

**POLICY DIALOGUE ON
RENEWABLE GENERATION AND
REGIONAL POWER TRADE IN AFRICA**

COMPANION READING FOR SESSION #1

RENEWABLE ENERGY AND POWER POOLS



**AFRICAN
SCHOOL OF
REGULATION**



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¹ Prepared by [Carol A. Ofaa and Elias Zigah, February 2023, African School of Regulation.](#)

1. Introduction

Regional interconnections play a critical role in integrating renewable energy at scale, ensuring the reliable, affordable, and environmentally sustainable supply of electricity that is needed for the clean energy transition. Strong interconnections allow combining resources with different generation profiles and at different locations, makes possible to achieve economies of scale in generation, reduces operation costs and enhances the reliability of supply. The massive deployment of variable renewable resources and storage hydro, adequately combined with other flexible generation resources, is indispensable to achieve the decarbonisation of the power sector and the economy.

The Sustainable Development Goal on energy (SDG7) is incorporated in the social, economic and sustainability goals of Africa's Agenda 2063. Sustainable energy is at the forefront of the development plans of African nations, recognising its central role in achieving all SDG targets and mitigating and adapting to climate change. Out of the 53 African Nationally Determined Contributions (NDCs), 45 contain quantified renewable energy targets (IRENA, 2016). Africa has vast renewable resources that have the potential of putting the continent on a clean development path, if their deployment and integration in the grid is properly coordinated.

Africa could meet nearly a quarter of its energy needs from indigenous and clean renewable energy by 2030. By that time, modern renewables amounting to 310 gigawatts (GW) could provide half the continent's total electricity generation capacity. This corresponds to a sevenfold increase from the capacity available in 2017, which amounted to 42 GW (IEA, 2022). A transformation of this scale in Africa's energy sector would require an average annual investment of 70 billion US dollars (USD) by 2030, resulting in carbon-dioxide emissions reductions of up to 310 megatonnes per annum (IEA, 2022). The renewable energy sector today employs 10.3 million people worldwide. With far-sighted industrial policies and targeted skills development, millions of new jobs can be created in Africa. Doubling the share of renewables by 2030 would create additional economic value by increasing the global gross domestic product by up to 1.1%. This would signify a 3.7% improvement in global welfare and jobs for over 24 million people in the renewable energy sector (IRENA, 2019). This would enable further economic benefits such as improved healthcare services, especially in the most remote areas. It would also further support the empowerment of women, who represented 35% of the renewable energy labour force and whose role would become more prominent, notably through the productive use of renewable energy.

This technical note discusses Africa's renewable energy potential, the role of Africa's clean energy corridors in the deployment of renewables, the example of SAPP's potential for scaling up renewable energy deployment and the investment barriers that exist in renewable energy deployment.

2. Africa's Renewable Energy Potential

Renewable energy is booming globally, and Africa has the potential to become the world's renewable energy powerhouse. According to the International Renewable Energy Agency (IRENA), the annual average wind speeds in North Africa and Southern Africa could be as high as 7 metres per second (m/s), with the technical potential to generate up to 461 GW² of wind energy. Africa's solar PV theoretical potential could provide the continent with more than 660 000 TWh

² Assuming a 1% land-utilisation factor

of electricity a year, far above its projected needs³ (IEA, 2019). Solar power is already the fastest-growing renewable energy source in Africa and will be a crucial driver of new capacity additions in the next decades to come (IRENA, 2019).

Even though Africa is ideally suited for renewable energy generation, solar and wind resources remain highly underexploited in the continent. While in the rest of the world, investments in renewable energy have intensively increased from USD587 billion in 2000 to USD2 841 billion in 2020, only approximately USD 60 billion, representing 2% of such investments in renewable addition, occurred in Africa in the last two decades. Within Africa, investments in renewable assets remain concentrated in a few countries, such as South Africa, Morocco, and Egypt, which attract most of the investment, accounting for 60% of the total (IRENA, 2022). But other countries like Kenya and Ethiopia are also growing their share. Figure 2 shows the percentage of the overall investments in renewable energy assets excluding hydropower in the various regions in Africa from 2000 – 2020. At the end of 2020, the total solar and wind generation installed capacity in Africa amounted to 10.4 GW and 6.5 GW, respectively. In 2020 the world total installed capacities of solar and wind generation were 772 GW of solar and 744 GW of wind, respectively. African countries with a significant fraction of the total installed generation capacity in the continent are South Africa: 57% solar and 41% wind; Egypt: 17% solar and 21% wind; and Morocco: 7% solar and 22% wind.

