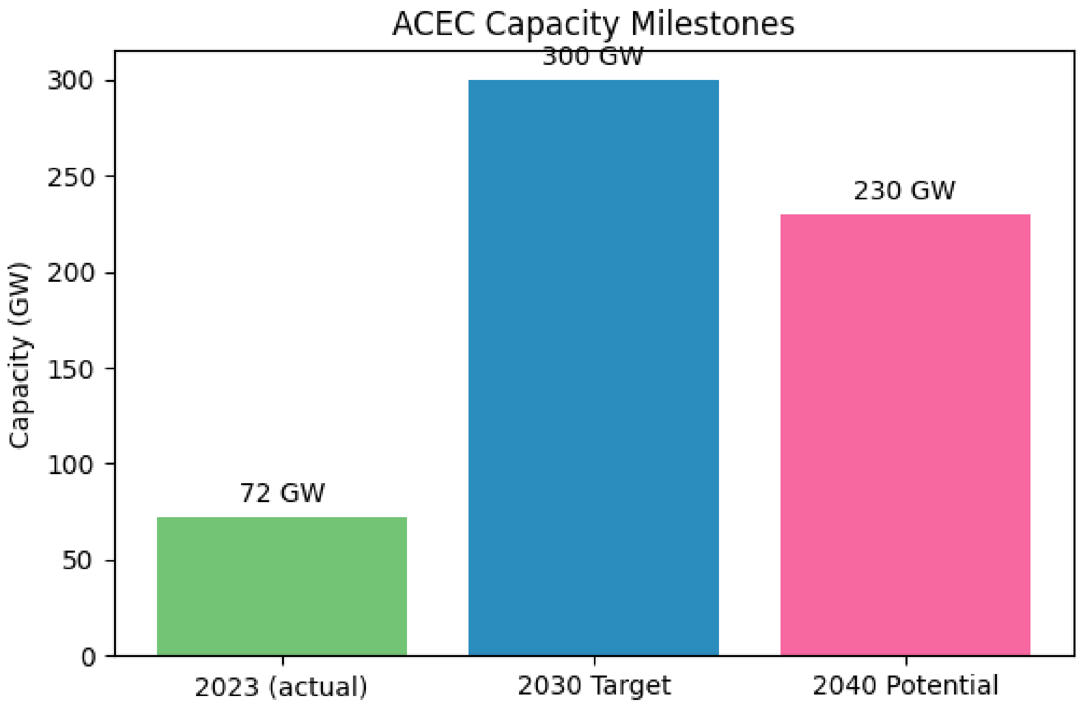

Figure 10 – Africa Clean Energy Corridor targets versus actual capacity. Achieving the 2030 and 2040 milestones requires massive acceleration.

Figure 11 summarises the West Africa Clean Energy Corridor's renewable share targets. WACEC seeks to raise renewables (excluding large hydro) to 35 % by 2020 and 48 % by 2030 (Ref. 5). Progress to date has fallen short; policy harmonisation and financing mechanisms will be essential to achieve the 2030 goal.

