



GREEN HORIZONS IN 2024: EXPLORING AFRICA'S RENEWABLE ENERGY POTENTIAL FOR CHINESE INVESTORS

1 INTRODUCTION

African countries possess vast untapped renewable energy resources that, if utilised, can not only position African countries at the forefront of sustainable development but also support with the global push towards a low-carbon future. The continent is endowed with abundant sunlight, wind, hydro, and geothermal potential, providing a fertile ground for harnessing clean energy. These resources offer a unique opportunity for African nations to not only diversify their energy mix and reduce dependence on fossil fuels but to also address the substantial surge in their energy demand which is projected to increase by 30%-40% in the coming decades¹ as a result of the backdrop of electrification expansion, industrialization, and the demographic and economic growth in the continent. Despite the continent's vast renewable energy potential however, limited financial resources and underinvestment in the energy sector have kept much of this potential dormant.

Between 2020 and 2030, African countries' Nationally Determined Contributions (NDCs) demand an estimated \$2.8 trillion, surpassing 93% of Africa's collective GDP.² While governments have pledged roughly 10% of this sum, a funding gap of approximately \$2.5 trillion remains, notably in sectors like energy and transport.³ Given financial challenges such as rising debt and prohibitive borrowing costs, few African nations can bridge this gap sustainably on their own. Notably, in 2020, Africa's Climate Finance investment reached \$29.5 billion, but nearly 45% was concentrated in just five countries, not necessarily reflecting the most impactful energy projects.^{4,5}

Taking this into account, Chinese investors can play a pivotal role in supporting African nations to unlock the full potential of their renewable energy resources. China's experience in rapidly expanding its own renewable energy sector positions it as a valuable partner for African countries seeking to develop their green energy capabilities. Chinese investment can provide crucial funding, technology, and expertise to help African nations harness their renewable energy potential efficiently. Collaborative efforts between African countries and Chinese investors can foster sustainable development, propel economic growth, and create a win-win situation that addresses the pressing issues of climate change while uplifting the communities and economies of the African continent.

Having said that, the purpose of the country briefings is to provide Chinese investors seek to invest in Africa's renewable energy sector with a focused, data-driven analysis of the renewable energy potential of the top five (5) African nations that showcase significant untapped potential and a compelling demand for energy investments.

2 METHODOLOGY

In order to identify which from the 54 African countries are the top five (5) African countries with greater renewable energy potential as well as with heightened appeal for Chinese investors, we

¹ IEA (2022), Africa Energy Outlook 2022, IEA, Paris <https://www.iea.org/reports/africa-energy-outlook-2022>, License: CC BY 4.0

² Kone, T. (2023). For Africa to meet its climate goals, finance is essential. UNDP Climate Promise.

<https://climatepromise.undp.org/news-and-stories/africa-meet-its-climate-goals-finance-essential>

³ *ibid*

⁴ Global Center on Adaptation (GCA). (2023). State and Trends in Adaptation 2022: Adaptation Finance Flows in Africa.

https://gca.org/wp-content/uploads/2023/01/GCA_State-and-Trends-in-Adaptation-2022_Adaptation-Finance-Flows-in-Africa.pdf

⁵ Climate Policy Initiative (CPI). (2022). Landscape of Climate Finance in Africa. <https://www.climatepolicyinitiative.org/wp-content/uploads/2022/09/Landscape-of-Climate-Finance-in-Africa.pdf>

pinpointed seven (7) key criteria to gauge our analysis namely; Total Climate Finance (TCF), Electricity Access (EA), Chinese Foreign Direct Investments (CFDI), Renewable Energy Capacity (2022), Deployment of Policies (DOP), Percentage of Renewable Energy Source (RES) in Total Electricity Generated and Renewable Energy Potential (REP).

These criteria were sorted out into two primary categories:

1. Criteria Showcasing a Need

- Relevant Criteria: TCF and EA
- What It Indicates: Countries that have been underfunded and are energy deficient.
- Ranking Approach: Countries with lower TCF and limited EA were ranked higher, indicating greater needs.

2. Criteria Showcasing Potential, Opportunities, Capacity, Strong Chinese Relationships

- Relevant Criteria: RES, REC, REP, CFDI, and DOP.
- What It Indicates: Countries with favourable policies, existing infrastructure that can support further investments, potential for more renewables, and an existing relationship with China.

