ZAMBIA

DEVELOPMENT REIMAGINED

February 2024

1 Zambia's Renewable Energy Potential and Country Overview

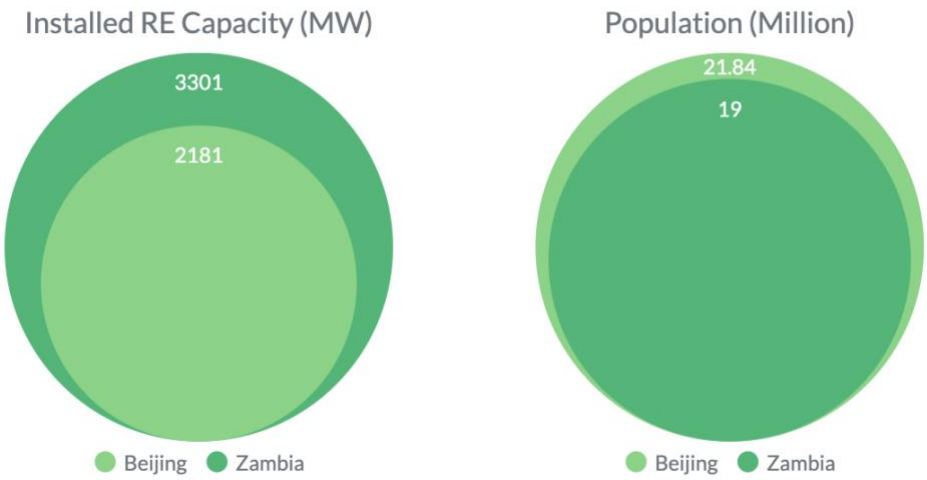
Figure 1: Zambia's location within Africa

Zambia, a landlocked, resource-rich nation, strategically located at the intersection of Central, Southern, and Eastern Africa stands as a promising frontier for renewable energy investment as it has significant yet unexploited renewable energy resources. This opportunity is further underscored by the country's constantly growing energy demand, its continuous efforts for regional integration as well as its efforts to create a stable regulatory environment to support such investments. According to the 2022 census, Zambia's population surpassed 19 million, close to the population of Beijing (21.84 million)[1], with projections indicating a rise to 24 million by 2030[2] while it is said to have one of the world's youngest population by median age.[3] Despite Beijing's significant renewable capacity of 2181 MW, Zambia surpasses this with 3301 MW, indicating Zambia's substantial investment in renewable energy infrastructure relative to its population size. Regarding its economy, Zambia is the nineteenth-largest economy in Africa and the sixth-largest in Southern Africa with a GDP of USD 29.27 billion translating to a per capita GDP of USD 1,420.[4] The economy is heavily reliant on commodity export which accounts for a significant portion of governmental revenue and export revenue. To counteract its economic vulnerabilities, Zambia developed its Vision 2030 and Seventh National Development Plan with the aim to transform the country into a climate-resilient, middle-income nation by 2030, targeting a 10% annual economic growth rate. Zambia recognizes clean energy as a vital driver for both socio-economic development and the fight against climate change. For that reason, it has developed its Nationally Determined Contributions (NDCs), which amongst others prioritize an increased renewable energy mix with the aim to fulfill its pledge of an unconditional 25% reduction in emissions by 2030.

Table 1: Summary of Zambia's Overall Renewable Energy Potential

	Renewable Energy Resource		Zambia	China
	Solar Photovoltaic (PV) Power Output potential (kWh/kWp/day)		4.54-5.5	2.21-5.82
	Wind resource potential (Wind speed range, metre per second)		4.86-7.17	5.96-10.21
	Biomass Potential (GW)		N/A	30
	Hydro Potential (MW)		6,000	542,000
	Geothermal Potential (MW)		N/A	1500
	Electric Price (USD/kWh)	Households	0.022	0.076
		Businesses	0.034	0.089

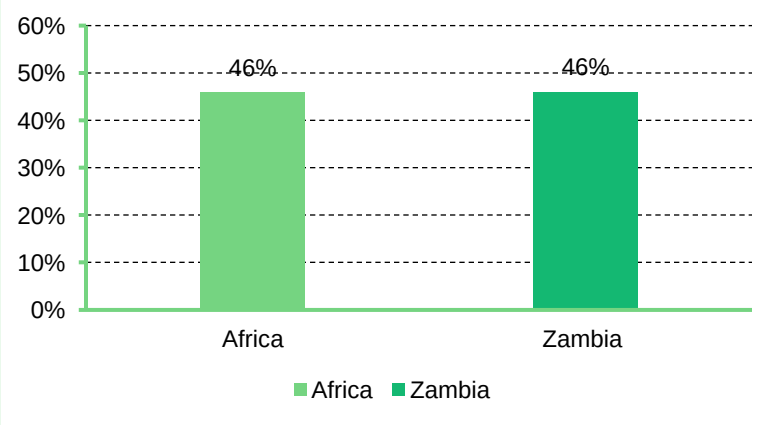
[1] The Time Weekly. 2023. https://www.thepaper.cn/newsDetail_forward_22640606
[2] Zambia Statistics Agency. Zambia Statistics Agency, 2023. https://www.zamstats.gov.zm/
[3] World Bank. The World Bank in Zambia 2023. 2023. https://www.worldbank.org/en/country/zambia/overview
[4] IMF. Zambia Country Data. 2023. https://www.imf.org/en/Countries/ZMB#countrydata