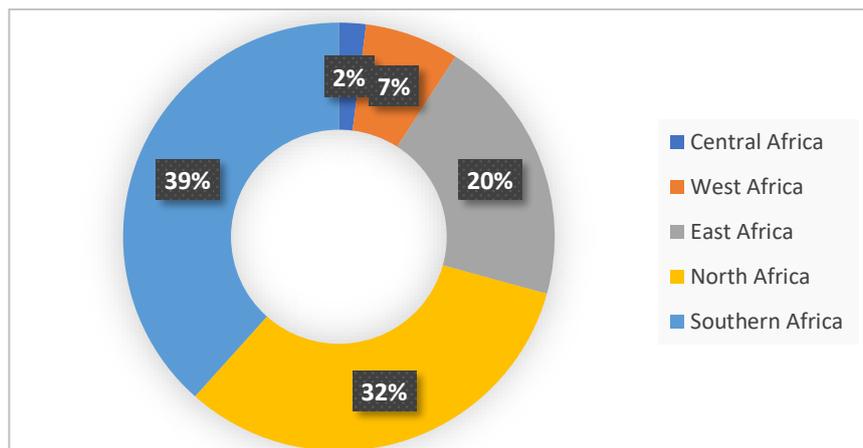


Figure 1: Overall renewable energy investment in Africa per region, 2000-2020 (IRENA,2022)

Africa’s energy needs are growing fast, raising the pressure to invest in infrastructure and energy technologies that can sustainably power social, economic, and industrial growth over the coming decades. Renewable energy is now the cheapest source of energy generation (IRENA, 2019). The levelized cost of electricity (LCOE) of solar technologies has constantly declined since 2010, gaining increased competitiveness compared to fossil fuels, with solar technologies experiencing the highest decrease in LCOE with a reduction of 77% since 2010. The LCOE of wind technologies has also declined by 35% since 2010 (IRENA, 2019). More importantly, renewables are the most suitable and effective solution to achieve Africa’s energy security, equity, and environmental sustainability.

³ These potentials are purely theoretical potentials, with no techno-economic evaluation undertaken. These resource potentials, therefore, are subject to a significant reduction when economic parameters are applied.

3. Scaling up Renewable energy deployment in Africa power pools

Although the energy generation resources are vast, they are not evenly distributed and are not available at the same time.