Ranking Approach: Countries scoring higher in these indicators are seen as having a conducive environment for renewable energy investment due to existing infrastructure in place that can support further investments, an enabling policy environment, and established relationships with China.

In our study, we employed both primary data, encompassing sources like annual reports, surveys, and policy documents, and secondary data, sourced from academic journals, industry reports, articles, and databases such as the World Bank, DTU-WAsP, IRENA, World Bank Global Solar Atlas, Global Wind Atlas, and the Climate Policy Initiative.

Upon conducting research and finding the values under each of the criterion, we then proceeded with normalising these values in order to eliminate the effects of different units of measurement and bring all values to a comparable level. The values were adjusted on a scale of 0 to 1.

Table 1 is a matrix table providing information on each of the criterion including their unit of measurement, a short description of each, the rational for selecting this criterion as well as our approach to ranking each.

Table 1: Matrix of Criteria Considered in Country Selection

Indicator / Criteria	Unit of Measurement	Short Description of Criterion	Rational for Selecting this Criterion	Ranking Order of this Criterion (Ascending / Descending) and Reason	Source
Total Climate Finance (TCF)	USD million	This data point is sourced from "The Landscape of Climate Finance in Africa," a comprehensive report by the Climate Policy Initiative. TCF offers a comprehensive overview of climate-related investment flows in the African continent. This dataset provides users with the ability to track climate finance commitments both at the country level and by sector, utilization, or institution type. All monetary values are expressed in USD million, and the data represents annual averages for the years 2019 and 2020	The amount of climate-related investment a country receives is a crucial indicator because it reflects the commitment of both domestic and international entities to address climate change. The indicator helps us identify countries that require increased investment in climate-resilient infrastructure and renewable energy. This approach helps identify investment opportunities in areas that have historically been underserved by global financing but hold significant potential for sustainable and climate-friendly development.	Ranked in ascending order - countries with lower finance were ranked higher. This ranking emphasizes regions with financing gaps in climate projects, highlighting investment opportunities in climate-resilient infrastructure, renewable energy, and energy efficiency that have historically been overlooked by global financing.	https://www.climatepolicyinitiative.org/wp-content/uploads/2022/09/Africa-Landscape-Data-1.xlsx
Electricity Access (EA)	Percentage	This indicator represents the percentage of the population with access to electricity as of 2021. The data is sourced from the World Bank Global Indicators. The World Bank compiles electrification data from various sources, including industry reports, national surveys, and international organizations such as the International Energy Agency (IEA), the International Renewable Energy Agency (IRENA), the United Nations Statistics Division (UNSD), the World Health Organization (WHO), and the World Bank itself. This data provides valuable insights into the extent of electricity access worldwide.	Access to electricity is a fundamental need for a country's socio-economic growth. This indicator helps in identifying areas where there is a more significant demand for energy infrastructure development where investment in expanding energy access is urgently needed.	Ranked in ascending order - countries with lower electricity access rates were ranked higher. This ranking emphasizes countries with a significant demand for energy infrastructure development. Higher-ranked countries are those with a greater need for improving electricity access, potentially indicating opportunities for energy investment.	https://www.irena.org/Data/Energy-Profiles
Chinese FDI (CFDI)	USD (Average from 2017-2021)	This data point is an average of CFDI figures from the years 2017 to 2021. This data point is sourced from "Chinese investment in Africa" from the SAIS-CARI (China-Africa Research Initiative at the School of Advanced International Studies), focusing on Chinese investment in Africa. SAIS-CARI compiles this data by combining outward direct investment (ODI) figures from various sources, including the China Statistical Yearbooks, Statistical Bulletins of China's Outward Foreign Direct Investment published by China's Ministry of Commerce (MOFCOM), and converting these figures from 10,000 US dollars to millions of US dollars for consistency.	This indicator is used as a proxy to help identify countries with existing economic ties and an established atmosphere for Chinese investment. Understanding the investment behavior of Chinese companies, which can be influenced by their relationship with the target country, is crucial. By considering Chinese FDI, we gain insights into whether a country is conducive for Chinese investment, taking into account the dynamics of these relationships.	Ranked in descending order - countries with lower Chinese FDI were ranked lower. This ranking reflects the attractiveness or strength of economic ties with China. Countries with higher Chinese FDI are considered more attractive to investors due to their strong economic and existing ties with China.	http://www.sais-cari.org/chinese-investment-in-africa
Renewable Energy Capacity (REC) for 2022	Mega Watt (MW)	This data point is sourced from "Renewable Energy Statistics 2023," a publication by the International Renewable Energy Agency (IRENA). IRENA compiles its data from a diverse range of sources, including responses to IRENA questionnaires, official national statistics, reports from industry associations, consultant reports, and news articles. The data on renewable power capacity included in this indicator represents	This indicator is used to identify countries with established infrastructure capable of supporting further renewable energy development. The presence of existing infrastructure not only signals a commitment to renewable energy but also attracts investment by potentially lowering the costs associated with integration into the existing energy systems. This indicator helps pinpoint countries that offer	Ranked in descending order - countries with lower capacity were ranked lower. This ranking is based on the belief that countries with higher renewable energy capacity in 2022 are more committed to renewable energy generation. They have established infrastructure to support further development and may make investments in variable renewable projects more attractive, since it may lower the costs of power integration.	https://www.irena.org/Publications/2023/Jul/Renewable-energy-statistics-2023

