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Article

The Development of Chinese Investments in the Renewable Energy Sector in African Countries

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Abstract

This study aims to explore and analyze the nature of Chinese investments in the renewable energy sector in African countries and to identify the various challenges and structural obstacles facing its development. Among the key findings of the study is the doubling of Chinese investments in renewable energy in African countries in recent years, thanks to China's massive expansion in production capacities and the strong presence of its companies, which possess a wide range of green technology applications, along with relatively low costs, especially in the fields of solar and wind energy. This results in maximizing the economic benefits for both China and African countries.

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On the other hand, the limited access to private and foreign financing, the underdeveloped infrastructure and networks, and the unstable financial and economic conditions have contributed to accelerating and strengthening Sino-African cooperation. This has been achieved by redirecting the Belt and Road Initiative — a global infrastructure development project — to focus on clean energy and green infrastructure, thereby facilitating access to funding for renewable energy projects. The cooperation between the Chinese public and private sectors helps to speed up the implementation of large-scale renewable energy projects across the continent, in addition to leveraging the advantages of exploiting Africa's rare vital minerals, which are essential for technological industries and clean energy.

Keywords: Chinese foreign investments, fossil fuels, renewable energy, rare minerals, African countries.

Introduction

In recent years, China has taken the lead in foreign investments in the renewable energy sector in African countries, investing heavily in various fields ranging from the construction of solar and wind energy plants and projects to electricity distribution networks. This is particularly significant given that the African continent holds important minerals essential for renewable energy technologies, such as copper, cobalt, and lithium — the main components used in battery manufacturing. Consequently, the race for green energy has led to a race for these minerals in Africa, driven by China, the United States, and Europe.

According to the International Renewable Energy Agency, Africa's share of global investments in renewable energy has remained very small, despite its exceptional natural resources and the growing demand for electricity. This is mainly due to the financing gap and the lack of necessary capital to build sustainable energy infrastructure. As a result, most African countries have engaged in partnerships and cooperative frameworks with China, the United States, and some European countries in order to attract more investments, achieve their long-term clean energy goals, and ensure the success of the energy transition process.

China has placed great importance on cooperation with African countries in the field of renewable energy. It is one of the key partners in promoting the use of clean energy, particularly as multilateral platforms such as the Forum on China-Africa Cooperation and the Belt and Road Initiative aim to assist African countries in increasing their renewable energy supplies through the development of solar, geothermal, and wind energy. This enables African countries to learn from China's experience in developing renewable energy by strengthening joint cooperation and sharing successful practices. Accordingly, we pose the following research question: What are the factors that

have contributed to the growth of Chinese investments in the renewable energy sector in African countries?

1. The Dilemma of Energy Transition in African Countries

African countries face the challenges of the energy dilemma, as described by the World Energy Council. The first challenge revolves around the possibility of achieving universal access to modern, reliable, sustainable, and affordable energy services by 2030, as outlined in the seventh goal of the United Nations Sustainable Development Goals. The second challenge lies in achieving and accelerating the transition toward a reliable, sustainable, and low-carbon energy system by developing renewable energy sources, which have emerged as an attractive alternative to avoid the risks associated with reliance on fossil fuels.

