Deploying Renewable Energy (REs) in Africa – Exploring Strategies

Julius Gatune, MSM

Abstract

Africa remains energy poor, while energy is the foundation for transforming livelihoods. The shift to green energy provides a new opportunity for Africa to make energy accessible as Africa is well endowed with green energy resources which if tapped can be the basis of a new kind of industrialization. However, the region faces many challenges chief among which is the lack of business models that can support significant deployment of renewable energies. Current models tend to be limited to simple applications or are too costly to support widespread adoption.

A strategy of increasing uptake of RE technologies but also becoming a participant in manufacturing value chains is key. The uptake of RE technologies will need innovative approaches to drive financing, build skills, catalyse business model innovations and more crucially building an ecosystem that will ensure inclusive uptake of REs. Building RE platforms that can help build an inclusive ecosystem is proposed. Beyond uptake, manufacturing of REs can be incentivized by leveraging Local Content laws and regulations to mandate greater processing of critical minerals. More crucially the changing geopolitics with concerns for security of critical minerals supplies give Africa another leveraged to incentive building of green manufacturing value chains.

1. Introduction

Growth and economic transformation is at the core of sustainable development (as outlined in SDGs). Rural electrification is crucial to achieve Sustainable Development Goal 7: "access to affordable, reliable, sustainable and modern energy for all. However, more than 560 million people in sub-Saharan Africa live without electricity (IEA, IRENA, UNSD, World Bank, WHO, 2025).

Fossil fuels have been the traditional driver of economic growth with concomitant release of Greenhouse Gases (GHGs). However, given the unfolding climate change, a new growth path away from fossil fuel driven economic is now a key imperative. Many countries are charting a green growth path with Renewable Energy (REs) at the core of this growth. The shift to green energy provides a new opportunity for Africa to make energy accessible. Africa is well endowed with green energy resources which if tapped can be the basis of a new kind of industrialization especially when paired with digitalization. For example, informal manufacturers can get access to energy and at the same time use digital platforms to access new markets essentially formalizing in a new way and providing new pathways for industrialization. Indeed, an opportunity for leapfrogging development is possible. (Gatune et. al. 2022). However, Africa is currently generating

only about two per cent of its renewable energy potential (IEA, 2022). More crucially many countries are not part of renewable energy value chains key to driving green industrialisation.

Lema et. al. (2025) points that to capitalize on the potential opportunities, countries must experiment with new ideas and technologies, tailoring them to fit local circumstances. For Africa the first order challenge is to make the green technologies accessible and affordable. However, this may not be enough to drive needed transformation. This will come from moving from being mere consumers to becoming considers of these technologies. Green technologies are today largely concentrated in a few industrialized countries and with China dominating (UNCTAD, 2023). This concentration poses a risk that the economic and social benefits of the green transition will predominantly accrue to the most industrialized nations.

This paper explores strategies Africa can take to increase uptake of green technologies especially Renewable Energy (REs) technologies. The next section looks at general strategies; section 3 looks at how to drive uptake of RE technologies while section 4 explores strategies for catalysing manufacture of RE technologies and section 5 concludes.

2. REs Uptake and Upgrading Strategies

In thinking about green industrialization, a two-pronged strategy is needed. Firstly, absorbing and integrating these technologies into the economies and secondly, a strategy on how to become a producer not just a consumer of green technologies. Anzolin & Lebdioui (2021) find that a greener consumption is necessary but can hardly be achieved without industrial policies to stimulate green manufacturing and low-carbon innovation.

Lema et. al. (2025) explores potential for middle incomes counties achieving green industrialisation through participating in green global value chains (GVCs). They argue that will come from participating in two complementary value chains: (a) the deployment chain covers all aspects related to installation and utilization, including pre-project financing and post-project operations and maintenance; (b) the manufacturing chain which includes stages such as designing, producing, and assembling the key equipment. Initially countries participate in lower end of the value chain and eventually upgrade to higher nodes in the value chain. These are summarized in Table 1.

Table 1: Green Technology Value Chains

Stage	Deployment GVC Value Chain	Manufacturing Value Chain
Participation	• Domestic firms provide operations and maintenance activities	• Domestic firms assemble renewable energy products/ systems using imported components

	• ·Domestic firms offer peripheral services (e.g., transportation) or low-value inputs (e.g., cabling) for installations • Domestic firms establish joint ventures with international firms for project development	• Domestic firms manufacture and supply low-value components • Domestic firms enter joint ventures for component supply
Upgrading	• Domestic firms are lead developers • Domestic firms are engineering, procurement, and construction service providers • Domestic firms have expanded internationally, managing or constructing renewable energy projects abroad	• Domestic firms manufacture high-value components • · Domestic firms produce and supply complete • renewable energy products/systems • · Domestic firms export to global renewable • energy markets

The strategy for green industrialization then goes from establishing the deployment value chain and then upgrading gradually through learning. For example, initially, Lema et al (2025) point that domestic firms engage in operation and maintenance activities, provide peripheral services like transportation, supply low-value inputs, and collaborate with international firms through joint ventures for project development. When they upgrade, they become lead developers and then gradually move into manufacturing. This is the case for China which began by importing technology for its wind deployment chain. Then, through an articulated policy strategy aimed at building local capabilities, China gradually expanded its value chain activities into the manufacturing sector. This approach facilitated upgrading by localizing certain higher value-added stages of the chain through import substitution. Learning from importing is a predominant feature in renewable energy upgrading trajectories (Lema et. al. 2025).