2 RENEWABLE ENERGY SECTOR

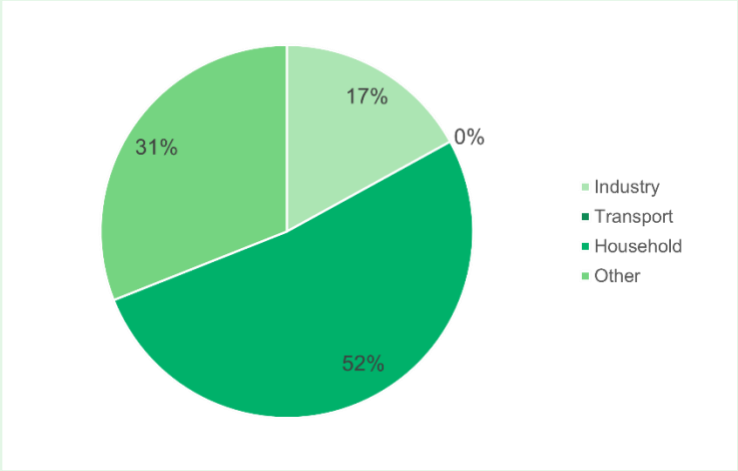
Despite the fact that Zambia's renewable energy potential (as the average of its wind power density at 100m and its solar PV potential) is relatively high and aligned with the average renewable energy potential of all African countries, (standing at 46%) (see Figure 2) the country has been slow in developing its abundant renewable energy resources which among others include solar, wind, biomass, hydroelectric and geothermal. Moreover, its renewable energy capacity, excluding large hydroelectric, based on licensed grid connected and off-grid plants stands at a relatively 134.74 MW, primarily composed of PV solar systems, mini hydropower, and bioenergy technologies.[5] Figure 3 below shows Zambia's renewable energy consumption by sector in 2020.

Figure 2: Comparing Zambia's and Africa's average REP



[5] ibid

Figure 3: Zambia's Renewable energy consumption by sector[6]



The low renewable energy capacity in conjunction with Zambia's abundant renewable energy sources and its interest in diversifying its energy portfolio represent great investment opportunities for Chinese investors. A breakdown of Zambia's renewable energy sources as well as potential investment opportunities within each sector is provided below.

2.1 Solar Energy

Zambia receives an average of about 3,000h of annual sunshine, with an average energy output potential of 4.5–5.5 kWh/kWp/day. When compared to the average solar PV potential of the African continent (4.51 kWh/kWp/day), Zambia marks a higher potential (4.83 kWh/kWp/day) (see Figure 3), making it an ideal location for solar energy generation.[7] Despite its great potential however, the share of solar energy in Zambia's electricity mix has remained low (from 0% in 2015 to 2.4% in 2022 - adding 89.54MW to its installed capacity) mainly due to the high upfront capital cost of investment required. Historically the sector relied on donor funded initiatives, government entities, and Non-Governmental Organizations (NGOs) which created a challenge for Zambia to exploit its solar potential.

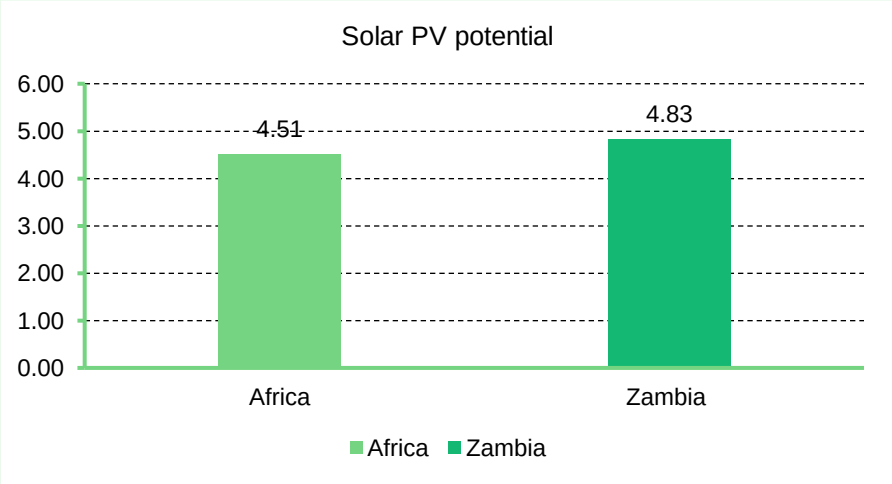
However, with the solar energy market expected to grow as a result of the growing electricity demand and the reduction in technology prices there is certainly an opportunity arising for investors. For example, when considering the needs of Zambia's vast population living in rural and remote areas, it becomes evident that there is potential for investors to develop and operate solar mini-grids and off-grid solutions to provide electricity to underserved communities while other investment opportunities could be in the areas of solar panels and related accessories as well as solar systems. To further promote its solar potential, the Zambian government is also actively supporting private participation which is evident in the increasing number of licenses provided to grid-connected and off-grid solar companies as well as the several financing

[6] IRENA. Energy Profile. Zambia. https://www.irena.org/-/media/Files/IRENA/Agency/Statistics/Statistical_Profiles/Africa/Zambia_Africa_RE_SP.pdf?rev=074b6d296eca452bb17ab2f595cbc13a