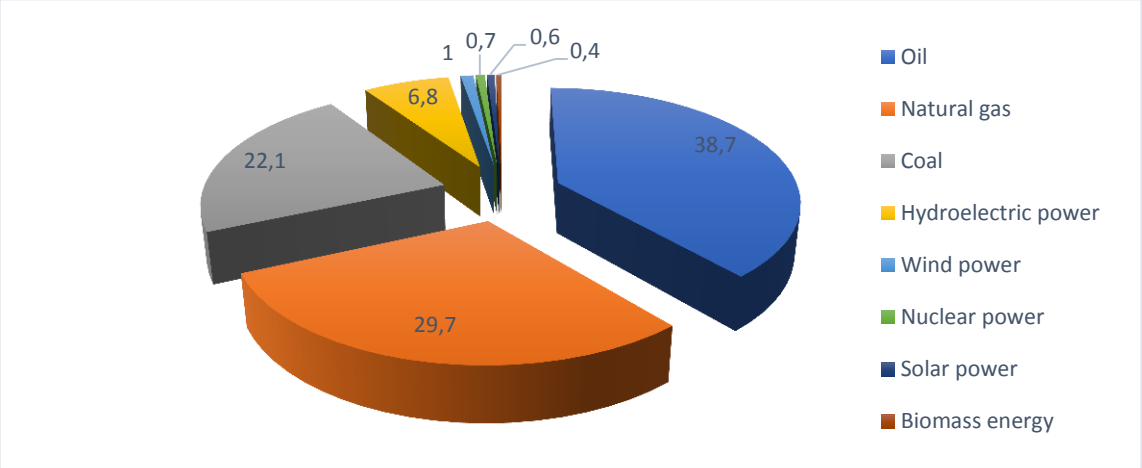

Figure 1. The Energy Generation Mix in Africa (Source: Price water house Coopers, 2021, p 5)

From the graph above, we observe the dominance of fossil fuels in Africa's energy mix. Crude oil ranks first at 38.7%, followed by natural gas at 29.7%, and coal at 22.1%. The remaining shares are distributed among hydropower at approximately 6.8%, wind energy at 1%, nuclear energy at 0.7%, solar energy at 0.6%, and biomass at 0.4%. The reliance on fossil fuel sources has deepened due to the presence of African countries rich in crude oil and natural gas, such as Algeria and Nigeria. This situation has raised important questions concerning sustainable development and environmental security.

The overall share of renewable energy sources within Africa's current energy generation mix remains very small, with fossil fuels continuing to dominate, except for hydropower. This is despite efforts to accelerate solar and wind energy generation technologies across the continent, which still account for only about 1.6% of the energy mix, as shown in Figure (01).

Africa enjoys abundant renewable energy resources. It possesses the richest solar energy resources in the world due to its high solar radiation levels. It also benefits from wind energy potential — especially in North and East Africa — and hydropower, which currently represents its main renewable energy source thanks to the presence of major river basins. Additionally, geothermal energy resources can be found throughout the continent. Overall, according to the International Energy Agency, Africa's renewable energy potential is far greater than the energy currently generated, in addition to the continent's expected significant increase in energy consumption. (Raimondi, 2023)

The development of clean energy aligns with the actual needs of economic transformation, based on securing the requirements of economic growth and development. Therefore, African countries have focused over the past decade on developing and utilizing various types of renewable energy, with the total installed renewable energy capacity increasing from 28.45 gigawatts in 2012 to 55.71 gigawatts in 2021.

The African continent possesses one of the largest global potentials for solar energy production, as it receives an average annual solar radiation of 2,119 kilowatt-hours per square meter. Most countries in the northern, western, and southern regions of Africa receive an average radiation exceeding 2,100 kilowatt-hours per square meter annually. According to estimates by the International Renewable Energy Agency, the continent's technical potential for photovoltaic energy amounts to 7,900 gigawatts, indicating vast potential for solar power generation. Despite all these resources, solar energy deployment at the utility scale has been limited to a small number of countries. Additionally, the northern, eastern, and southern regions of Africa are considered suitable for the development of wind energy projects, with a technical potential of 461 gigawatts. Algeria, Ethiopia, Namibia, and Mauritania possess the largest capacities in this field. (Irena, 2022)

The potential and capacity of green energy sources in Africa, according to estimates by the International Renewable Energy Agency, vary between solar energy (10 terawatts), hydro energy (350 gigawatts), and wind energy (110 gigawatts). What distinguishes the abundant renewable energy potential in Africa is that its appropriate utilization could lead to the transformation of countries into "green" nations, producing minimal carbon emissions that contribute to greenhouse gases, in line with global climate goals. Africa's contribution to global greenhouse gas emissions is less than 5%, with renewable sources accounting for over 70% of electricity in thirty African countries. Meanwhile, only five countries produce renewable electricity at a rate of less than 10%. Relying on renewable energy sources is one of the most crucial solutions that Africa needs to focus on, in an effort to lift 600 million people out of energy poverty.(Adeleke et al., 2022)