The question then is whether this strategy can be applied to majority of Africa countries strategy. This strategy assumes a strong private sector that an participate in GVCs, absorb technology and eventually move up to even become exporters of technology and services. However, for Africa with limited manufacturing capacity, highly informal sectors, this traditional technology transfer mechanism may not work very well as it is difficult to include highly informal micro-enterprises in formal business supply chains. Further due to poverty, small fragmented markets and perception of high risk, it is hard to attract investors in the sector. As result uptake of green technologies can be very slow and thus new approaches are needed.

Tamasiga et, al. (2026) argues that to accelerate the transition towards green industrialization, it is essential for governments to adopt targeted and sector-specific subsidies, foster innovation in green/clean energy technologies and promote

collaboration between public and private sectors. Additionally, integrating the informal sector into green economies can enhance resource efficiency and promote sustainable practices, contributing to the achievement of the United Nations' Sustainable Development Goals.

3. RE Deployment Strategies for Africa

Uptake of REs is the first step in climbing the ladder on green industrialisation for many developing countries. Key to this is stimulating demand for REs. For example, in 2015, Pakistan Net Metering Regulations allowed households and businesses to install rooftop solar panels and sell excess electricity back to the grid at the same rate they paid for consumption. The policy has shown great success due to rapid adoption of solar which now accounts for 25% of Pakistan electricity production making it one of the top adopters of solar energy globally. Van Assche et al. (2024) finds that public procurement plays central and direct role in deployment supply chains, reflecting the state's position as a market creator in renewable energy diffusion

With regards to electricity, the traditional approach to extending electricity connection is through extending the national grid. However, experience in Saharan Africa shows that grid-extension costs are prohibitive specially for areas with dispersed or remote populations—and even when the national grid is available, the supply is often unreliable ((IEA, IRENA, UNSD, World Bank, WHO, 2025). Decentralized energy solutions are now seen as the way forward. These systems provided 55 percent of the new connections in Sub-Saharan Africa between 2020 and 2022, proving resilient to macroeconomic challenges. Decentralized energy solutions can usually be deployed faster than grid extension at a lower cost per connection.

Two approaches are being taken with regard to uptake of decentralized RE technologies. This is standalone systems and mini-grids approach.

3.1. Stand-Alone RE Systems

Stand-Alone systems especially solar have taken largely driven by private investments with policy support. But the approach can come with challenges. The case of Pakistan is instructive. This has been mainly a bottom-up approach as citizens responded to spiralling electricity bills and erratic supply (Ashraf, 2026a). However, the rapid adoption has been due to people's frustration with the formal supply system inability to deliver, it has been a bottom-up response. Those who can afford solar mainly urban middle-class have moved to rooftop solar. The result is that the inefficient utility has lost customers while still stuck with high fixed costs (including high transmission losses due to poor grid and onerous obligation to various pay various Independent Power Producers (IPPs)) which has meant higher costs to those who cannot make the transition especially poor rural folks (Ashraf, 2025b). This transition has impacted the poor negatively as there is no model to help them access. Today more than 40 million Pakistanis — mostly in rural areas

— still lack access to electricity. Without targeted policies for off-grid solar and community-based microgrids, the rural poor risk being left behind in the very revolution that has empowered urban households. There is thus need for a model that can bring inclusive energy transition. Several initiatives are doing are being tried.) Some approaches are elaborated below:

- Solar Panda: Solar Panda offers rent-to-own rooftop solar systems that include a battery and compatible appliances such as LED lights, radios and TVs, for a small deposit and payments of as little as 50 cents a day through local mobile money apps. The company launched in Kenya in 2017 and has just expanded to three new countries: Zambia, Benin and Senegal. The systems are sold and often installed by one of thousands of field agents operating out of the company's 60 shops. It takes one to three years of monthly payments for families to pay off the solar panels. Solar Panda says it's now powering 400,000 homes for two million people (Chung, 2026).
- Jaza Energy: Solar-powered battery swapping; Jaza Energy provides access to solar through battery swapping model. Its solar panels go up on "solar charging hubs" instead of homes to charge lithium-ion battery packs that customers rent to power lights and TVs and charge their phones. When the batteries are depleted, customers come back and swap them for new ones, about once every three days. The company expanded from Tanzania into Nigeria (Chung, 2026).
- Women Barefoot Solar Engineers of Africa: The Women Barefoot Solar Engineers of Africa aim to improve the lives of the rural poor living on less than $1 a day in remote inaccessible villages off the energy grids in the 21 least developed countries in Africa, supplying their communities with clean, low-cost household lighting from solar energy. Since 2005 more than 140 women from Africa, many of them grandmothers, almost all of them illiterate, have trained at the Barefoot College in India. In six months, these women learned how to fabricate, install and maintain solar-powered household lighting systems, and have become Barefoot Solar Engineers transforming the lives of over 2,000 families in the first self-sufficient and self-reliant, solar-electrified villages in Africa. The Barefoot Approach has reached remote, poor, rural villages in 25 countries in Africa, Asia and Latin America. Illiterate rural mothers and grandmothers who have never left their villages before training in India have solar electrified their own villages. Each household agrees to pay a fee between $5 to $10 a month for the solar lighting, roughly what they used to spend on kerosene, candles and flashlight batteries. This pays for salary of barefoot engineers and maintenance. (https://www.barefootcollege.org/women-barefoot-solar-engineers-a-community-solution/).

While the models discussed above provide a novel way of deploying RE technologies, the question is how scalable they are. More crucially these systems often only power phone

chargers or lights. Yet rural transformation also requires power systems that can drive small machinery to drive rural industrialisation.

3.2. Mini Grids

Mini grids are community-scale electricity generation and distribution systems, typically under 100 kilowatts in size. Mini grids can supply enough energy to power small businesses that do milling, refrigeration and welding thus supporting rural industrialisation (Lunanga et. al 2026). Mini grids are seen as a cost-effective solution for many rural parts of Africa as the cost are expected to fall from 60 US cents per kilowatt-hour to just 22 cents by 2030, compared with an average of 53 cents for alternatives like diesel generators (PowerForAll, 2019). World Bank (2019) points that to achieve universal access to electricity by 2030, 40 percent of all installed capacity will have to come from mini grids.

RE driven mini grids have received significant support with many countries putting in place regulations to support their deployment e.g. Kenya (IEA, 2024), Sierra Leone (SEforALL (2024), Nigeria (Sesan, 2024) with significant support from development partners[1]. The policy interventions have been focused on reducing risks and attracting private investment. However, RE mini grids have not lived up to their promise. For example, though there has been a 40% increase in mini-grid electricity supply since 2017 in Nigeria, the targeted people cannot afford the high tariffs. RE based Mini grids will need to overcome several challenges. PowerForAll (2019) points to poor asset utilization, costly financing options and regulatory barriers are the main drivers of costs for mini grids. They point out that Solar-hybrid mini-grid cost can be reduced by 60% by 2030 by leveraging hardware cost reduction, remote monitoring technology, system standardization, demand stimulation, low-cost financing and minimizing regulatory.

3.3. Stimulating Demand

Lunanga et. al. (2019) finds that Mini grids REs needs customers to buy the electricity but often face low demand and high operational costs. This can make them financially unsustainable. Most rural people are poor and therefore may not be able to afford. Part of the reason is low productivity of agriculture, the main economic activity (Sesan, 2024). Low electricity consumption is also related to rural consumers' lack of access to electrical appliances and loans (RMI, 2019). Land tenure matters as households must provide proof of land ownership to obtain a connection. However, land titles can be costly, slow to obtain and are often disputed (Lunanga et. al. 2026). Many people live in family homes or rented dwellings without formal documents. The result of these challenges is poor utilization rates that drive up the mini-grid cost per unit of electricity

[1] Mini-grids reported receiving substantial grants from donors such as the World Bank, All On and the Africa Enterprise Challenge Fund (AECF). The grants ranged from 75% to 80% of capital (SEforALL, 2024)

sold. Studying a successful RE mini-grid operation in DR Congo with over 6 million customers, Lunanga et. al. (20260 find that success was based on:

- Coordinated efforts by public-private partnerships, supported by strategic public and development finance, helped stimulate electricity demand. They encouraged businesses to locate near the mini-grid and helped households to adopt electric appliances. This means that building a mini grid is not enough: electricity demand must be actively developed
- They set up the Virunga Alliance, a public-private partnership bringing together government authorities, civil society and the private sector. This developed industrial activities such as cocoa processing and soap production near the mini grid. These created a stable electricity demand while generating local employment.
- Although electricity was far cheaper than diesel, firms often used diesel generators because they lacked the funds to buy electrical equipment. To address this, the alliance partnered with a bank to offer microcredit with repayments added to electricity bills. This made it easier to pay and created a strong incentive to repay, since non-payment could lead to temporary disconnection
- The company has promoted electric cooking, giving away free electric pressure cookers to families. The households saved money by spending less on charcoal, while the electricity company recovered the costs of the cookers as the families bought more electricity.
- The company has also sold carbon credits by delivering electricity to local businesses and reducing the amount of diesel being burnt.
- Development partners played a central role. Early donor grants and development finance helped reduce the initial capital burden. Blended finance, combining donor grants and development finance, was used to set up the company. Development partners also supported the rollout of electric cookers