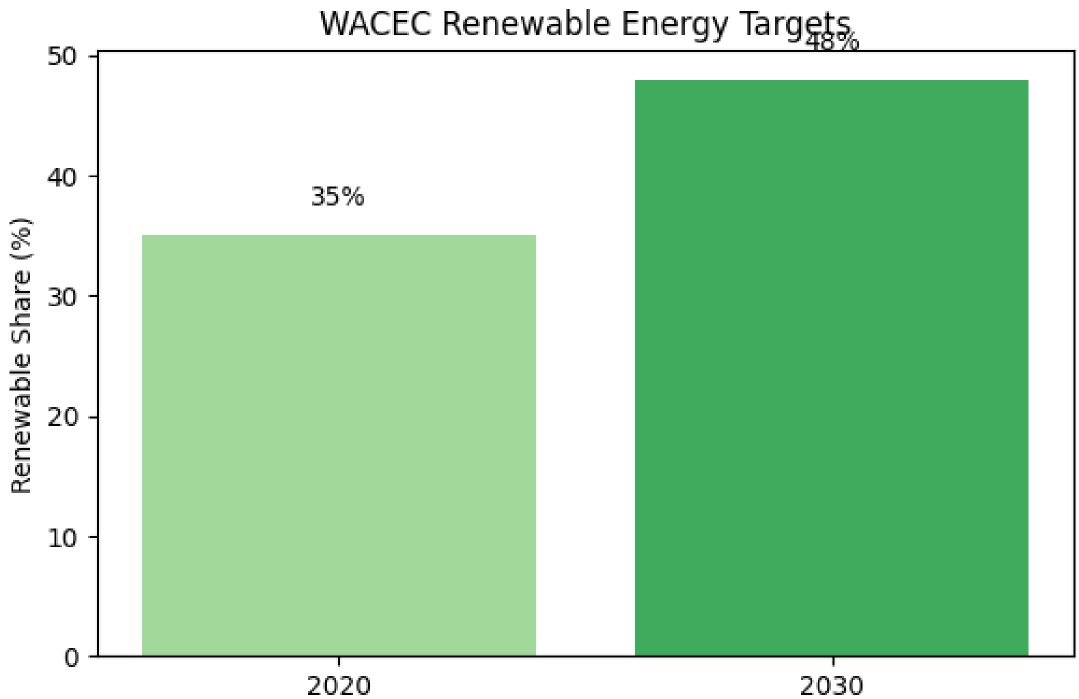

Figure 11 – West Africa Clean Energy Corridor renewable-mix targets. Increasing the share of renewables requires strong policy implementation.

The ACEC also requires major grid and generation investments. Figure 12 shows that USD 25 billion per year is needed for generation projects and USD 15 billion for grid infrastructure (Ref. 5). Given Africa's current investment levels, attracting this capital will necessitate innovative financing structures and regional cooperation.

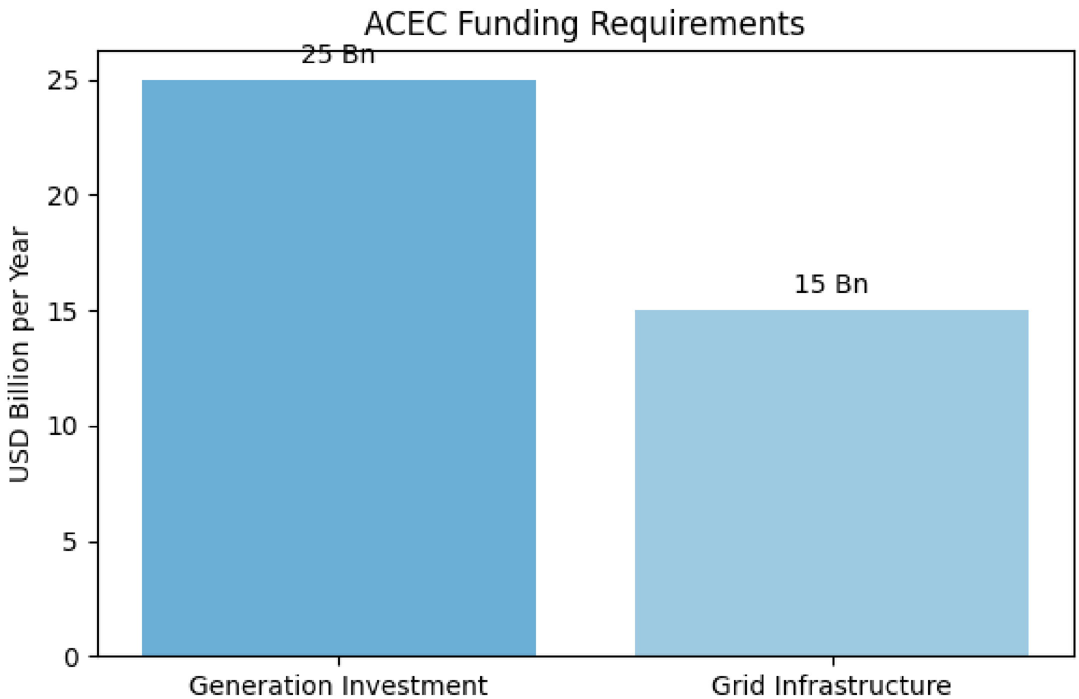

Figure 12 – ACEC annual funding requirements. Both generation and grid investments are substantial.