[7] The World Bank. Global Solar Atlas. https://globalsolaratlas.info

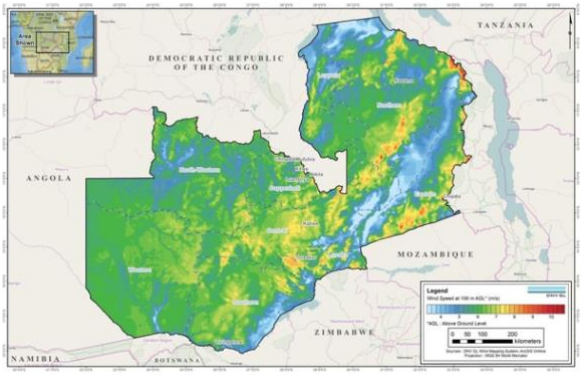
opportunities provided to private firms. Looking forward, Zambia aims to add 600 MW of on-grid solar in the next 2-3 years, complementing its existing 14 plants.

Figure 4: Comparing Zambia's and Africa's average Solar PV Potential



2.2 Wind Energy

Figure 5: Zambia's Wind Speed Map at 100 m AGL



Zambia's wind energy potential, while not as well-known as its solar potential, is still noteworthy. The country has regions with reasonable wind resources, particularly in areas such as the Western and Southern provinces (see Figure 5) while large parts of the country are flat or slightly undulated which makes it ideal for setting up wind power projects.[8] Zambia's wind energy potential is also underscored by a recent Energy Sector Management Assistance Programme (ESMAP) study that reported average wind speeds of 6.42 m/s with the highest wind speeds occurring in the southern and western regions of the country and wind density of 233 w/m^2 at 100 meters.[9] Further supporting this potential, Zambia's wind atlas and established wind measurement maps indicate favorable conditions for utility-scale wind power, with speeds ranging from 5.6 m/s to 6.4 m/s at 80 meters.[10] Despite this potential however, wind-generated energy in Zambia is still in its infancy due to several challenges including the high upfront capital cost required to develop wind power projects. While active investors are conducting feasibility studies for utility-scale wind power projects in targeted sites within the Eastern and Central Provinces, the prospects of wind energy in Zambia are largely untapped, which indicates an opportunity for Chinese investors. Investment opportunities in the wind subsector include wind

[8] Ministry of Energy Republic of Zambia. Renewable Energy Strategy and Action Plan. 2022. https://www.moe.gov.zm/wp-content/uploads/2022/08/Renewable-Energy_final-file_for-web.pdf
[9] The World Bank. Global Solar Atlas. Zambia. (2023). https://globalsolaratlas.info/
[10] Ibid.

energy feasibility studies, equipment for further wind measurement, wind mills for small-scale power use, and advanced technology for harnessing electricity generation.

2.3 Biomass Energy

With abundant arable land and forestry, Zambia's bioenergy potential is high. The Ministry of Energy estimates that bioenergy could contribute an additional 1192 MW to the electricity grid, primarily from agricultural, forest, and solid waste. Currently, Jatropha is the most produced biofuel while a few other large-scale biomass plants exist, primarily within the sugar industry. Furthermore, the domestic landscape features more than 4800 biogas digesters in use. Noteworthy investment prospects within the biomass energy sector encompass the cultivation of biofuel and biomass crops for consumption.

2.4 Hydropower

According to the estimate of some preceding studies, Zambia has a potential of hydropower generation of more than 6,000 MW and only 1,700MW out of that has been developed so far.[11] However, not many Mc-HP projects to serve rural electrification have been discussed. The country is endowed with abundant water resources, primarily from the Zambezi River and its tributaries, making it well-suited for hydropower generation. The potential of hydroelectric energy in Zambia is highlighted by the presence of major dams and power plants such as the Kariba Dam and the Kafue Gorge Dam. These facilities have contributed substantially to the country's electricity supply. Additionally, the government has been actively pursuing the development of new hydropower projects to harness its hydroelectric potential, both for domestic consumption and export to neighboring countries, underscoring Zambia's commitment to leveraging this sustainable and renewable energy source for economic and energy security benefits.

2.5 Small Hydropower

The Ministry of Energy estimates that small hydro-power potential is high at 1106.95 MW, sourced from small rivers and water bodies. There is a high potential especially in the Northern and North-Western parts of the country, due mainly to its favorable topography and rainfall patterns ideal for small hydropower generation. Currently, 128 small hydro projects (1,090.64 MW), 16 micro-hydro sites (560 kW), and 28 mini-hydro sites (15.75 MW) are in operation or under development.[12]

2.6 Geothermal Energy

Zambia's geothermal potential remains largely untapped due to resource constraints. However, over 80 thermal mineralized springs have been identified, with surface temperatures reaching 110°C, offering a potential generation capacity of at least 10 MW. Investment opportunities in geothermal subsector include further feasibility and exploration studies, grid-connected plants, and local production of components and equipment.

[11] Rural Electrification Master Plan for Zambia Final Report. https://openjicareport.jica.go.jp/pdf/11871027_03.pdf
[12] Ministry of Energy Republic of Zambia. Renewable Energy Strategy and Action Plan. 2022.

2.7 Energy Sector

A significant portion of Zambia's total energy supply in 2020, approximately 80%, was derived from renewable energy sources while petroleum and thermal sources accounted for 14% and 6% respectively (see Figure 6). The 80% renewable energy resources consisted mainly of bioenergy (85%) and hydro/marine (15%) (see Figure 7).