Indicator / Criteria	Unit of Measurement	Short Description of Criterion	Rational for Selecting this Criterion	Ranking Order of this Criterion (Ascending / Descending) and Reason	Source
		the maximum net generating capacity of power plants and other installations that utilize renewable energy sources to produce electricity. The data covers the period from 2013 to 2022 and is expressed in MW. IRENA provides generation data in gigawatt-hours (GWh)	favorable conditions for renewable energy investments due to their readiness and established foundation in the sector.		
Deployment of Policies	Counted out of 4 categories	This data point is sourced from the "Renewable Energy Market Analysis: Africa and Its regions" by IRENA. These policies are placed in four categories including various regulatory and pricing, fiscal measures, mandates, and financial support aimed at creating a conducive environment for renewable energy development and utilization. It covers policies such as energy efficiency measures, net metering and grid integration, Incentive Programs, and structured procurement mechanisms. Countries that have policies under all 4 categories received a count of 4 and countries that have one received a count of 1	Given that the investment behavior of Chinese companies is significantly affected by government policies, the indicator enables the identification of countries with a conducive and supportive regulatory environment. Such policies play a critical role in encouraging energy innovation and facilitating the transition to clean energy. By assessing the presence of policies across various categories, this indicator helps investors pinpoint countries with a clear and supportive framework for energy and climate-related investments, reducing risks and enhancing the attractiveness of these countries for renewable energy projects.	Ranked in descending order - countries with a lower number of policies were ranked lower. This ranking emphasizes the investment potential in countries actively creating and implementing energy and climate policies. It signals to investors the presence of a clear and supportive regulatory framework, which encourages energy innovation and sustainable practices. Countries with robust energy policies typically provide a more favorable investment environment. Deployment policies play a critical role in driving the adoption and expansion of renewable energy technologies. These policies are placed in four categories including various regulatory and pricing, fiscal measures, mandates, and financial support aimed at creating a conducive environment for renewable energy development and utilization. It covers policies such as energy efficiency measures, net metering and grid integration, Incentive Programs, and structured procurement mechanisms. Countries that have policies under all 4 categories are ranked higher than countries which have policies in only one category.	https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2022/Jan/IRENA_Market_Africa_2022_Summary.pdf (Page 31 of the document)
Percentage of Renewable Energy Source in Total Electricity Generated	Percentage	The data provided in this indicator represents the estimated percentage of electricity generated from renewable energy sources in each country for the year 2021. This data point is derived from the 2022 Energy Statistical Profile of each country, as compiled by the International Renewable Energy Agency (IRENA). IRENA gathers its data from a wide range of sources, including responses to IRENA questionnaires, official national statistics, reports from industry associations, consultant reports, and news articles.	This indicator is used to identify countries that demonstrate a strong commitment to clean energy and the extent to which a country's renewable energy potential has been integrated into its power generation. This indicator helps in identifying countries where renewable energy projects are likely to be supported and welcomed on a practical level.	Ranked in descending order - countries with a lower percentage of renewable energy in their electricity mix were ranked lower. This ranking reflects a country's commitment and ease in transitioning to clean energy sources. Lower-ranked countries may face more significant challenges in shifting to renewable energy.	https://www.irena.org/Data/Energy-Profiles
Renewable Energy Potential (REP)	Calculated composite score	REP is a calculated indicator that offers insights into a country's renewable energy potential. However, we do acknowledge that estimating the renewable energy potential can be challenging and often complex due to the number of indicators that can be considered. For the purpose of this analysis we have selected two indicators to estimate potential namely; 1. Average Wind Density at 100m: This data is obtained from the	This indicator is essential for identifying countries with high renewable energy potential, allowing investors to focus on regions that offer significant opportunities for renewable energy development.	Ranked in descending order - countries with lower REP were ranked lower. Countries with a lower REP are considered less favorable in terms of renewable energy prospects. This ranking is based on a composite score that considers various factors, such as wind and solar potential, indicating a country's potential for renewable energy development.	https://globalsolaratlas.info/map https://globalwindatlas.info/en