While evidence from the literature points to hybrid (i.e., public-private) ownership, partial subsidies, the inclusion of anchor business customers, and the financial bundling of portfolios as the most promising strategies for financial sustainability and scalability, no bulletproof business model exists. All the same regulation will be key to making mini grids work. Fajardo e. al. (2025) put forward the following policy recommendations with regards to the future regulation of mini grids: i) there should be greater clarity of regulation, compensation and enforcement in terms of the arrival of the main grid into the vicinity of a mini grid; ii) strategies to decrease credit risk must reflect the needs of both households and productive users in order to arrive at an affordable tariff structure and workable payment collection method; iii) communities' needs, concerns and expectations should be addressed in project development, including for instance working with local authorities and local champions to connect the community to the mini

grid; iv) finally and relatedly there should be accessible and continuous communication regarding tariffs and the service provided to all mini grid users.

3.4. Financing REs – Can Carbon Credits Bridge The Gap

A key challenge for both deploying REs and creating RE manufacturing value chains is financing. Of the $91 billion of investment required to connect 380 million people in SSA to solar hybrid mini grids, less than 10 % had been approved by 2022 (Fajardo et. al. 2025).

A potential financing source that has not been properly tapped is carbon credits. Today Africa is generating barely 2% of its carbon credit potential (Joubert, 2026). Issa (nd) citing the Africa Carbon Markets Initiative (ACMI) attributes this to several challenges:

- **Enabling policies**: Many African countries do not have adequate policies to effectively support carbon markets;
- **Weak ecosystem**: the carbon market ecosystem in Africa is largely uncoordinated and lacks essential market information.
- **Policy Instability**: Buyers and investors are wary of the uncertainty surrounding long-term policy stability in African countries. This creates a high-risk environment, which discourages investment and participation in carbon projects.
- **Credibility:** There are no standardised processes for rating/assessing carbon credit benefits: there is an absence of standardised processes for evaluating the benefits of carbon credits. This makes it difficult to assess the true impact of carbon projects and undermines the credibility of the carbon market; and
- **Validation and Verification capacity**: Africa faces a shortage of local verification and validation bodies (VVBs) and expertise. This knowledge gap means that many projects must rely on international bodies for validation, which can be costly and time consuming.

Africa Carbon Markets Initiative (ACMI, 2024) has launched a number of programmes aim to accelerate Africa's participation in the global carbon market and seeks to attract over 6 billion pr year by 2030. However, there is no guarantee that revenues generated from carbon credits will be allocated to directly improve the livelihoods of communities. Some have called the carbon credit scheme as new form of colonialism with benefits accruing to the Developed world. Arko (2024) argues that developing countries, in their pursuit of investment and revenue, may become reliant on carbon offset projects funded by entities from the Global North and this dependency can limit their agency in negotiating project terms, leading to deals that favour foreign investor interests over those of local communities. Arko (2024) further argues that these mechanisms, particularly in Africa, are unveiling a complex web of injustices, power imbalances, and conflicts over land rights. It has been argued that African nations must enact unequivocal environmental legislation, establish transparent regulatory bodies and ensure communal participation in the relevant governance processes (Adow, 2024). For example, in Zimbabwe, projects

that generate income from reducing carbon emissions allocate at least 50 per cent of the revenue to the government and local communities, enabling the government to invest in climate resilience projects and empowering communities to implement sustainable development initiatives (G0Z, 2023).