Green hydrogen

Figure 13 summarises key metrics from the EIB/IRENA/AU study on Africa's green-hydrogen potential. With abundant solar resources, the continent could produce more than 50 Mt of green hydrogen per year by 2035, requiring roughly EUR 1 trillion of investment and avoiding 500 Mt of CO_2 emissions (Ref. 11). Delivered costs could reach 1.55–1.90 €/kg, and the sector could contribute EUR 40 billion annually to GDP (Ref. 11). While promising, these figures assume significant policy support, water management and international off-take agreements.

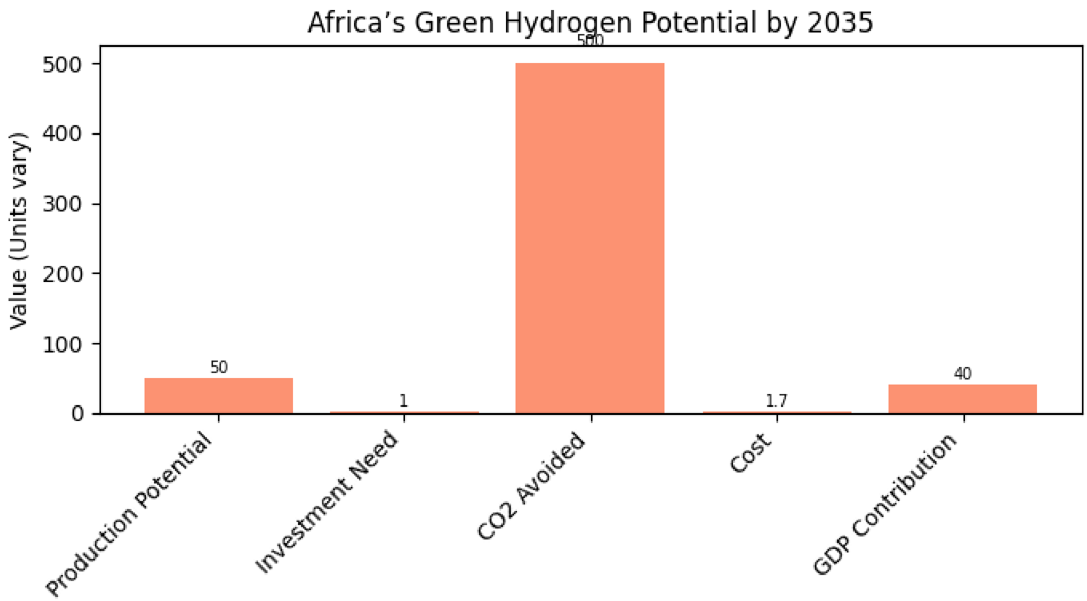

Figure 13 – Africa's green-hydrogen potential by 2035. Realising this potential requires massive investment and supportive policies.

Financing structures and cost of capital

Hydropower projects illustrate financing challenges. Figure 14 shows the funding structure of the GERD; 91 % came from Ethiopia's state budget and citizen bonds (Ref. 7), highlighting reliance on domestic financing when access to concessional loans is limited. Diversifying funding sources (through public–private partnerships, green bonds and sovereign guarantees) is crucial. Figure 18 provides an illustrative breakdown of clean-energy investment by technology, with hydropower attracting about 40 % of investment, solar 30 %, wind 15 %, geothermal 5 %, bioenergy 8 % and other technologies 2 %. Balanced portfolios can reduce risk and build resilience.