Clean energy investments across Africa reached a record high of $36.6 billion in 2023, representing a 12% increase ($3.8 billion) compared to the previous year, according to the

International Energy Agency. Renewable energy investments nearly doubled over the past five years, and investments in electricity access grew by 30%. This growth has been difficult to achieve amidst high debt levels and expensive financing costs.(Sobeh, 2024)

Solar energy is one of the most prominent renewable sources for electricity generation, as it is highly sustainable, clean, and available. In 2020, 9% of the total energy generated in Africa came from renewable sources. Solar and wind energy increased by 13% and 11%, respectively, from 2019 to 2020, while hydroelectric energy grew by 25%. Additionally, the total installed renewable energy capacity in Africa has increased by more than 24 gigawatts since 2013.

Renewable energy sources enhance the role of mini-grids in providing low-cost electricity to electrically isolated communities. African countries rely on two technologies to convert solar energy into electricity: photovoltaic solar energy and solar thermal energy. The recent surge in solar energy production in Africa is due to decentralized systems and off-grid networks (external grids) used to supply electricity to rural areas, mining sites, and businesses, whose cumulative production capacity is difficult to measure.
Africa has the opportunity to benefit from its renewable energy potential, with serious steps being taken in several African countries to support the global trend toward adapting to an energy mix for sustainability development. The development of renewable energy in African countries brings many crucial social and economic benefits for national development, which can be summarized in the following elements:(Brauch et al., 2022)

- Economic Growth: Africa could see an average increase of 6.4% in GDP between 2021 and 2050, directly resulting from the success of the energy transition process. Economic growth is expected to be driven by public spending and private investment, particularly in energy technologies. Key sectors likely to benefit from this transformation include electricity supply – for underserved and low-income areas – public and personal services, manufacturing, and business services.

- Job Creation: Investment in renewable energy technologies creates three times as many jobs as fossil fuels for every million dollars invested. By 2030, between 8 million and 14 million jobs could be created in the energy transition sector in Africa. This is likely to be driven by public spending on public services and investment in renewable energy technologies after 2030. Job creation is estimated to be driven by intensive and indirect efforts through increased spending by low-income households.
- Improvement in the Trade Balance: Renewable energy generation could improve the trade balance deficit in most African countries by reducing spending on fossil fuel imports. While Africa holds a unique position as a net exporter of crude oil, it is a net importer of petroleum products.

Fuel imports in sub-Saharan Africa account for about 2% of GDP. Therefore, domestic energy sources will provide protection against external shocks and fluctuations in global oil prices. Moreover, if African countries manage to build manufacturing capacities, they could also export renewable energy components to other countries, leading to further positive trade flows.

- Energy Efficiency: Renewable energy plays a crucial role in bridging the energy access gap in Africa and achieving the seventh Sustainable Development Goal to ensure access to energy for all, lifting hundreds of millions of Africans out of energy poverty. Access to energy also enhances agricultural productivity, modern health services, education, and industrial development.

Several African countries, such as South Africa, Egypt, Morocco, Kenya, Senegal, Uganda, Ethiopia, are showing encouraging trends in developing new renewable energy capacities, supported by increasing political commitment and the rapid decline in renewable energy prices. They are also adopting major and large-scale programs and projects, such as the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) in South Africa, aimed at attracting investments. Through these initiatives, renewable energy plants are being built through public-private partnerships. Among the leading African countries driving solar energy projects are Egypt, Algeria, Morocco, Senegal, South Africa, Kenya, Nigeria, Zambia, Mauritania, and Namibia. Africa, in general, faces several challenges that hinder its global leadership in energy sectors, despite its natural potential, as the continent needs funding, foreign investments, and modern technologies.

