UGANDA

DEVELOPMENT REIMAGINED

February 2024

1 Uganda's Renewable Energy Potential and Country Overview

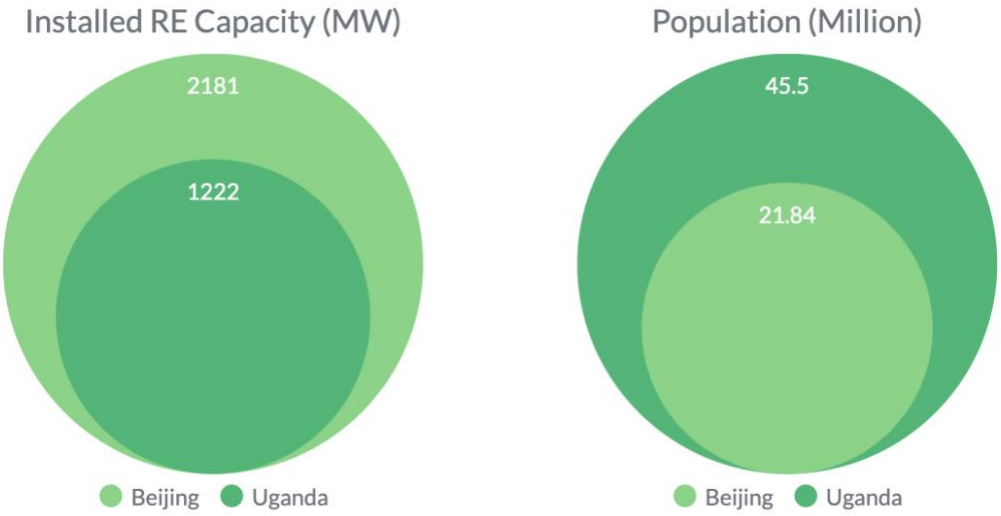
Figure 1: Uganda's location within Africa

Strategically situated in Eastern Africa, the Republic of Uganda offers a highly lucrative renewable energy investment opportunity due to its abundant natural resources, stable macroeconomic environment, and a rapidly growing population of 45.5 million, about two times the population of Beijing (21.84 million), and with projections indicating a rise to 59.44 million by 2030.[1][2][3] However, with a renewable capacity of 2181 MW, Beijing surpasses Uganda's capacity of 1222 MW. This means Uganda's renewable energy efforts need to be advanced to meet the demand for electricity resulting from the growing population. Uganda has a robust and regionally integrated economy ranking as the thirteenth largest in Africa and the third in East Africa, with a GDP of USD 52.39 billion.[4] Agriculture plays a big role in the country's economy as it employs around 68% of the population, contributes 25% to its GDP, and accounts for 90% of export earnings. However, its susceptibility to climate change and weather-related shocks has led the government to place great focus on other sectors such as the energy sector which is seen as a catalyst for achieving economic diversification and socio-economic goals which among others include achieving middle-income status and climate resilience by 2030.[5] This commitment is also evidenced in its development plans, such as the National Development Plans (NDP), as well as Uganda's Vision 2040, and the Energy and Mineral Development Sector Development Plan which inter alia outline a clear roadmap to increase sustainable clean electricity grid access by 80% and 90% renewable energy mix by 2030.[6] Additionally, Uganda's Nationally Determined Contribution (NDC) also includes unconditional commitment to achieve a 5.9% emissions reduction by 2030 through cost-effective investments, renewable energy promotion, and energy efficiency enhancement.[7] The aforementioned factors clearly demonstrate Uganda's strong commitment to advancing and investing in its renewable energy sector, which underscores a significant opportunity for Chinese investors to seize.