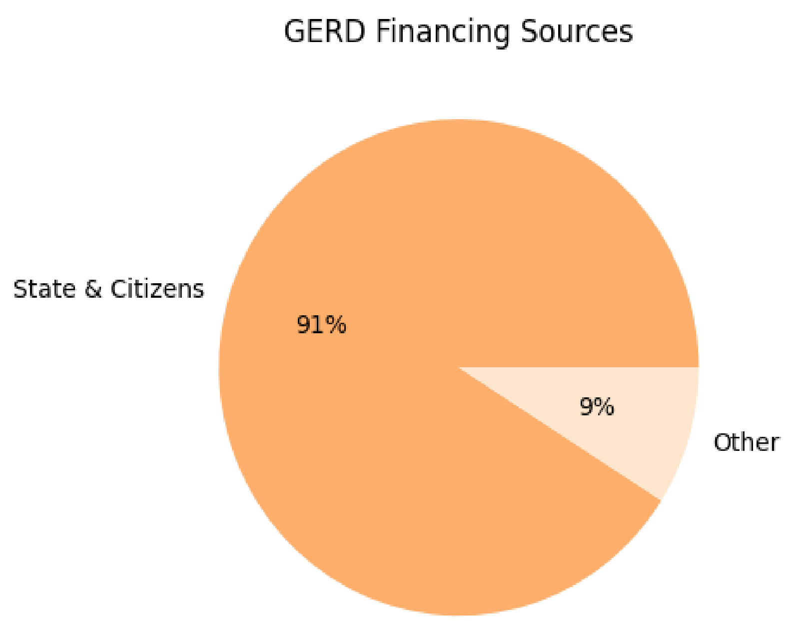

Figure 14 – Financing sources for the Grand Ethiopian Renaissance Dam. Domestic funding played a dominant role.

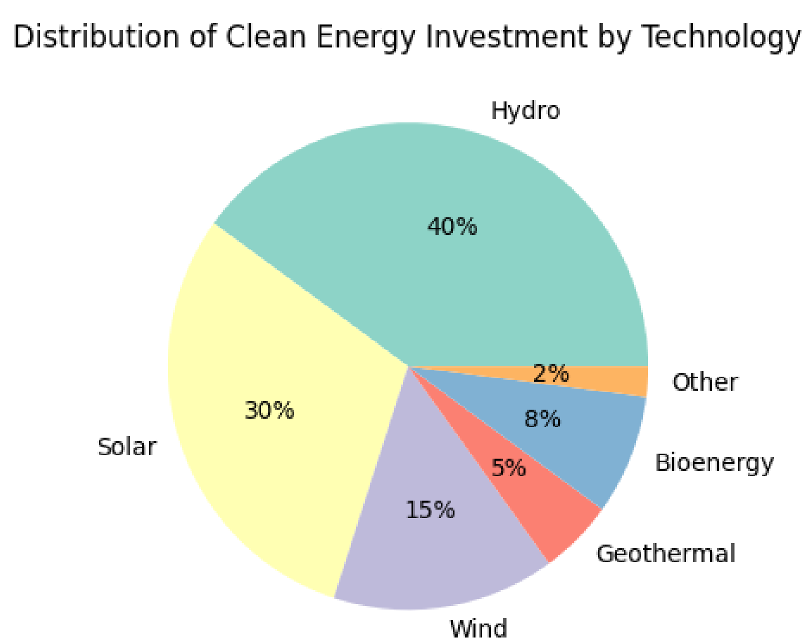

Figure 18 – Illustrative distribution of clean-energy investment by technology. Hydropower and solar dominate current spending.

Energy access and social outcomes

Electricity access remains a pressing challenge. Figure 16 shows that around 60 % of Africa's population currently has access to electricity, leaving about 40 % without. Figure 20 plots a gradual improvement from roughly 42 % in 2015 to 60 % in 2024. Achieving universal access by 2030 will require accelerated mini-grid deployment, off-grid solar solutions and grid extension.