According to a report issued by Bloomberg in November 2022 titled "Scaling Up Renewable Energy in Africa," despite the abundant natural resources on the continent that make clean energy the least costly option, Africa has gained limited benefits from the energy transition towards renewable energies, as indicated by the following indicators:(Brauch et al., 2022)

- Investments in renewable energy in Africa dropped to their lowest level since 2011 in 2021. Of the $434 billion invested globally in clean energy projects, only 0.6%, or $2.6 billion, went to Africa.
- Africa's share of global solar energy was only 1.3% in 2021, with solar capacity reaching 13 gigawatts, or 5.5% of Africa's total energy.
- The top three solar markets, namely South Africa, Egypt, and Morocco, accounted for 65% of the total solar energy capacity in Africa in 2021.
- Solar energy made up the majority of investments in renewable energy, with 57% from 2010 to 2021, compared to 30% for wind energy during the same period. Investment in solar energy reached $5.9 billion in 2015 and approached $5.4 billion in 2018, but investment flows slowed significantly, with total new solar investment falling to only $1.3 billion in 2021, the lowest

level since 2011. Wind energy investment dropped to $734 million in 2021, its lowest level in four years.

- Thirty-six African countries had renewable energy development goals out of the 42 African countries included in the Bloomberg analysis. However, investment was concentrated in a few key markets. South Africa, Egypt, Morocco, and Kenya have accounted for nearly three-quarters of all renewable energy asset investments, totaling $46 billion since 2010, while other countries combined received only $16 billion during the same period. Côte d'Ivoire was one of the key countries that saw a qualitative leap in 2021, having allocated $282 million to complete a 46 MW biomass plant. Gabon and Tanzania also attracted more than $150 million each in 2021.
- Insufficient Implementation Mechanisms Limit Renewable Energy Investment Opportunities: Although the share of African countries with long-term clean energy targets in effect jumped from 57% in 2019 to 86% in 2022, the implementation mechanisms to ensure the achievement of these goals have been weak.

Despite the positive momentum in the development of renewable energies in most African countries, legal and regulatory frameworks often remain incomplete and inconsistent. Notably, robust regulatory frameworks play a crucial role in attracting both local and foreign private investments in energy. For example, Kenya's experience illustrates how a strong and advanced regulatory framework can drive the clean energy transition.

The challenges related to infrastructure development, grid integration, and the incorporation of smart grids and digital transformation to accommodate the added renewable capacities are among the priorities in the African plan to ensure secure and efficient energy access. A combination of political risks, governance issues such as corruption, social unrest, commercial risks, and consumers' inability to pay their bills has discouraged private and foreign investors, resulting in a low level of investment in renewable energies due to the significant financing gap. It is important to note that perceived and actual investment risks are higher in Africa than in developed countries. As such, policy uncertainty, limited access to private and foreign financing, inadequate infrastructure and networks, and unstable financial conditions are among the major barriers preventing the full exploitation of renewable energy. Therefore, Africa needs to create a more conducive environment to attract private and foreign investments to finance renewable energy projects, which is a key priority and major challenge. This has led African countries to engage in multiple partnerships and cooperative frameworks with leading renewable and clean energy development countries such as China, the United States, Germany, and other European nations to achieve the energy transition.

2. Chinese-African Cooperation Mechanisms for Renewable Energy Development

The renewable energy sector in China has gained more momentum than any other country in the world, both in terms of installation and manufacturing, driven by the increasing demand for electricity and emission reduction goals. No other country has come close to China in terms of expanding renewable energy capacity. This is not only because renewable energy in China is leading a global record growth in installed capacity, but also because of its dominance in manufacturing solar panels and wind turbines around the world, making it a major exporter of renewable technologies in the clean energy sector. Particularly, China has been pushing for years towards dominance in the clean energy supply chains. As a result, the rapid scale of renewable energy development has led Chinese clean energy technology companies to seek new markets and opportunities in Africa.