Figure 6: Zambia's Energy Supply (2020)

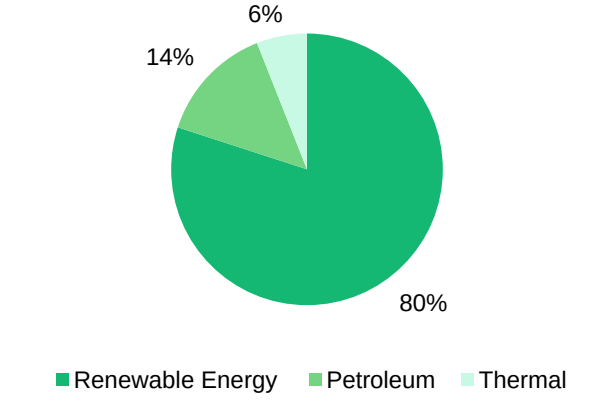
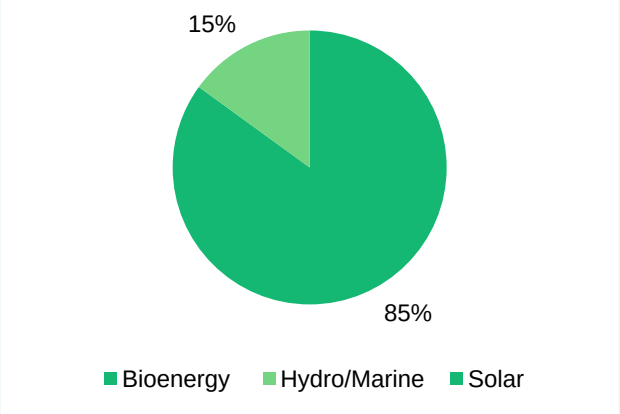


Figure 7: Zambia's Renewable Energy Supply (2020)



However, despite the existence of abundant energy resources, Zambia continues to face challenges in clean fuel and technology access which declined from 16.3% in 2009 to 10.9% in 2020—well below the African average of 19.85%.[13] This access disparity is particularly pronounced between the urban and rural areas, with 21.3% of the urban population having access to clean fuel and technology compared to 2.3% of the population living in rural areas.[14] Among those with access, per capita energy consumption surged from 2735 kWh to 3099 kWh in 2020, mainly driven by the rise in energy-intensive appliances while with regards to energy intensity, Zambia has witnessed a notable improvement, reducing from 8.47 MJ to 7.6 MJ, which indicates an emerging trend of enhanced energy efficiency.[15]

2.8 Electricity Sector

Zambia's electricity sector highlights the broader challenges in its energy landscape. While electricity accounts for only 10% of the nation's energy consumption, its crucial role in industrialization and elevating living standards is clear.[16] From 2009 to 2021, electricity access surged from 26.5% to 46.7% of the population although still standing below the continent's average (56.7%).[17]

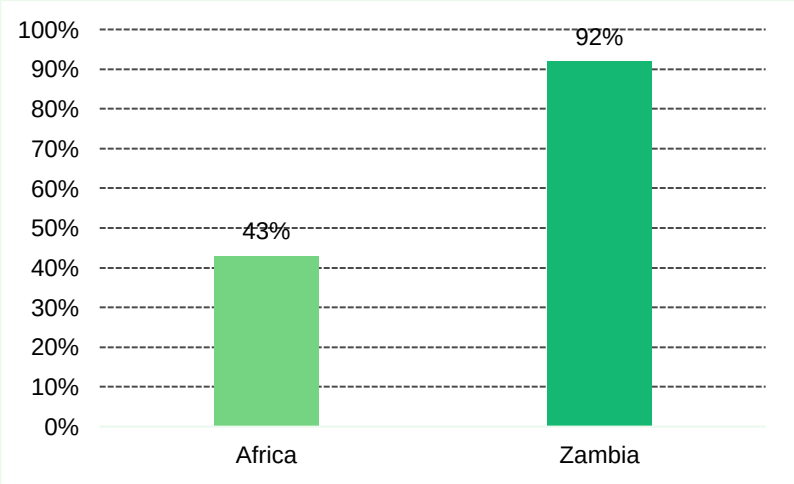
Installed electricity capacity has been growing although the electricity sources have remained consistent. In 2022, Zambia's installed electricity capacity stood at 3,777 MW with the vast

[13] World Bank. World Development Indicators. 2023. https://databank.worldbank.org/source/world-development-indicators#
[14] ibid
[15] IEA. SDG7: Data and Projections. IEA, Paris. 2023. https://www.iea.org/reports/sdg7-data-and-projections (License: CC BY 4
[16] Ministry of Energy, Republic of Zambia. Scaling-Up Renewable Energy in Low-Income (SREP) Countries: Investment Plan for Zambia. 2019. https://africa-energy-portal.org/sites/default/files/2019-12/Zambia-SREP-IP.pdf
[17] World Bank. World Development Indicators.

majority (3,167 MW), derived from large hydro sources[18] and the rest being split among thermal (8.7%), Heavy Fuel Oil (2.9%), solar (2.4%), and diesel (2.2%).[19] However, it is vital to underline that although hydropower is a cheaper, clean and demand-responsive energy source, the uncertain impacts that climate change could have on rainfall patterns and water supply could affect consistent energy supply.[20]