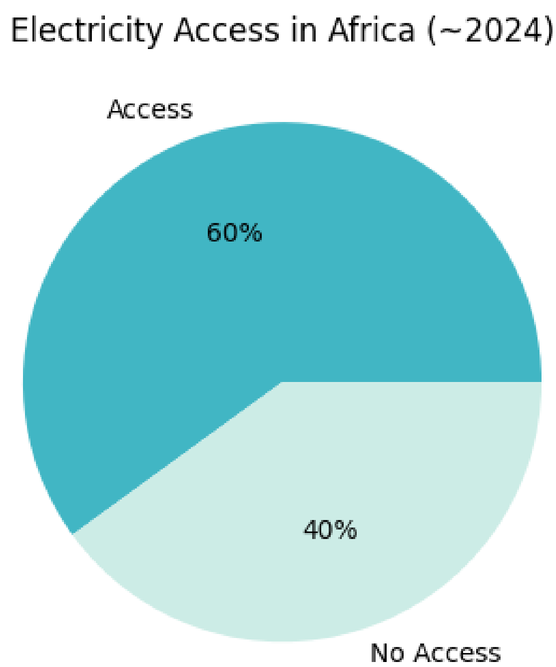

Figure 16 – Electricity access in Africa (circa 2024). Four in ten Africans still lack electricity.

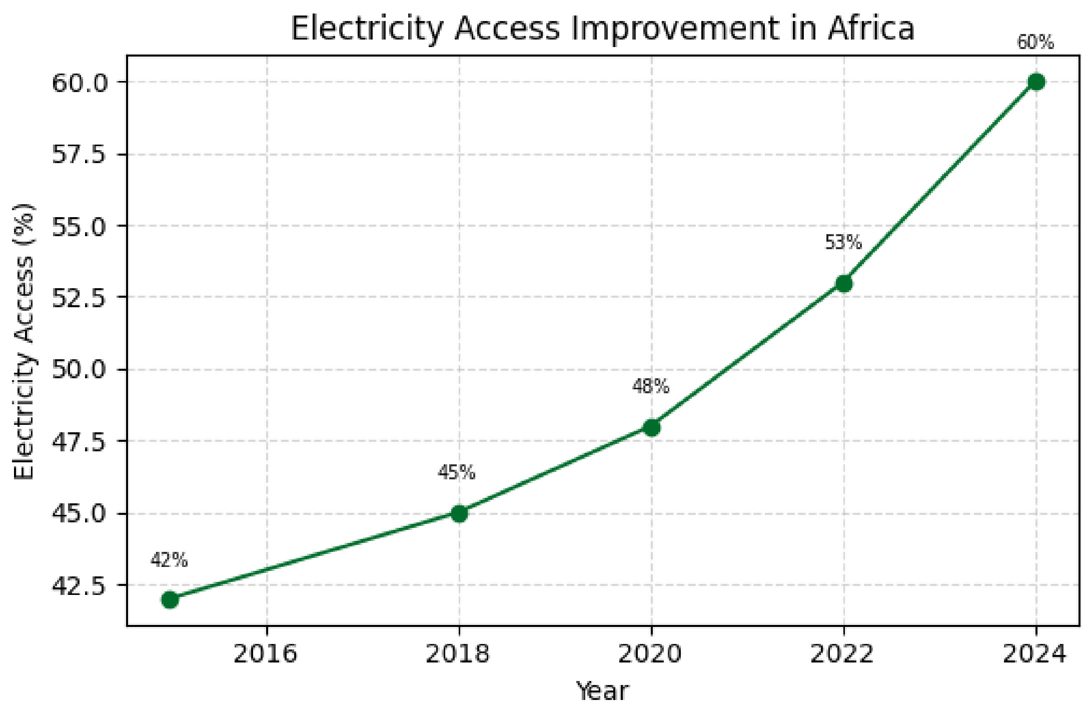

Figure 20 – Improvement in electricity access (2015–2024). Progress is positive but insufficient to meet universal access targets by 2030.

Floating photovoltaics and innovation

Floating solar PV offers a novel opportunity to co-locate generation with existing hydropower reservoirs. As shown in Figure 17, Africa has hundreds of suitable dams, yet only a handful of projects have been realised. Encouraging demonstration projects and developing regulatory frameworks can unlock this potential. Additionally, cross-border electricity trading through the ACEC and WACEC could improve load-factor utilisation and attract larger investors.