Based on this, Chinese-African cooperation has seen significant growth in recent years in the field of renewable energy development. This was reflected in the China-Africa Cooperation Forum held on October 13, 2021, in Nairobi, Kenya's capital. As expressed by "Zhang Yijun," the Minister-Counselor at the Chinese Embassy in Kenya, he stated: "Beijing is committed to a healthy partnership with Africa to help it achieve energy security and drive the growth of the manufacturing sector, especially as it is a global leader in harnessing renewable energy sources," adding, "Cooperation with African countries will allow China to benefit from its vast solar and wind energy resources to support low-carbon growth. China will encourage its companies to engage in closer collaboration with their African partners in the clean energy sector, such as photovoltaic energy, wind energy, nuclear and hydrogen energy, and biomass energy."(Brauch et al., 2022)

Guided by mechanisms such as the China-Africa Cooperation Forum, South-South cooperation, and the joint construction of the Belt and Road Initiative, China and Africa have worked together for many years to implement a large number of large-scale clean energy projects, in addition to the flourishing of small and medium-sized new power generation equipment and energy storage equipment. Chinese smart grid providers and major renewable energy manufacturers have also provided technological and financial support in this field, establishing pilot projects that include assisting in the construction of small electrical grids in some homes and villages in Africa, in a framework aligned with large-scale clean energy development.

China's Motivations for Investing in the Renewable Energy Sector in African Countries:

China is a major investor in the renewable energy sector, the largest trading partner of Africa, and a prominent investor in infrastructure and mining projects. The growing Chinese investments in African markets to develop renewable energy sources represent a mutually beneficial opportunity for both sides. The main factors and trends that influence China’s i A. Growing Demand for Renewable Energy: Clean energy is a new point of convergence and growth for Sino-African cooperation in light of the continuous development of cooperation mechanisms such as the Belt and

Road Initiative. The demand for renewable energy is rising, driven by the declining costs of renewable energy technologies. The cost of electricity generated from solar energy decreased by 85% between 2010 and 2020, while the cost of onshore and offshore wind energy decreased by 56% and 48%, respectively. This presents a real opportunity for low- and middle-income countries to supply much of their energy needs from low-carbon sources in the coming years. Furthermore, efficient and reliable renewable energy technologies can create a system less prone to market shocks and enhance energy resilience and security by diversifying available options for economic advancement.(Rena, 2023)

The growing dynamics behind China's involvement in the renewable energy sector in Africa offer significant opportunities for economic progress in African countries. National energy sectors in Africa often suffer from insufficient generation capacity, weak transmission infrastructure, and low electrification rates, all of which are major barriers to economic development. Increasing the use of available clean energy potential plays a key role in boosting electrification rates while opening a development path to maintain and sustain resources. However, expanding renewable energy sources requires both technical and financial efforts, often hindered by financial constraints and a lack of technological expertise. China can provide both of these essential components, bridging the investment and technology gaps, and thus serve as a catalyst to unlock the potential for renewable energy development in Africa.(Conrad et al., 2011)

The deepening of Sino-African cooperation in the field of clean energy has significantly prompted some Western countries with traditional interests in Africa to consider that their influence on the continent will be marginalized. However, China's clean energy technology enjoys the advantages of low cost and strong applicability. Furthermore, enhancing cooperation in clean energy technology between China and Africa can break the technological bottleneck in the clean energy sector in Africa. It can also stimulate technological innovation in China. Thus, both sides can form a mutually beneficial and profitable cooperation scenario.

B. Africa's Abundance of Raw Materials Necessary for Manufacturing Renewable Energy Products: He African continent is rich in strategic critical mineral reserves such as lithium, cobalt, nickel, and manganese, which are the core materials for manufacturing renewable energy products. These resources provide an attractive option for Chinese companies looking to set up renewable energy manufacturing facilities near supply chains for these resources.

With the shift towards clean energy, which is highly dependent on the intensive use of these minerals, including wind turbines, photovoltaic solar energy, electrical grids, electric vehicles, and nuclear energy, minerals such as copper, lithium, nickel, silicon, cobalt, rare earth elements, and uranium are crucial. The demand for these minerals is expected to grow rapidly as the clean energy

transition gains momentum. According to the International Energy Agency, renewable energy technologies could represent up to 40% of global demand for copper and rare earth elements over the next two decades, between 60% and 70% of total demand for nickel and cobalt, and nearly 90% of the demand for lithium. This is a significant opportunity for Africa, which hosts 30% of the world's green mineral reserves. Africa holds a large share of global mineral reserves, including 92% of platinum, 56% of cobalt, 54% of manganese, and 36% of chromium. These minerals are used to produce green technologies such as electric vehicle (EV) batteries and wind turbines.(Hund et al., 2020)