Additionally, in 2021, Zambia's total electricity generation stood at 17,725 GWh of which 92% derived from renewable sources, mainly hydro and marine (91%) and solar (1%)[21]. This is significantly higher than the average of Africa's electricity generation from renewable sources which stands at 43% (see Figure 8). In addition, total electricity consumption also grew by 7.4% reaching a level of 13,777.9 GWh which was mainly driven by the demand from the transport and mining sectors.[22] However, inefficiencies led to transmission losses, with peak demand (2,374.5 MW) nearly matching the recommended generation (2,375.5 MW).[23]

Figure 8: Comparing Zambia's and Africa's Average Percentage of Renewable Energy Resources in Electricity Generation



In light of Zambia's population rise, expanded electricity accessibility, positive economic growth, and increased industrialization, the country projects a 4% yearly growth in electricity demand, reaching 8,000 MW by 2030 and 10,000 MW by 2040.[24] In response to this, Zambia has scaled up its efforts in diversifying its energy portfolio, focusing on cost-effective, alternative clean sources to enhance its energy resilience, which indicates a great opportunity for Chinese investors.

[18] Energy Regulatory Board. Energy Sector Report 2022. https://www.erb.org.zm/wp-content/uploads/files/esr2022.pdf
[19] ibid
[20] Bayliss, K., & Pollen, G. The Power Paradigm in Practice: A Critical Review of Developments in the Zambian Electricity Sector. World Development, 2021. https://www.sciencedirect.com/science/article/pii/S0305750X20304861#s0015
[21] IRENA. Energy Profile-Zambia. https://www.irena.org/-/media/Files/IRENA/Agency/Statistics/Statistical_Profiles/Africa/Zambia_Africa_RE_SP.pdf
[22] Bayliss, K., & Pollen, G. The Power Paradigm in Practice: A Critical Review of Developments in the Zambian Electricity Sector. World Development, 2021.
[23] ibid
[24] Government of Zambia. Government Green Paper on the Findings and Recommendations of the 2021 Electricity Cost of Service Study. 2022. https://www.erb.org.zm/wp-content/uploads/files/CoSS/Green-Paper-on-CoSS.pdf

3 INSTITUTIONAL AND REGULATORY FRAMEWORK

The government of Zambia has been actively working to develop and enhance its regulatory framework in order to attract investments in renewable energy as it has recognized the key role it can play in addressing the country's energy needs and environmental concerns. Regarding its regulatory framework for example, Zambia has established institutions and agencies such as the Energy Regulation Board (ERB) which aims to oversee the energy sector and set up guidelines for renewable energy projects and the Rural Electrification Authority (REA) which is responsible for promoting and supporting renewable energy projects, particularly in rural areas.

In addition to government-led authorities, private actors (foreign companies included) are also heavily involved in Zambia's renewable energy sector mainly as Independent Power Producers (IPPs) which invest in, develop, and operate power generation projects by using renewable energy sources. These IPPs play a crucial role in diversifying the country's energy mix and increasing the capacity of renewable energy generation. Notably, between 2021 and 2022, the contribution of IPPs to Zambia's electricity supply surged by 72.67%, with solar energy being the primary source used.[25]

Moreover, one of the key policies established by the Zambian government is the Renewable Energy Feed-in Tariff (REFIT) program. This program provides a fixed tariff rate for electricity generated from renewable energy sources and is intended to encourage investment in renewable energy projects by providing a guaranteed price for electricity generated from these sources. Finally, Zambia's participation in regional initiatives such as the Southern African Power Pool (SAPP) that promotes collaboration and trade in renewable energy within the Southern African region is yet another indication of the country's commitment to promote its renewable energy sector.

To support potential investors in better understanding the governance of Zambia's renewable energy sector, Table 1 below provides an overview of the key relevant actors (including government authorities and private sector companies) as well as a list of relevant regulatory frameworks and legislations.

Table 2: Zambia's Renewable Energy Sector: Key Actors and Regulatory Framework

Key Actors	Responsibilities
Ministry of Energy	The Ministry of Energy is responsible for the formulation and implementation of energy policies and regulations, including those related to renewable energy. Within the Ministry of Energy there has been a new unit established, the Office for Promoting Private Power Investment (OPPPI) whose role is to promote private sector involvement in the development of power projects in Zambia.
Energy Regulation Board (ERB)	The ERB regulates and oversees the energy sector in Zambia. It plays a crucial role in setting and enforcing rules and standards for renewable energy projects.

[25] Energy Regulatory Board. Energy Sector Report 2022. 2022. https://www.erb.org.zm/wp-content/uploads/files/esr2022.pdf