Discussion and Policy Implications

Mobilising capital and reducing risk

Closing the USD 2 trillion investment gap requires mobilising both domestic and international capital. Multilateral development banks (MDBs) should expand concessional financing and guarantee facilities to de-risk projects. Sovereign wealth funds and pension funds in Africa can allocate a portion of their portfolios to infrastructure, while green bonds can tap global climate-finance markets. Blended finance mechanisms (combining grants, concessional loans and private equity) can improve project bankability and lower the cost of capital. Policymakers should also harmonise procurement processes and adopt transparent, technology-agnostic auctions to lower tariffs and attract competition.

Strengthening regional energy corridors

The ACEC and WACEC offer frameworks for scaling renewables and balancing variable generation across borders. Realising these corridors will require harmonised grid codes, wheeling charges and electricity tariffs. MDBs and regional institutions should prioritise interconnector projects that unlock stranded renewable resources, such as linking East Africa's geothermal potential with southern industrial demand. Investment in grid digitalisation and storage is needed to manage variability. In parallel, countries should accelerate the adoption of regional power pools and allow independent power producers to trade across borders.

Leveraging hydropower and floating PV

Hydropower's role as a flexible resource is indispensable for balancing solar and wind. However, future projects must address environmental and social impacts through robust impact assessments and benefit-sharing schemes. Rehabilitating existing dams and adding turbines can provide faster returns than constructing new mega-dams. Floating PV can harness underutilised reservoir surfaces, reduce evaporation and enhance capacity factors. Policymakers should establish clear guidelines for concession rights, environmental safeguards and revenue sharing to attract developers.

Developing the green-hydrogen ecosystem

Africa's green-hydrogen potential can position the continent as a net exporter of zero-carbon fuels while supplying domestic industries such as steel and fertiliser. Governments should craft national hydrogen strategies that identify priority hubs (e.g., Namibia, Morocco, Egypt, South Africa), streamline permitting and align with water-resource management. Bilateral agreements with off-takers in Europe and Asia can underpin bankable projects. Supporting infrastructure (pipelines, storage, port facilities) and training programmes will be essential. Given the high investment requirements, hydrogen projects may initially rely on concessional finance and credit guarantees.

Addressing energy access and socio-economic benefits

Universal energy access remains a moral and economic imperative. Off-grid solar, mini-grids and clean-cooking solutions can complement grid expansion, especially in rural areas. Electrification programmes should be integrated with agriculture, education and health initiatives to maximise developmental impact. Policymakers must also ensure that renewable-energy projects create local jobs, build supply-chain capacity and avoid deepening inequalities.

Limitations

This analysis relies on secondary data and illustrative modelling. Official statistics for 2024–2025 were not always available, leading to reliance on extrapolations and assumptions (e.g., regional capacity shares or technology investment breakdowns). While the figures provide indicative trends, actual investment flows and capacity additions may differ. The paper also focuses on large-scale generation and does not examine in detail demand-side measures, energy efficiency or socio-cultural factors influencing electrification. Finally, geopolitical risks, exchange-rate fluctuations and local regulatory dynamics are complex and context-specific; readers should consult country-level analyses for investment decisions.

Conclusion

Africa stands on the cusp of a green industrial revolution. The continent possesses abundant solar, wind, hydro and geothermal resources, a young and growing workforce and increasing political commitment to decarbonisation. Yet the scale of investment required (around USD 2 trillion over the next decade) demands unprecedented cooperation among governments, investors and development partners. This paper has quantified the renewable-energy investment gap, surveyed regional initiatives and mega-projects and presented twenty illustrative charts to elucidate trends. It finds that while renewable capacity doubled to 72 GW by 2023 and hydropower additions are accelerating, current trajectories fall far short of the AU's 300 GW target for 2030. Bridging this gap will require blended finance, robust regulatory frameworks, regional electricity corridors, innovation in floating PV and green hydrogen, and unwavering commitment to universal energy access. With targeted action, Africa can transform its energy landscape, drive industrialisation and contribute meaningfully to global climate solutions.

Table of Figures

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15. World Economic Forum & IEA (2024). *Tracking SDG 7: The Energy Progress Report*. Details progress on electricity access and underscores that ~600 million Africans lack electricity (not directly cited in text but relevant for context).