[1] Ministry of Energy and Mineral Development of the Republic of Uganda, Expression of Interest to Participate in SREP. Climate Investment Funds. https://www.cif.org/sites/default/files/Uganda_EOI.pdf
[2] World Bank, Population 2022. World Development Indicators database, 2023. https://databankfiles.worldbank.org/public/ddpext_download/POP.pdf
[3] United Nations, Department of Economic and Social Affairs, Population Division (2022). World Population Prospects 2022, Online Edition. https://population.un.org/wpp/Download/Standard/Population/
[4] IMF, World Economic Outlook Database.
[5] NPA, Uganda Vision 2040. http://www.npa.go.ug/uganda-vision-2040/
[6] Ibid
[7] Ministry of Water and Environment, The Republic of Uganda, Updated Nationally Determined Contribution. UNFCCC, 2022. https://unfccc.int/sites/default/files/NDC/2022-09/Updated%20NDC%20_Uganda_2022%20Final.pdf

Table 1: Summary of Uganda's Overall Renewable Energy Potential by Resource

	Renewable Energy Resource		Uganda	China
	Solar Photovoltaic (PV) Power Output potential (kWh/kWp/day)		3.8-4.9	2.21-5.82
	Wind resource potential (Wind speed range, metre per second)		3.65-6.0	5.96-10.21
	Biomass Potential (GW)		N/A	30
	Hydro Potential (MW)		4100	542,000
	Geothermal Potential (MW)		1500	1500
	Electric Price (USD/kWh)	Households	0.171	0.076
		Businesses	0.123	0.089



2 RENEWABLE ENERGY POTENTIAL (REP)

While Uganda's renewable energy potential (indicated by the average of its wind power density at 100 meters and its solar PV potential) falls slightly below the continent's average (see Figure 2), the country has substantial untapped renewable resources which include biomass, geothermal, hydropower, solar, and wind. An overview of the estimated potential of these resources is provided in Table 1 above. Figure 3 below illustrates Uganda's renewable energy consumption by sector in 2020.

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

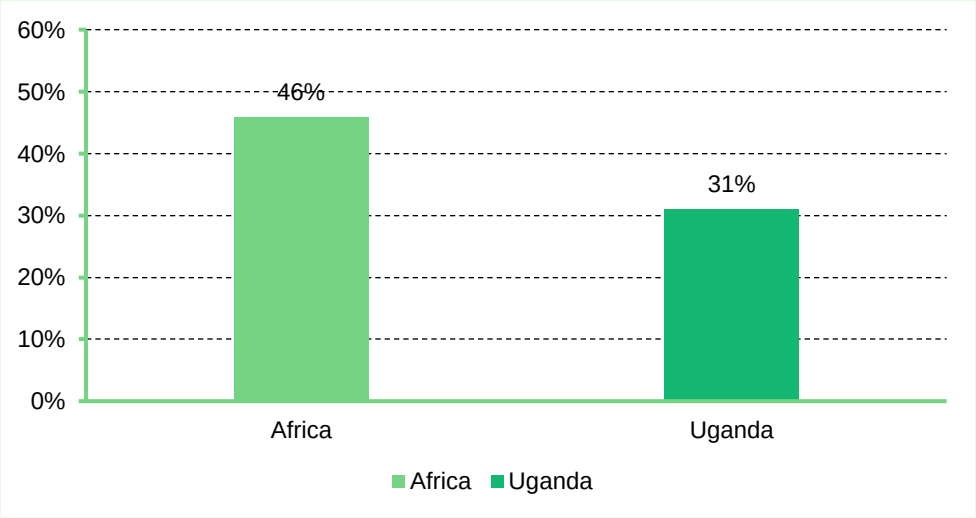
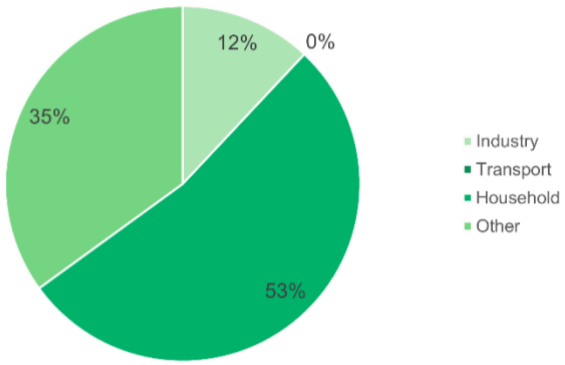


Figure 3: Uganda's Renewable energy consumption by sector[8]



Considering Uganda's ongoing issues with power cuts as well as the increasing energy demands of the nation, diversifying the country's energy portfolio emerges as a key solution. Moreover, by increasing investments in various available renewable energy resources, the country can reduce its dependence on hydro resources and therefore enhance energy security. To support potential investors interested in exploring opportunities in Uganda's renewable energy sector, a breakdown of each renewable energy resource as well as potential investment opportunities within each area is provided below.