China is the dominant global player in refining these strategic minerals. It refines 68% of nickel, 40% of copper, 59% of lithium, and 73% of cobalt worldwide. It accounts for most of the global production of mineral-rich components for manufacturing battery cells. Notably, China possesses 78% of the global manufacturing capacity for electric vehicle batteries and other energy storage applications. It hosts three-quarters of the world's giant lithium-ion battery production plants.(Castillo & Purdy, 2022)

In 2024, Ivory Coast became the third-largest supplier of nickel ore to China. In 2023, China imported nearly 90% of its cobalt requirements from the Democratic Republic of the Congo. The value of China's copper-related projects in the Democratic Republic of the Congo exceeded two billion dollars, while projects in Botswana amounted to nearly two billion dollars. Other large mining-related projects, including lithium mining in Mali and Zimbabwe, collectively exceeded one billion dollars.(CNBC 2025)

While China relies on Africa for supplying it with essential minerals, Africa also depends on China, which is the largest global hub for importing, refining, and processing essential minerals. China accounts for between 85% and 90% of the global refining and processing of rare earth elements from mines to metals, establishing a reciprocal relationship. China maintains a relative advantage as a global processing and refining hub, ensuring its access to African essential minerals for its domestic industries, while leaving Africa with limited options to diversify its export markets.

C. Dynamics of Sino-African Economic Relations: China has remained Africa's largest trading partner for the fifteenth consecutive year, with intra-trade volume reaching $282.1 billion in 2023, marking a new record for the second consecutive year. Chinese direct investment in Africa surpassed $40 billion by the end of 2023.(Agency, 2023) This growth is primarily attributed to increased Chinese exports to the African continent, despite the challenges posed by global supply chains during the COVID-19 pandemic.(Castillo & Purdy, 2022)

Major cooperation programs have contributed to enhancing bilateral trade between China and African countries. China has been Africa's largest trading partner for fifteen consecutive years. The

cumulative direct investment of Chinese companies in Africa has exceeded $43 billion, and over 3,500 Chinese companies of various types have been established in Africa, employing more than 80% of local workers, directly and indirectly creating millions of job opportunities.(Al-Sanhouri)

Calls to localize operations along the manufacturing value chain are increasing, as the COVID-19 pandemic revealed the over-reliance of African countries on global supply chains. Consequently, the African Development Bank launched the Africa Manufacturing Initiative to support both domestic and foreign manufacturing efforts.

African countries have recognized the need to prepare their economies to benefit from a low-emissions manufacturing path and efficient resource use. For instance, the African Union's 2022-2032 Climate Strategy heavily focuses on the need for a "new manufacturing path," considering Africa's "unique leap opportunity" to avoid further marginalization from the global economy. Countries like Kenya, Morocco, Namibia, and Rwanda are also working on promoting their nations as key investment destinations for green economy projects, where they plan to offer (in the future) low-cost clean energy, but are also investing in a skilled workforce and a range of financial and non-financial incentives to facilitate investment in clean energy projects.(Medinilla & Sergejeff, 2023, p. 10)

China-Africa Cooperation in Renewable Energy: Towards a More Sustainable Path China's investments in Africa play a crucial role in transforming the continent's energy landscape, thus accelerating the shift to renewable energy sources. China stands out through three main pillars that make it a key player in this transition: (Guerroudj, 2024)

- China is a global leader in solar and wind energy production, providing many of the components needed for green energy production in Africa. For example, in 2023 alone, South Africa imported 3.4 gigawatts of solar panels from China, representing about 5% of its total electricity capacity in 2022. This large production capacity, coupled with relatively low costs, allows China to play a leading role in solar energy for many energy projects across the continent.
- The significant presence of Chinese companies in Africa forms a second key pillar. With over 500 companies operating on the continent, Chinese entrepreneurs hold about 61.9% of the market share in various sectors, including construction. This presence enables them to diversify their activities, transitioning from traditional infrastructure building to the development of renewable energy facilities such as hydroelectric dams and solar power plants.
- Financing renewable energy projects by China, as state-owned Chinese companies maintain close relationships with local banks and state insurance companies, facilitating access to financing for green energy projects in Africa. This cooperation between the Chinese public and private sectors helps accelerate the implementation of large-scale renewable energy projects across the continent.