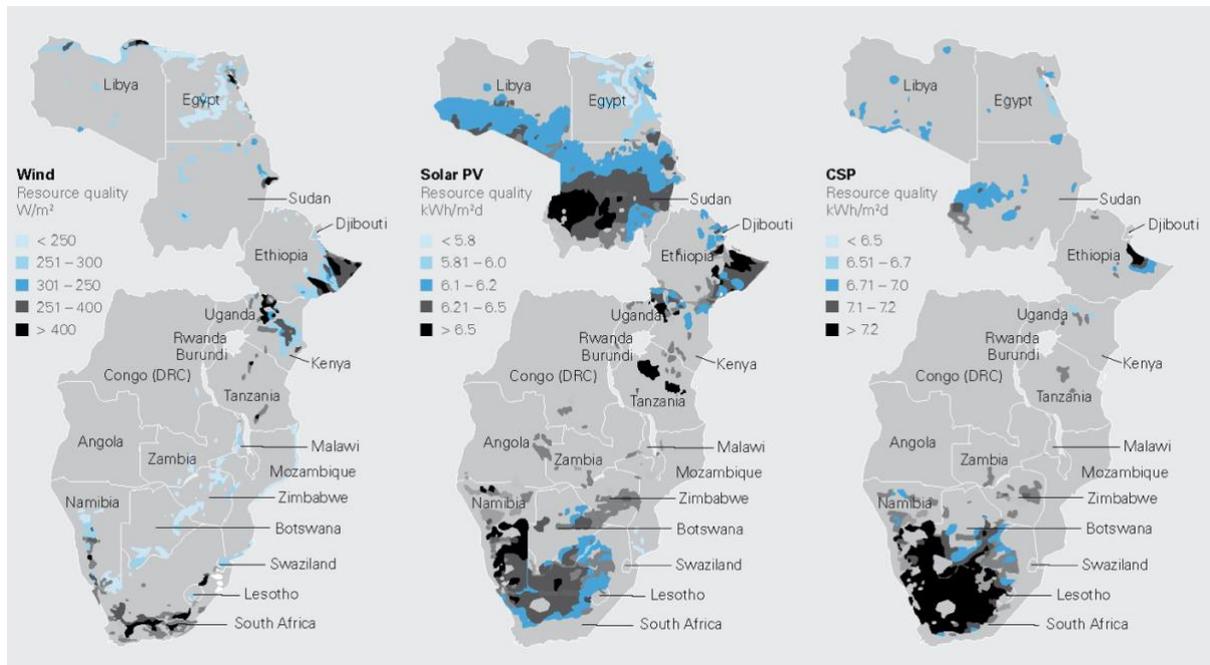


Figure 2: The location and energy potential of African renewable energy resources in selected African countries(terawatt hours). Data Source: UC Berkeley, 2021.

Figure 2 shows the distribution of some renewable resources in selected African countries. This uneven distribution and the uncertain and variable availability of renewables demands a strong effort of coordination in the deployment of the renewable resources and with other generation technologies, which is only possible through strong transmission interconnections among the zones where the massive deployment of the different renewable technologies should take place. The coordination in the deployment and operation of power resources is precisely the mission of power pools, which can be further expanded with other ambitious initiatives, such as the African Clean Energy Corridors (ACEC) or the Pan-Arab Clean Energy (PACE).

3.1. Africa Clean Energy Corridor (ACEC)

The African Clean Energy Corridor (ACEC) is a regional initiative to accelerate the development of the renewable energy potential and cross-border trade of renewable power. Clean Energy Corridors were first established within the Eastern Africa Power Pool and the Southern African Power Pool, and then extended to the West African Power Pool. Figure 3 shows the regional renewable energy road map for Africa's power pools.

The implementation of ACEC is guided by the Ministerial Communiqué that endorsed the ACEC Action Agenda in January 2014 and contributed to the development of Africa's flagship climate action programme, the Africa Renewable Energy Initiative (AREI). ACEC requires up to USD 25 billion per year of investments in power generation until 2030, with an additional USD 15 billion per year for grid infrastructure (IRENA, 2022). Combined efforts will diversify resource availability, improve energy security and foster investment opportunities and job growth. Scaling up

renewable energy also offers a comprehensive opportunity to avoid carbon-intensive infrastructure lock-ins and leapfrog towards a low-carbon future.

Clean Energy Corridors⁴ in Eastern, Southern and West Africa are helping African countries scale up renewable power generation and cross-border electricity trade. The Clean Energy Corridors in Africa aim to support efforts to meet the continent's fast-growing electricity needs through accelerated development and optimal use of the region's abundant renewable energy resources. The Corridors largely focus on utility-scale development of renewables-based electricity with a cross-border trade dimension to benefit from resource efficiency and economies of scale.

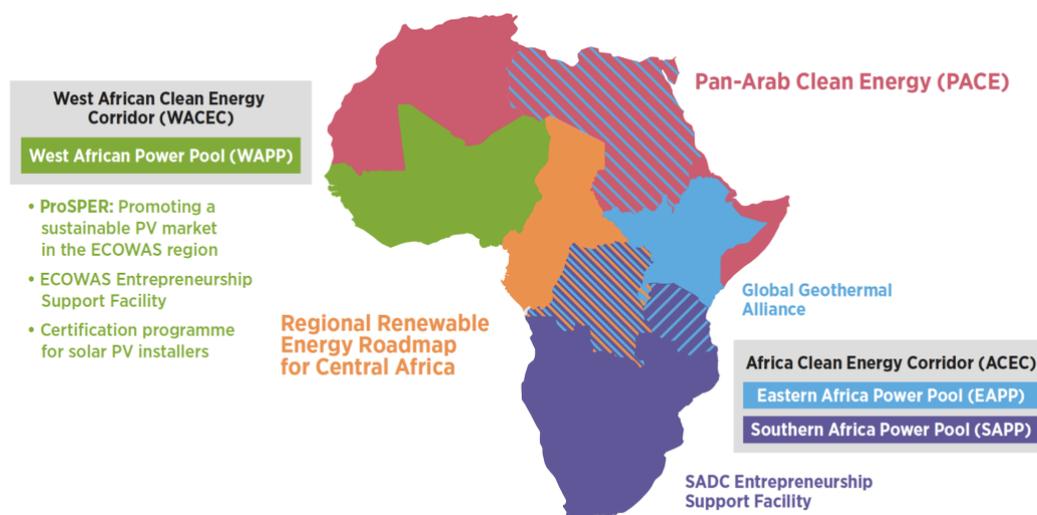


Figure 3: Regional Renewable energy Roadmap, IRENA 2019.