Rural Electrification Authority (REA)	REA is tasked with extending electricity access to rural areas, and it often supports renewable energy projects aimed at providing electricity in underserved regions.
Zambia Environmental Management Agency (ZEMA)	ZEMA is responsible for environmental impact assessments and ensuring that renewable energy projects adhere to environmental and sustainability standards.
Ministry of Finance	This ministry may be involved in providing financial incentives, tax breaks, or subsidies to promote renewable energy development
Office for Promoting Private Power Investment (OPPPI)	The OPPPI is a unit in the Ministry of Energy whose role is to promote private sector involvement in the development of power projects in Zambia. In its undertakings, the OPPPI identifies projects, conducts feasibility studies, develops an appropriate solicitation strategy and documents for developers, procures developers and facilitates negotiations for Implementation Agreements on behalf of the government.
Electricity generating companies include: **1) ZESCO (Zambia Electricity Supply Corporation)** **2) Copperbelt Energy Corporation (CEC),** **3) Lunsemfwa Hydro Power Company (LHPC)** **4) Maamba Collieries Limited and North-Western Energy Corporation (NWEC)**	ZESCO is a state-owned vertically integrated utility company which oversees approximately 90% of the country's electricity generation, transmission, and distribution while simultaneously purchasing power from renewable energy projects, including IPPs.
Relevant Regulatory Frameworks and Legislation	• National Energy Policy (NEP 2008), Rural Electrification Act (2003), Energy Regulation Act (2003). • Energy Regulation Act (2003). • Various legal and regulatory frameworks. i.e. Zambia Electricity Grid Code (ZEGC) - SI No. 79 of 2013. • SAPP institutional arrangement. • Electricity Amendment Act (2003) • Renewable Energy Feed in Tariff (REFIT) Strategy (2017) • National Energy Policy (NEP 2008), The REA Act No. 20 of 2003

4 INVESTMENT INCENTIVES

Financially, Zambia offers a range of incentives aimed at promoting rural electrification and energy project development. These include grants from the Rural Electrification Fund, capital support of up to 100% for mini-hydro and mini-grid projects, and government-backed loan guarantees for ZESCO. Additionally, risk-sharing agreements and insurance indemnifications are also available to investors.

On the fiscal front, Zambia provides a five-year tax holiday on corporate tax (standard rate of 35%) for investments exceeding USD 10 million or for those in priority sectors. Following this period, reduced tax rates apply. Dividends for such investors are tax-free for five years. Import duty exemptions on most renewable energy components and deferred Value Added Tax (VAT) (standard rate of 15%) are also available for qualifying investments. Finally, there are also some additional support mechanisms provided which include expedited land and utility service

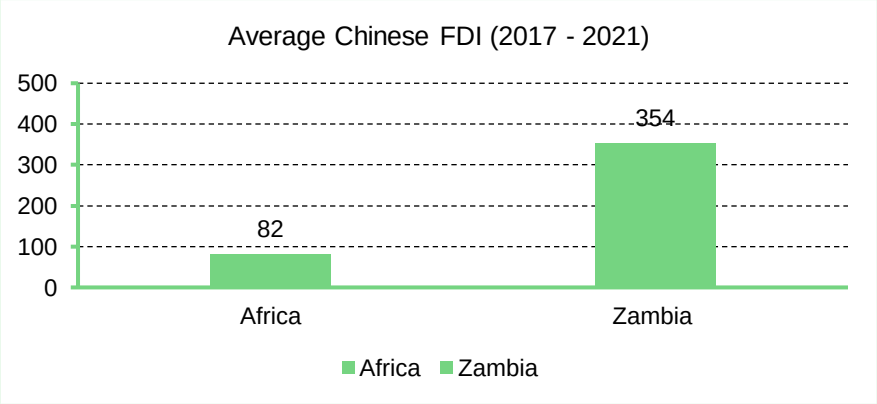
processing, licensing, employment permits for expatriate workers, technical assistance, and the opportunity to negotiate prices or tariffs.

5 FOREIGN RENEWABLE ENERGY INVESTMENTS AND COLLABORATIONS

5.1 Chinese Investments in Zambia's Energy Sector

Zambia maintains robust political and economic ties with China, ranking as the third-largest destination for Chinese FDI and fifth-largest destination for Chinese loan disbursement.[26][27] In comparison to the average Chinese FDI received by all other African nations, Zambia's intake is significantly higher as seen in Figure 9. Within the energy sector, Zambia has secured both concessional and commercial financing from China. Institutions such as the Commercial Bank of China (ICBC) and the Export-Import Bank of China (CHEXIM), have provided concessional loans of USD2.3 billion of debt, targeting mainly hydropower projects.[28]

Figure 9: Comparing Chinese FDI received by Zambia and all other African countries on average from 2017 – 2021 (million)



Moreover, in June 2020, ZESCO and the Power Construction Corporation of China (PowerChina) signed a contract worth $548 million to develop 600 MW of solar projects. Chinese enterprises have further diversified their engagement through various contractual modalities, including Engineering, Procurement, and Construction (EPC) contracts and Power Purchase Agreements (PPAs). Key examples include (i) a USD 6 billion PPA between the Integrated Clean Energy Power Company Ltd (CiEG), a subsidiary of China Huadian Corporation,) for 2,400 MW of renewable energy[29] and (ii) Sinohydro Corporation Limited's USD 22 million contract for the 34 MW Riverside Solar Plant[30]. Amid debt pressures, Zambia and China are deepening their

[26] BU Global Development Policy Center. A New State of Lending: Chinese Loans to Africa. 2023. https://www.bu.edu/gdp/2023/09/18/a-new-state-of-lending-chinese-loans-to-africa/
[27] China-Africa Research Initiative, School of Advanced International Studies. (2023). Dataset: Chinese Investment in Africa. Johns Hopkins University. Washington DC. Retrieved from http://www.sais-cari.org/s/FDIData_April2023.xlsx
[28] BU Global Development Policy Center. A New State of Lending: Chinese Loans to Africa. 2023.
[29] Hakeenah, N., China's CIEG Signs 2.4 Giga-Watts Power Purchase Agreement with Zambia's ZESCO Amidst Debt Crisis. China Global South. 2023. https://chinaglobalsouth.com/2023/04/05/chinas-cieg-signs-2-4-giga-watts-power-purchase-agreement-with-zambias-zesco-amidst-debt-crisi
[30] Xinhua. Zambia Commissions Chinese-Built Solar Plant. 2023. https://global.chinadaily.com.cn/a/202302/17/WS63eed5e2a31057c47ebaf518.html

pragmatic collaboration in renewable energy. Emerging initiatives indicate a shift towards participating in IPP frameworks and government backed PPAs, technology transfers, and increased solar investment portfolios.[31][32]