Commitment to small-scale energy projects in Africa's emerging renewable energy sector marks a departure from traditional Chinese-African investments that focus on large infrastructure projects such as railways, highways, and bridges. It also differs from China's previous involvement in Africa's renewable energy sector, which showed a clear focus on building large hydroelectric power stations, typically financed through resource-backed loans, and thus directly linked to China's efforts to secure access to African natural resources. However, China's commitment to clean energy in Africa is by no means coincidental, as it aligns with the new role of renewable energy in China's broader economic strategy.(Conrad et al., 2011)

According to the China Global Energy Finance Database, from 2000 to 2021, the China Development Bank and the Export-Import Bank of China committed $49 billion in loans to African governments for 128 energy projects. These loans were distributed as follows: oil ($18 billion), hydroelectric energy ($13 billion), coal ($6 billion), gas ($3 billion), wind ($611 million), geothermal energy ($480 million), and solar energy ($367 million), while loans for unspecified sectors totaled around $7.5 billion.(Conrad et al., 2011)

China has implemented hundreds of clean energy and green development projects under the China-Africa Cooperation Forum, supporting African countries to better utilize the benefits of clean energy sources such as solar, hydroelectric, wind, and biogas.(Yan et al., 2024)

- In 2022, a Chinese company signed a contract for the geothermal power plant project in Tormoi, Ethiopia, which is Ethiopia’s first geothermal power generation plant. This plant will contribute to effectively improving the structure of the local energy supply.
- The largest photovoltaic power station in Garissa, northeastern Kenya, was commissioned by a Chinese company in 2019, with an average annual energy generation exceeding 76 million kWh, helping to alleviate Kenya's electricity shortage problem.
- The Dia Wind Farm in the Northern Cape, South Africa, was commissioned in 2017 and is China's first wind energy project in Africa to integrate investment, construction, and operation. The project reliably provides around 760 million kWh of clean electricity to the local region each year, with energy generation equivalent to saving 215,800 tons of standard coal and reducing carbon dioxide emissions by 619,900 tons.
- In 2016, the International Energy Agency (IEA) issued a report titled "China's Contributions – Enhancing Electricity Development in Sub-Saharan Africa," which praised China's efforts to enhance electricity development in the region. In 2019, the IEA again projected that China is expected to complete 49 energy generation projects in Sub-Saharan Africa by 2024, most of which will be renewable energy projects, accounting for 20% of the total installed capacity in the region during the same period.

These massive projects highlight the growing gap between China's vision for South-South climate cooperation, which prioritizes clean energy projects, and its actual investments across the African continent, which still include coal projects that pose significant environmental risks. However, renewable energy projects between the two sides have gained considerable momentum in recent years. A 2018 report from the Institute for Energy Economics and Financial Analysis pointed out the construction of an additional 200 MW solar farm by Power China in Ghana, as well as the De Aar wind farm with a capacity of 244.5 MW built by a Chinese company near Cape Town, South Africa. Alongside the "Benban" solar farm in Egypt, Chinese solar and wind energy companies also act as manufacturers and suppliers of equipment. In 2014, Jinko Solar built a photovoltaic solar power plant in South Africa, and GCL announced that it would follow suit in Egypt, thus increasing opportunities for Chinese companies to access the African market. Additionally, the South-South Climate Cooperation Fund was launched in 2015, with one of its goals being to support 100 projects for mitigating and adapting to the impacts of climate change.(Urban, 2018)

Redirecting both aid and loans towards renewable energy will have significant implications for energy development in Africa. For example, Kenya aims to become a hub for clean energy by exploiting its rich renewable energy resources, but it is also planning to build its first coal-powered station with the help of Chinese financing. As such, a shift in China's investment priorities could alter Kenya's stance on coal, as other international lenders are increasingly unwilling to support such projects.