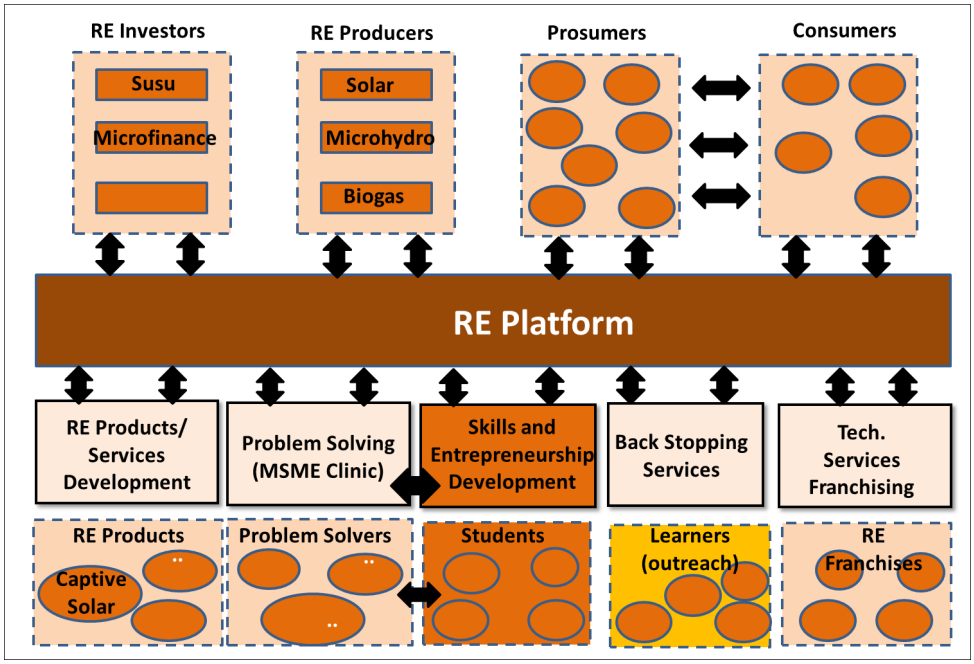
3.5. RE Platform Business Model

The foregoing discussion has explored challenges of deploying RE especially at grassroots level. It makes clear the need for new business models. A potential business model is an RE Platform

Digitalization has seen the emergence of platform economies. Platform business model seeks to bring various actors together and use digital systems to support transactions. A platform model that seeks to build an ecosystem that brings informal sectors, new actors, the traditional utilities with huge experience has been proposed.

This model seeks to connect that various ecosystem components and include people usually excluded to participate is being pioneered by MSM in Sierra Leone as illustrated in figure 1.

Figure 1: Towards a Platform Model for REs Deployment



We envisage the development of a platform for bringing the Ecosystem actors together. In this platform those interested in investing (**investors**) in RE energy, producers of RE (**Producers** and **Prosumers**) and **consumers** can interact and exchange. The platform will facilitate emergence of new actors in the RE energy space by driving innovation in the sector. This model is illustrated in figure 2. The key components include;

- **Energy Products/Services Development (R&D).** This will entail developing RE energy systems that are suited for Sierra Leone and Africa market e.g. captive solar. These products can then be sold to investors who can deploy them. Here the platform can work closely with Universities, TVETs and other innovators via an open innovation platform.
- **Problem Solving (MSME Clinic):** This serves to help business especially MSMEs move to REs. These services may include helping them re-organize their business processes and models. The clinic will include teams of students, academics and retired professionals as problem solvers.
- **Skills and Entrepreneurship Development**: As the objective is to build skills in RE Space, a specialized curricula will be build designed specifically to close gaps in students graduating from various Higher Education Institutions (HEIs). The curricular will also include buildings skills that can be exported as there is a huge demand for green and digital skills especially in Europe which is experiencing a huge deficit and looking for a model to bring in skills on a temporary basis. The objective is not only to building in demand technical skills but also to build RE entrepreneurs. The building of skills will be combined with problem solving activity where students involved in problem solving will be given classes to get the theory behind the problem they are solving and also other needed skills.
- **Backstopping Services:** As the ecosystem develops and a mix of RE entrepreneurs emerge, many will not have the capacity or expert to rollout support services. The Platform can offer common back-office services like billing and customer support.
- **RE Franchising Service:** As many entrepreneurs who emerge and even those who are in the field may struggle to establish their credentials (trust) and even be able to reach customers the platform can establish a franchise system where service providers can be trained, supported and connected to customers through the platform. Therefore, someone needing a solar system installed in their home can find a vetted service provider on the platform. The platform will support the contracting and the payment thus earning revenues from fees and commission.

4. Establishing Africa RE Manufacturing Value Chains

Behuria (2020) points that focus on deployment of REs without adequate attention to industrial policy in renewable energy sectors will inevitably cement a green division of labour, with most of the Global South locked in dependency on American, European and East Asian technologies. It is thus imperative to give significant thought on how to build a manufacturing value chain. Lema et. al. (2025) sees the process of establishing RE manufacturing in the context Global Value Chains (GVC). Domestic firms initially participate by assembling products using imported components, manufacturing low

value components, and creating joint ventures for component supply. They progress by manufacturing higher-value components, producing and supplying complete renewable energy systems, and exporting their products to global markets. However, this process is not necessarily automatic it requires interventions. Several industrial polices approach have been proposed to develop RE manufacturing industries. Some approaches used include:

4.1. Local Content (LC)

Local content (LC) is a strategy to jumpstart manufacturing by requiring utilization of local content in the equipment being deployed. This can be further energized by government procurement policies that favour locally manufactured goods as has been observed in South Africa (Department of Public Works, 2018). LC policies can force foreign investors to invest in local manufacturing or stimulate emergence of local manufacturers. However local content approach may have its challenges. Eicke (2025) points that local content requirements effectively promote green domestic industries only when the mandated share of locally manufactured components is moderate or when implemented in countries with related existing industries. Local content approach may also be subject to other challenges. LC regulations remain controversial, as they often contravene World Trade Organization rules (Wu & Salzman, 2013) which can make them less effective. For example, India's ambition of domestic manufacturing of Solar Panels has received limited support, especially after the United States launched a complaint against the domestic content requirements, requiring energy developers to procure domestically produced panels (Behuria, 2020).