Table 3: Chinese Loan Disbursement in the Zambian Energy Sector[33]

Year	Project Name	Loan (USD Million)	Chinese Lender
2016	Mpika Power Supply	29.60	ICBC
2017	Kafue Gorge Lower Hydropower Plant (750MW)	1530.58	MixedCN: CHEXIM and ICBC
2017	Kabwe - Pensulo Second Transmission Line (330kV) (300km)	113.90	CHEXIM
2017	Luapula, Musonda Falls Hydropower Plant Rehabilitation and Upgrading, 10MW	35.25	ICBC
2017	Connection of Lundazi and Chama to the National Grid	36.84	ICBC

In addition to the financing ties between the two countries, Zambia has further established itself as a host country for numerous Chinese companies (see Table 3 for a sample of countries). Over the years, Chinese companies have made substantial investments in various sectors, including mining, construction, telecommunications, and renewable energy, contributing to Zambia's economic development and infrastructure expansion. These investments have created jobs, facilitated technology transfer, and bolstered the nation's capacity in critical industries. As a result, Zambia has become an attractive destination for Chinese investors, further solidifying its reputation as a host country for Chinese businesses seeking opportunities in Southern Africa.

Table 4: Sample List of Chinese Companies in Zambia (2023)

Companies	SOE or Private	Areas	Projects
China Nonferrous Metal Mining Group (CNMC)	SOE	Mining, special economic zones, construction	
China Jiangxi International Economic and Technical Cooperation Co.	SOE	Construction, special economic zones	Jiangxi Multi-Facility Economic Zone (Zambia) (赞比亚江西经济合作区) is in operation involving power equipments, agricultural processing, renewable energy batteries
The Integrated Clean Energy Power Company Ltd (CiEG) of China	SOE	Electricity generation, energy	The Integrated Clean Energy Power Company Ltd (CiEG) of China signed a Power-Purchase Agreement (PPA) on Monday with the Zambia Electricity Supply Corporation (Zesco) for the generation of 2,400 Megawatts (MW) of renewable energy.

[31] Xu Shengpeng. Zambia Hopes that China Will Invest in Rural Photovoltaics in Zambia. Seetao. 2022. https://www.seetao.com/details/134423.html
[32] UNDP (United Nations Development Programme). China-Zambia South-South Cooperation for Renewable Energy Technology Transfer. 2023. https://www.undp.org/china/projects/china-zambia-south-south-cooperation-renewable-energy-technology-transfer
[33] BU Global Development Policy Center. (2023). A New State of Lending: Chinese Loans to Africa.

Sinohydro Corporation Limited	SOE	Hydropower, renewable energy, hydroelectricity	The Riverside Solar Plant in Kitwe town - a project of Copperbelt Energy Corporation
Zhongyang Construction Group	SOE	Construction, agriculture	Zhongyang Eco-Agriculture Park - Agricultural production and the agricultural industry chain

The presence of Chinese companies in the country not only signifies their successful engagement in Zambia but also imparts a sense of confidence to new investors who are considering investing in Zambia's renewable energy market. The established track record of Chinese firms demonstrates the feasibility and potential for success in various sectors, acting as a testament to the country's business-friendly environment. These existing partnerships can serve as valuable references and sources of guidance for newcomers, offering insights into local market dynamics, regulatory procedures, and potential challenges.

6 OTHER FOREIGN INVESTMENTS

Although investments in the Zambian sustainability sector have grown in recent years, capital inflows are yet to reach favorable levels. Many multilateral and bilateral partners, such as the African Development Bank (AfDB), the World Bank (WB), United National Development Program (UNDP) are involved in the energy sector. As of 2022, total climate finance was about USD 241 million, 92% provided by public institutions such as multilateral and bilateral Development Finance Institutions (DFIs) and 33% has been directed at energy sector projects.[34]

Zambia's energy sector has benefited from strategic partnerships and competitive auctions, notably the WB's Scaling Solar Program, which raised nearly $91 million.[35] Zambia has also tapped into grants and concessional loans to diversify its energy portfolio, such as a €6.5 million project from SIDA and a $26.5 million WB loan for rural electrification.[36][37] The country's Renewable Energy Feed-in Tariff Strategy also effectively attracted bidders aiming to generate around 120MW of solar energy, boosting private sector involvement in renewables.[38]

7 BARRIERS TO RENEWABLE ENERGY DEPLOYMENT IN ZAMBIA

The development of renewable energy in Zambia faces several challenges that span from financial constraints to regulatory hurdles. Below are some of the key barriers:

Perceived High Risk: ZESCO's current financial instability and a nascent financial sector contribute to a perception of elevated risk for equity financing in Zambia. This situation often