Despite the promising views on the benefits of China-Africa cooperation, China's involvement in Africa's renewable energy sector raises several concerns regarding social and environmental sustainability standards, accountability, and good governance, which are the metrics by which its involvement is measured. Equally important in assessing China's involvement in Africa's renewable energy sector is the question of how well China's motivations align with the expectations of African countries and the broader goals of sustainable development and climate protection.

This emerging Chinese trend is not driven solely by resource considerations for securing energy security supplies and economic growth requirements; it is also linked to the important role that green technology development and manufacturing will play in China's long-term economic policy planning. In order to sustain its unprecedented economic growth, China has had to adjust its economic model, shifting from low-cost labor manufacturing to local innovation and the production of globally competitive goods. As such, expanding green technology capabilities has become a core element of China's efforts to achieve this transformation, especially since Africa has historically served as a true testing ground for the expansion and investments of Chinese companies.

Thus, China is steadily entering Africa's renewable energy sector through investments in wind energy, solar power, biogas, and small hydropower, guided by a range of national interests. These

interests will inject strong dynamics, but they will also pose challenges regarding the choices and strategies China employs to implement clean energy projects versus fossil fuel projects. In turn, African countries face a dual challenge: reaping the benefits of Chinese investments in the renewable energy sector, particularly securing their energy needs from clean sources, transferring technology, and benefiting from knowledge exchange, while simultaneously protecting themselves from the undesirable impacts of China's involvement, including debt-trap diplomacy.

China's dominance in renewable energy minerals raises concerns among African countries that wish to add value to their mineral wealth domestically, rather than exporting it as raw materials and then importing it as expensive products. There are also growing concerns about the impact of China's race to acquire renewable energy minerals in Africa on labor conditions and local populations, with the expansion of mines, forced evictions, and human rights violations. Additionally, the rising control of China over key renewable energy minerals leads to diverse challenges for African mineral suppliers. For African countries, this raises developmental concerns—many countries wish to achieve added value for their minerals internally, rather than merely exporting raw materials to China and importing them back as manufactured goods.

Conclusion:

China-Africa cooperation in the field of renewable energy offers what China considers a win-win situation. The Asian economic giant provides technology, technical knowledge, and capital to produce various clean energy solutions. In return, Africa offers a growing market for renewable energy investments, especially since investment opportunities on the continent are promising. Furthermore, Central and Southern African countries are endowed with abundant mineral resources, such as nickel and cobalt, which are essential for the production of electric batteries, wind turbines, and other low-carbon technologies.

China is in a position to shape the direction of energy development in Africa, particularly through the expansion of large-scale renewable energy infrastructure projects. It is clear that the responsibility lies with African countries and their leadership to design and implement effective and decisive political measures to promote renewable energy projects. At the same time, it is essential to strengthen measures that will lead to better projects and better terms for African countries when negotiating with China in order to avoid creating new dependencies. The success of the energy transition process greatly contributes to changing the stereotypical image of Africa as a constant hotspot for civil wars and authoritarian regimes. Although this path has resulted in export revenues for African economies, African countries have not yet fully benefited from renewable energy technologies. The study reveals several key findings regarding China's role in Africa's renewable energy sector.

It highlights China's growing influence as a catalyst for renewable energy development across the continent, where energy poverty remains a pressing issue for millions. Investments are heavily concentrated in a few countries—South Africa, Egypt, Kenya, and Morocco—which together receive nearly 75% of total renewable energy investment. China also capitalizes on its position as Africa's largest trading partner to strengthen its presence in the rare minerals sector critical to producing technologies such as electric vehicles and wind and solar power systems. Furthermore, Chinese investment and financing introduce a new model of cooperation that could foster deeper political and economic ties. However, the expansion of renewable energy in Africa faces challenges, including limited local investor awareness, poor planning, and reluctance from the private sector, resulting in a substantial financing gap. To overcome these obstacles, African nations must establish stronger partnerships to identify viable clean energy projects and mobilize private sector funding with governmental support, aiming to boost their installed capacity and assume leadership in the clean energy transition.

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