Indicator / Criteria	Unit of Measurement	Short Description of Criterion	Rational for Selecting this Criterion	Ranking Order of this Criterion (Ascending / Descending) and Reason	Source
		<p>Global Wind Atlas, which provides information on wind resources at a height of 100 meters above the ground. The wind density data helps assess the wind energy potential in a given region or country.</p> <p>2. Average Practical Potential of Solar: This information is sourced from the Global Solar Atlas, which offers a realistic assessment of the solar energy generation potential in a specific area. It goes beyond theoretical estimates by factoring in real-world conditions and technical constraints. The solar energy potential is typically expressed as the Photovoltaic (PV) power output (PVOU), which represents the specific yield measured in kilowatt-hours per installed kilowatt-peak of the system capacity (kWh/kWp).</p>			

3 LIMITATIONS

Considering that the topic of renewable energy potential has been examined by a number of entities such as governments, multinational organisations, private sector companies and more it is important to note that there may be discrepancies and variations in the available data used by each source due to the multitude of perspectives and approaches applied. Despite efforts to compile and synthesize relevant information, the inherent variability in existing data sources represents a challenge in achieving a uniform and standardized dataset for comprehensive analysis.

Moreover, the analysis of the country briefings captures all relevant information as of 2023. However, given the dynamic nature of the energy sector and evolving environmental, economic, and policy landscapes, it is essential to acknowledge that future changes beyond this timeframe may influence outcomes differently. Any alterations in regulations, technological advancements, or even climate change phenomena occurring post-2023 could potentially impact the renewable energy landscape of the analyzed country. Therefore, the study emphasizes the importance of considering its conclusions within the context of the provided timeframe, recognizing that subsequent developments could lead to different outcomes or trends not accounted for in the country briefings.

4 FINDINGS: TOP FIVE (5) PRIORITY COUNTRIES

Applying this systematic methodological approach, we pinpointed the five (5) countries that emerged as priority investment destinations for Chinese investors. These countries include:

1. Zambia;
2. Mozambique;
3. Democratic Republic of Congo;
4. Angola; and
5. Uganda.

In summary, our comprehensive analysis has successfully identified and spotlighted the top five countries that stand out as the most alluring destinations for renewable energy investments by Chinese companies. Given their untapped renewable energy potential, these nations present an opportunity for Chinese enterprises eager to contribute to and benefit from Africa's ongoing transition towards renewable energy. To equip investors with the essential insights needed to navigate these promising landscapes, detailed and tailored investor briefings for each of the highlighted countries have been drafted. These investor briefings function as comprehensive guides, providing crucial information to potential Chinese investors which amongst others include each country's resource potentials, regulatory landscapes, an overview of Chinese companies currently operating in the country, potential obstacles, and strategic recommendations for further investment. As Chinese companies gear up to capitalize on the renewable energy boom, these investor briefings will undoubtedly serve as invaluable tools, ensuring a well-informed and successful venture into the green energy markets of these top-tier destinations.



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