[34] Meattle, C., et al., Landscape of Climate Finance in Africa, Climate Policy Initiative, 2022. https://www.climatepolicyinitiative.org/publication/landscape-of-climate-finance-in-africa/
[35] Scaling Solar. Zambia News. 2023. https://www.scalingsolar.org/category/news/zambia-news/page/2/
[36] SNV. Building Biodigester Market in Zambia: Lessons Learnt. 2021. https://www.snv.org/update/building-biodigester-market-zambia-lessons-learnt
[37] World Bank. Zambia - Electricity Services Access Project. 2017. https://www.worldbank.org/en/news/loans-credits/2017/06/27/zambia---electricity-services-access-project
[38] Southern African Centre for Renewable Energy and Energy Efficiency (SACREEE). 1st SADC Industrial Energy Efficiency Conference. 2019. https://www.sacreee.org/sites/default/files/event_profile/attachs/Musalia_L..pdf

necessitates government-backed guarantees to de-risk investment projects by foreign IPPs. In light of Zambia's current debt distress challenges, risk guarantees and other incentives to attract investors, become an expensive option for the government.

Consumer Affordability and Capacity: Zambia lacks a local renewable energy industry, leading to reliance on expensive, sometimes subpar imports. Unfavorable exchange rates and high tariffs, particularly for off-grid solutions, make renewables less appealing. As a result, many choose cheaper, conventional energy, delaying the transition to greener options.

Limited Financing Options for SMEs: Lack of funding options for SMEs as domestic financial institutions often favor larger firms, often sidelining SMEs due to perceived higher risk. Coupled with relatively high interest rates ranging from 20-30%, this severely restricts SMEs' ability to invest in renewable technologies.

Regulatory Concentration and Complexity: Current regulations focus on the solar energy sector in Zambia but there is a lack of comprehensive regulations in other renewable sectors like wind and biomass. Additionally, the existing licensing and permitting processes for businesses in the sector are often complex and inconsistent.

Geographical and Infrastructural Challenges: Low population density in rural areas and inconsistent income levels hinder the feasibility of cost effective on-grid electrification solution and threaten the long-term viability of mini-grids due to unaffordable, cost-reflective tariffs.

8 CONCLUSION AND RECOMMENDATIONS

This briefing offers a comprehensive analysis of Zambia's renewable energy investment landscape, emphasizing the country's potential in renewable energy, particularly solar, wind and biofuels. While the Zambian government actively encourages renewable energy investments through various incentives to bolster energy security, there are certain barriers as outlined above, that affect the deployment of country- specific renewable energy investments. The report concludes with targeted recommendations for Chinese companies seeking to invest in the country.

- **Prioritise solar energy projects**: Chinese investments in Zambia's renewable energy have been predominantly in hydropower. Yet, there is a nascent but growing interest from Chinese firms in the solar sector, particularly in PV solar and concentrated solar power technologies, where China boasts a technological and manufacturing edge. Given Zambia's solar potential and the urgent need for energy diversification, it is an opportune moment for Chinese investors to leverage their existing ties with Zambia and prioritize large-scale solar energy projects, positioning themselves as preferred construction and service partners. In particular, Zambia has announced that one of it's key objectives is to construct a solar park with a capacity of up to 40 MW. To achieve this, the Zambian energy company Greenco Power Services Limited (Greenco) is seeking independent power producers (IPPs) to support with the construction of this solar park. There is therefore an opportunity for Chinese investors to get involved in the early stages of this new project by contacting Greenco.
- **Facilitate capacity building and knowledge sharing to further shape the regulatory environment**: While the regulatory environment within Zambia's renewable energy sector has witnessed some improvements, it is clear that additional efforts are required to address any gaps and enhance the appeal for renewable energy investments. Having said

that, China's extensive experience in developing its own wind and solar capacity during the past decade has provided Chinese regulators with ample experiences and lessons learnt that can be shared with the Zambian government. There is therefore an opportunity for Chinese enterprises to get involved in various capacity building activities and work hand-in-hand with Zambian regulators to develop clear policy frameworks, road maps on renewable energy capacity as well as clear measures and guidelines for attracting investments. The key government agencies to contact in order to achieve this is the Energy Regulation Board (ERB), as aforementioned in Table 1, it is the main agency responsible for regulating and overseeing the energy sector in Zambia.

- **Invest in other areas that will support the integration of renewable energy**: To support the expansion of Zambia's renewable energy, it is important to also upgrade and expand the country's grid infrastructure which is currently outdated and with limited capacity - making it thus difficult to integrate large-scale renewable energy projects into the system. There is hence an opportunity for Chinese investors to use their engineering and construction expertise to invest in Zambia's grid infrastructure and tap its innovative grid technologies which will support the integration of renewable energy. The Office for Promoting Private Power Investment (OPPPI) as well as the Rural Electrification Authority (REA) would be the first two stakeholders that Chinese investors should get in touch with to identify the country's investment needs and priorities.
- **Develop a "going out" strategy for renewable energy**: As aforementioned, Chinese renewable energy enterprises have been, for many years, investing mainly in the Chinese domestic market – as opposed to Western companies – and therefore their experience in operating in overseas renewable energy markets is limited and mainly focused on equipment exports. Consequently, Chinese enterprises are less competitive, particularly in the African region, which requires sufficient local knowledge and project management expertise. In light of African country's renewable energy potential – such as Zambia's - it is important that all Chinese enterprises develop a "going out" strategy focuses solely on the coordination of renewable energy projects.