3.2. Pan-Arab Clean energy (PACE)

The Pan-Arab Clean Energy (PACE) initiative provides a regional action plan to scale up renewables in power systems across the Arab region, complemented by IRENA's country-level support, such as through the recent launch of the Egypt Renewable Energy Outlook. The objective is to strengthen an investment framework that will enable cost-effective provision of up to a quarter of Egypt's total final energy supply from renewables in 2030. IRENA also collaborates with the Economic Community of Central African States (ECCAS), supporting the development of a renewable energy roadmap for the sub-region. The roadmap provides a set of specific actions to strengthen enabling policies and regulatory, institutional and financial structures for renewable energy deployment at regional and national levels. The PACE initiative was adopted by the League of Arab States, while the Central Africa roadmap, which was technically validated in November 2018, is set to receive the endorsement of Central African Heads of State.

3.3. West African Clean Energy Corridor

The West Africa Clean Energy Corridor (WACEC), enjoying broad regional political support, was adopted by the Council of Ministers for the Economic Community of West African States

⁴ See the Africa Clean Energy Corridor (ACEC) initiative <https://www.irena.org/Energy-Transition/Country-engagement/Regional-Initiatives/Africa-Clean-Energy-Corridor>

(ECOWAS) as an annex to the ECOWAS Treaty in December 2016. This was endorsed by the Summit of ECOWAS Heads of State and Government in June 2017. The West African region has a vast renewable energy potential sufficient to cover unmet power demand and achieve universal access to electricity while supporting the region's transition to a low-carbon growth path. In July 2013, the Authority of Heads of State and Government of the Economic Community of West African States (ECOWAS) adopted the ECOWAS Renewable Energy Policy (EREP); this aims to increase the share of renewable energy in the region's overall electricity mix to 35% in 2020 and 48% in 2030 (to 10% and 19%, respectively, excluding large hydro). Complementing the EREP is the ECOWAS Energy Efficiency Policy (EEEP), which aims to make 2000 megawatts of power generation capacity available through efficiency gains and ultimately double the rate of improvements in energy efficiency. To support the creation of a regional power market, IRENA, in collaboration with the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE), the West African Power Pool (WAPP), and the ECOWAS Regional Electricity Regulatory Authority (ERERA), has initiated the West Africa Clean Energy Corridor (WACEC) initiative. Building on existing efforts in the region, including those of UEMOA, AfDB and other development partners such as GIZ and USAID, the WACEC will promote the development and integration of utility-scale renewable power in West African power systems.

4. Investment Barriers in Africa

4.1. Cost of Capital

Despite the rapidly declining cost of renewable energy technologies, a growing energy demand, and a vast potential of electricity production from renewable energy sources, investments in renewables are still small in Africa because of their high investment risk perception. In general, Africa is perceived as a high-risk investment destination mainly due to the lack of:

- Political stability
- Favorable macroeconomic conditions
- Clear and ready policy and regulatory frameworks
- Institutional stability
- Transparency

The cost of capital is significantly higher in Africa than in most OECD countries. This perception pushes up project financing costs and obstructs investments in the continent. As a result, renewable energy investments in Africa are still limited and highly reliant on Foreign Direct Investment (FDI). Over 2009-2018, Foreign Direct Investment accounted for 50% of total RE investments in Africa, while they represented only 6% in the rest of the world (UNCTAD, 2022).

Adequate regulatory frameworks and business models can be the path to unlock private investment in transmission in Africa. The World Bank has examined in detail the most common business models for private sector participation in transmission (World Bank, 2017). It concludes that, although the most appropriate model for private-sector participation depends on the local context, independent power transmission (IPT) tenders are seen as most promising for national and regional-level investments in SSA. In IPTs, private owners assume the rights and obligations associated with a transmission line or a package of several lines.