Therefore, for Africa with a predominance of informal microenterprises may not be able to use this route without substantial attention to developing a strong private sector. Further they maybe constrained by existing manufacturing powerhouses challenging these laws under WTO rules.

4.2. Public Investment

Targeted public investment in infrastructures, subsidies to stimulate local manufacturing and even setting up State Owned Enterprises (SoEs) is another approach. This has been complemented by technology policies foster innovation through R&D subsidies, tax breaks, support for innovation systems, technology transfer, and technology transfer and learning initiatives. For example, China's Solar PV sector, upgrading has required public investment in research and development, along with targeted programs and projects to boost technological and innovative capacities (Shubbak, 2019). This path has it own challenges as many African countries lack the resources needed to invest.

4.3. Leveraging Africa Mineral Wealth

Africa has the unique advantages as a key supplier of the minerals needed to power on the ongoing green transition. To date Africa has mainly exported the minerals commodities with little processing done (Gatun and Adjaye, 2025). However, Africa can leverage this abundance to overcome challenges in using LC route or public investment route. China is the dominant processors of these minerals and the dominant producers of RE technologies. This is creating concerns in the West as they see China seeking to weaponize this dominance. This has seen the West seek to develop new supply chains in what they consider friendly countries. As a result, there has been significant rise of activities by US and EU in Africa to develop minerals resources. China is also increasing its investments as it seeks to maintain its dominance. This can be leveraged to develop a strong green processing sector.

The example of Indonesia is a pointer. Indonesia with a 50% share of global nickel production has leveraged this to develop a strong EV battery manufacturing sector. This outcome was achieved through a two-pronged strategy: phased banning the export of raw nickel and incentivizing value addition through the development of SEZs (Simmons and Marcilly 2024). Indonesia now produces battery-grade nickel and other materials that supply nine factories, accounting for over 40% of global EV production (Tritto, 2023). Indonesia's VC development worked for several reasons. First, Indonesia has market power in nickel production, giving it bargaining power with investors, particularly the Chinese. Second, it had an industrial policy that articulated a clear national strategy with clearly stated priorities. Third, the government invested in the necessary infrastructure to facilitate the processing and export of nickel[2].

Africa is thus in a unique position to leverage the growing interest to start developing a local green technologies manufacturing value chain. It can take a differentiated approach to the various partners. Gatune and Ajaye (2024) proposes the following strategies

<u>For China</u>

- Leverage the Belt and Road Initiative (BRI) to not only build infrastructure for mining but also industrial parks in designated Special Economic Zones (SEZs).
- Build African champions by mandating joint ventures and technology transfer in return for mining concessions.
- Develop a free trade agreement (FTA) based on the AfCTA to open new markets for Chinese products, but at the same time mandate Chinese joint venture investments in green technologies manufacturing in return for market access[3]

<u>For USA</u>

- As the US is keen on supporting the private sector and can provide financing to non-US companies, Africa should seek to help African mining and processing companies

[2] Indonesia leveraged the Belt and Road Initiative to build the infrastructure and negotiated with China to build the SEZs and related infrastructure.

[3] China grew on this model as Western companies sought to access China's huge consumer market.

access the various financing facilities. Africa should also seek to incentivize joint ventures that can not only help transfer technology but also access financing. To support this, Baskaran (2023) argues that African countries should develop a suite of economic diplomacy instruments to help the private sector work hand in hand with the U.S. government in a coordinated government approach.

For EU Partners

- First, Africa needs to engage the EU in a more strategic way. This can be through the Africa Green Minerals Strategy (AGMS). Africa needs to examine the overlaps between AGMS and the EU's critical Minerals strategy to prioritize areas of engagement
- Joint Green Industrialization efforts. The EU and Africa have a shared vision on green transition, and each has comparative advantages. Africa has the green minerals and youthful labor, while the EU has the technologies and finances, yet it is simultaneously facing labor shortages. A win-win situation can be established in which Africa supplies green mineral products and labor to the EU, and the EU supplies technologies and financing. A circular migration model can allow youths trained in green skills to work in Europe to close labor gaps. In turn, they are trained in entrepreneurship and, after a few years, return to Africa (supported with finances and joint ventures) to become African green entrepreneurs.