4.2. Power Market Integration

Transmission interconnections among national grids are deficient in Sub-Saharan Africa, even in the more power-integrated regions (Eastern Africa, Southern Africa, and West Africa) (AfDB, 2017; IRENA, 2022). With a combined length of 112,196 kilometres (km), the transmission

network in 38 countries in Africa is small if compared to Brazil, which has a total transmission network length of 125,640 km (World Bank, 2017). Despite its large land mass, Africa also has fewer kilometres of transmission lines per capita than other regions. The length of transmission lines in Africa is 247 km per million people (World Bank, 2017). Even where interconnections exist, they are sometimes congested, and the supply conditions in some countries remain, then, highly different from those in other countries in the corresponding region. Transmission cost allocation is also an issue. Highly integrated regional power markets have the potential to reduce the cost of electricity services in many African countries.

The operationalisation of power pools requires appropriate amounts of generation and transmission infrastructure. Poor power system integration limits the access of agents to new markets and new sources of supply, thus requiring the single system utilities to increase their investments and preventing countries from taking advantage of economies of scale. Cross-border power trade within existing regional power pools such as the West African Power Pool (WAPP), Southern Africa Power Pool (SAPP) and Eastern Africa (EAPP) is low and mostly realised through bilateral contracts. To facilitate trading, interconnections need to be upgraded.

4.3. Power Grid Dysfunctions

Most African Countries suffer from a low-quality and unreliable grid, affecting the whole economic system. With 16% of transmission and distribution (T&D) losses, Africa’s average is seven percentage points higher than the advanced countries' average. High T&D losses strongly affect the economy of sub-Saharan utilities, leading to losses equivalent to 0.3% of annual GDP (median value).

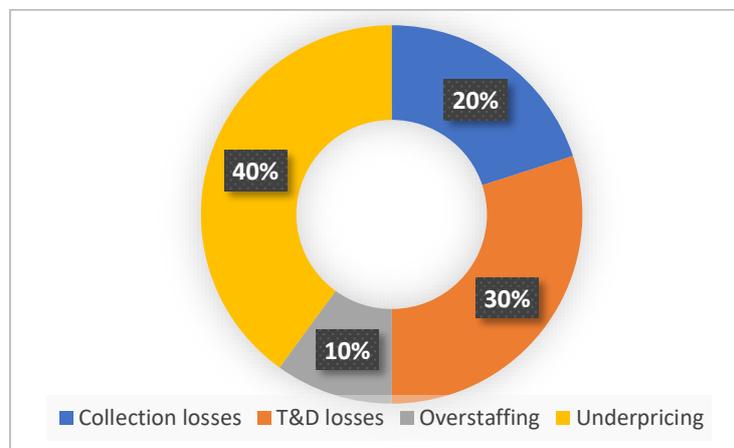


Figure 4: Breakdown of hidden costs in SSA excluding South Africa. Data Source: World Bank, 2016

4.4. Under-pricing and operational inefficiencies

Most utilities, especially distribution companies in Sub-Saharan Africa, are highly indebted and, thus, unreliable off-takers. Therefore, large renewable generators do not have whom to sell their power to. In only 2 out of 39 (5%) countries in Sub-Saharan Africa, utilities can cover their capital and operating costs of service (Seychelles and Uganda). In comparison, only operating costs are covered by 49% of them. Under-pricing, transmission and distribution losses, under-collection of bills and overstaffing are the hidden causes responsible for the fiscal deficit of sub-Saharan Utilities, with under-pricing counting for more than 40%. Across Sub-Saharan Africa, the quasi-fiscal deficit (QFD) is equivalent to US\$21 billion (2014), or 1.1% of GDP (2014). This strongly affects the ability of utilities to make investments, obstructing the development of necessary

transmission and distribution grids across the continent. Non-cost-reflective tariffs are increasingly unsustainable. The weighted average tariff in SSA is US\$0.08 per kWh, with significant variations across the region. The financial gap due to under-pricing accounts for US\$0.10 per kWh billed, leading to losses equivalent to 0.4% of the annual GDP (median values). These underlying factors explain why most utilities in Sub-Saharan Africa are insolvent.

5. The Way Forward

Unlocking Africa's renewable energy potential requires bridging the missing link between commitments and actions – designing stable policies and regulatory frameworks, strengthening, integrating and modernising the grid with a regional perspective, fixing the financially unviable distribution companies as the natural off-takers of renewable generation at scale, supporting systemic innovation, fostering an attractive electricity market, and a comprehensive de-risking instrument aimed at promoting private sector investments. Measures are required to address the high cost of capital in these emerging markets.

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