Development Finance institutions (DFIs)

- Mines are expensive to develop, and mining companies rely on DFIs to for finance. DFIs can be persuaded to develop an integrated value chain financing approach, which requires proposals for mine development to include associated processing infrastructure, linking project finance to industrial base development rather than simple extraction activities (Hidayat, 2025). This model has been advocated by the AfDB. DFIs can develop and finance partnership models where African countries provide value-added, sustainable mineral resources in exchange for long-term investment, technology transfer, and market access, ensuring both global supply security and local economic transformation (AfDB, 2025). In this way, DFIs can fuel a more equitable and resilient global economy with critical minerals.

Mining Companies Introducing RE in Remote parts of Africa

Beyond development of manufacturing value chains, Mining companies can play a significant role in in uptake of renewable energies. This is driven by the fact that mining uses a lot of energy and Africa is energy poor yet rich in minerals. Moreover, mines tend to be in remote areas not connected to the sparse grid found in Africa. Mining companies are also under pressures to reduce their carbon footprint especially as financing is increasingly tied to Environmental Social and Green (ESG) scores (IRD, 2025).

Therefore, there is a good case for developing renewable energies to support the activities, this is happening. For example, First Quantum Minerals is investing $500

million in a 430 MW renewable energy project to power its Kansanshi and Sentinel mines in Zambia. The project includes a 230 MW solar PV plant and a 200 MW wind farm. The facilities, set for completion in 2026 and 2027, respectively, aim to reduce First Quantum's carbon footprint by 30% by 2025 (Mining Weekly, 2025).

The is not only brings the RE technologies to rural areas but mining companies can be incentivized to extend the REs to local communities ither as part of their CSR or as a new business line. They can build mini-grids and provide financial support to build RE driven business in the localities.

4.3.1. Regional Green Value Chains

As discussed, African countries struggle to capture the benefits of abundance of critical minerals due to a lack of skills, access to technology, investment, and infrastructure (Gatune and Adjaye, 2024). Given that no one country has the capacity to develop all the needed skills, a regional approach could help address these challenges. Regional collaboration has several benefits. First, regional procurement would be more attractive to investors in critical minerals value chains due to economies of scale and a greater pool of available skills. Second, a regional approach could ensure a coherent LC policy that prevents a race to the bottom in fiscal frameworks where countries compete to provide incentives. Third, a regional strategy can have countries specializing in different nodes of the value chain and would be essential to fully leverage the diversity of CRMs. Green industrialization requires combining multiple minerals scattered across the region (Chen et. al., 2024). Finally, a regional approach would create a bigger market that could attract investments. Regional value chains needed not follow the regional economic blocks but be based on where minerals occurs and transport corridors are. For example:

- Zambia is the epicentre of three transport corridors. The Tazara railway (funded by China) links the Zambian copper mines to the Tanzanian port of Dar Es Salaam. The Lobito Corridor, funded by the US (and G7), links Zambia and DRC mines to the Lobito port on the Angolan Atlantic coast, while the Nacala Corridor, funded by Japan, links Zambia and Malawi to the Nacala port on the Mozambique coast of the Indian Ocean. Given that Malawi, Tanzania, and Mozambique have significant graphite deposits, copper, cobalt, nickel, and graphite are available along these corridors, there is an opportunity to build a battery complex
- South Africa is already building a hydrogen economy based on its PGM minerals. Given that Zimbabwe is also rich in PGMs and Namibia has a strong hydrogen ambition (with support of the EU), a Southern Africa Green Hydrogen complex could be established.
- In West Africa with abundance of Iron, Aluminium and Manganese, the region can develop regional clusters for building windmills.

5. Conclusion and Way Forward

Africa green industrialisation will require a twin strategy of increasing uptake of RE technologies but also becoming a participant in manufacturing value chains, The uptake of RE technologies will need innovative approaches to drive financing, build skills, catalyse business model innovations and more crucially building an ecosystem that will ensure inclusive uptake of REs. A platform that can bring various actors together has been proposed. This can help build an inclusive ecosystem for REs deployment.

With regards to manufacturing RE technologies Africa has now a window to leverage its mineral wealth and an urgent desire by countries to build new mineral value chains to break China's stranglehold on processing green minerals and developing green technologies. The urgency of building new value chain provides Africa with an opportunity to use local content and local value addition policies to transfer technologies, build local champions and establish green manufacturing clusters. The Africa Continental Free Trade Area (AfCTA) provides additional incentive to attract investment in RE technologies to tap the hug market opening.

References

ACMI (2024). Africa Carbon Markets Initiative Builds on Momentum from COP27, Announces 13 Action Programmes – Africa Carbon Markets Initiative (ACMI) (16 April 2024)
https://africacarbonmarkets.org/africa-carbon-markets-initiative-builds-on-momentum-from-cop27-announces-13-action-programmes/

Adow M. (2023). Africa Carbon Markets Initiative: A Wolf in Sheep's Clothing. *Climate Home* (7 September 2023)
www.climatechangenews.com/2023/09/07/africa-carbon-markets-initiative/

Arko, T (2024). Carbon markets and the new scramble for African land. Review of Africa Political Economy. 30 October 2024
https://roape.net/2024/10/30/carbon-markets-and-the-new-scramble-for-african-land/

Sajjad Ashraf *(2025)*. Pakistan's great solar escape: A revolution from below. Gulf News. September 17, 2025 | 16:29

Behuria, P. (2020). The politics of late development in renewable energy sectors: Dependency and contradictory tensions in India's National Solar Mission. *World Development,* 126, 104726.
https:// doi. org/ 10.1016/j. world dev. 2019. 104726

Chung E. (2026). Africa's record solar buildout includes tiny rural rooftops — and these Canadian companies. CBC News · Posted: Mar 03, 2026 4:00 AM EST | Last Updated: March 3

Department of Public Works. (2018). *Green Building Programme*. Governement of South Africa. Department of Public Works.
http:// www. publicworks. gov. za/ PDFs/documents/ White Papers/ Green Building_Policy_ Approved.pdf

Eicke, L. (2025). Does policy design matter for the effectiveness of local content requirements? A qualitative comparative analysis of renewable energy value chains. *Policy Studies Journal*. 53(3): 604–617.
https://doi.org/10.1111/psj.12590.

Fajardo, A., Baker L. H., Sesan T.; S. Bhattacharyya [e], Kerr, D., M. Katyega, M., Barnett, A. (2025). Business models and access to finance for mini grid development in sub-Saharan Africa. Energy for Sustainable Development. Volume 85, April 2025, 101666

Government of Zimbabwe, (2023), Statutory Instrument 150 of 2023: Carbon Credit Regulations.

IEA (2022) Africa Energy Outlook 2022: World Energy Outlook Special Report
Africa Energy Outlook 2022 – Analysis - IEA

IEA (2025). Kenya 2024 Energy Policy Review. International Energy Agency (IEA)
https://www.iea.org/reports/kenya-2024

IEA, IRENA, UNSD, World Bank, WHO (2025). Tracking SDG 7: The Energy Progress Report. World Bank, Washington DC.
TrackingSDG7TheEnergyProgressReport,2025.pdf

Isa. F.B. (2026).Africa's carbon credit journey: navigating opportunities for advocacy and legal tools. *International Bar Association 2026*
https://www.ibanet.org/africa-carbon-credit-journey

Joubert, R. (2026). Africa is capturing just 2% of its carbon credit potential. Farmers Weekly.11 April 2026 | 10:00 am
https://www.farmersweekly.co.za/agri-news/south-africa/africa-is-capturing-just-2-of-its-carbon-credit-potential/

Lema, R., Rabellotti, R. & Ambrogi, J. (2025). Seizing windows of opportunity in green global value chains: the role of industrial policies in middle-income countries. Journal of International Business Policy
https://doi.org/10.1057/s42214-025-00219-5

Lunanga, E. , Stoop, N., Verpoorten, M., Desbureaux, S. (2026).From demand deficit to development strategy: Navigating mini-grid viability in a fragile context. Energy Economics. Volume 154, February 2026, 109141

Mining Weekly (2025). Top Renewable Energy Projects Powering African Mining. Mining Weekly, 21 Jan 2025
Top Renewable Energy Projects Powering African Mining

PowerForAll (2019). Mini-grids costs can be reduced by 60% by 2030. PowerforAll Fact Sheet. August 2019.
https://www.powerforall.org/application/files/4415/6700/7650/FS__Mini-grids_costs_can_be_reduced_by_60_by_2030.pdf

RMI (2018). Six ways to reduce mini-grid costs by 60% for rural electrification Rocky Mountain Institute, 2018.

SEforALL (2024). Mini-grid CAPEX and OPEX Benchmark Study: A Regional Approach in Burkina Faso, Nigeria and Sierra Leone. Sustainable Energy for All (SEforALL).

Sesan, T. (2024). Nigeria's chronic power shortages: mini grids were going to crack the problem for rural people, but they haven't. Here's why. The Conversation. July 21, 2024 https://theconversation.com/nigerias-chronic-power-shortages-mini-grids-were-going-to-crack-the-problem-for-rural-people-but-they-havent-heres-why-233363

Tamasiga, P., Mfuni, H., Onyeaka, H., Ouassou, E. (2025). Green industrial policy as an enabler of the transition to sustainability: challenges, opportunities and policy implications for developing countries. Environment, Development and Sustainability (2025) 27:355–376 https://doi.org/10.1007/s10668-023-03952-0

World Bank (2019). Mini Grids for Half a Billion People: Market Outlook and Handbook for Decision Makers - Executive Summary. ESMAP Technical Report;014/19. World Bank. http://hdl.handle.net/10986/31926 License: CC BY 3.0 IGO."