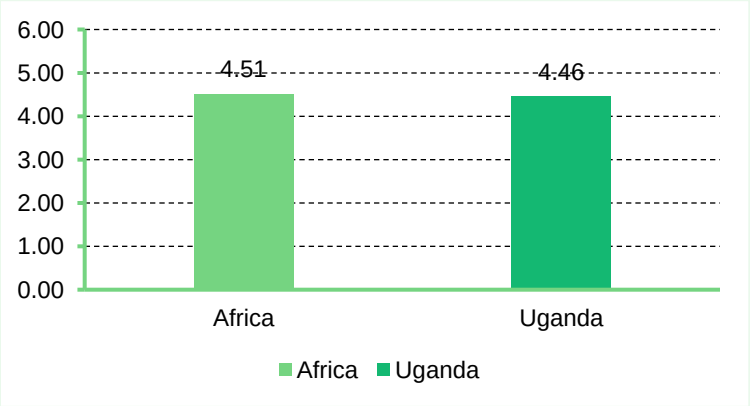
2.1 Solar Energy

Uganda is among the countries of Africa with substantial solar resource potential with solar irradiation levels ranging between 1,825 kWh/m² to 2,500 kWh/m² per year[9] and a daily average of 8-10 hours throughout the year. The Uganda Vision 2040 plan estimates the country's total

[8] IRENA. Energy Profile-Uganda. https://www.irena.org/-/media/Files/IRENA/Agency/Statistics/Statistical_Profiles/Africa/Uganda_Africa_RE_SP.pdf
[9] Global Solar Atlas. Global Photovoltaic Power Potential by Country. https://globalsolaratlas.info/global-pv-potential-study

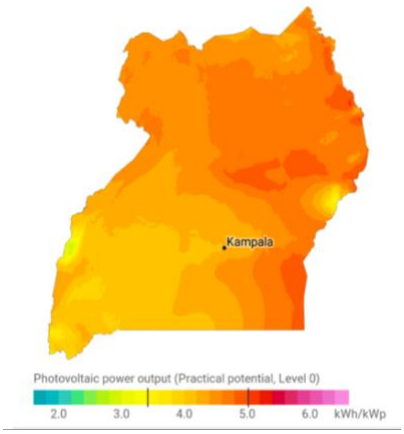
renewable energy power potential of 5000 MW. In comparison to the continent as a whole, Uganda's solar PV potential is nearly on par with the average solar PV potential of all other African nations (4.51 vs. 4.46 kWh/kWp/day respectively as depicted in Figure 4) which affirms the country's suitability for solar energy production.

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



The country has regions with reasonable solar resources, particularly in the Eastern provinces (see Figure 5). Solar energy use has grown in Uganda, following the introduction of the feed-in-tariff (FiT) scheme and a supportive regulatory framework which prompted private investment within the sector. Solar home systems and solar water heating solutions have become common use cases for solar and over 30,000 solar PV systems have been installed. This is evident in the 2022 report of the Electricity Regulatory Authority (ERA) report which shows an increase of solar energy's share in the electricity mix from 0MW in 2014 to 65.8MW in 2022.[10] The government of Uganda intends to expand rural electrification in rural areas and has identified opportunities in the northern and central regions with particularly high solar radiation. One of the long-term policy measures to increase diversity and security in energy supply in the country is to develop small renewable projects including the use of solar PV generated electrical energy. With use cases in solar cooking, heating, and power, solar holds significant potential in Uganda since a large number of the population live in well-isolated areas, without access to energy services.

Figure 5: Uganda's Solar PV Power Output Potential



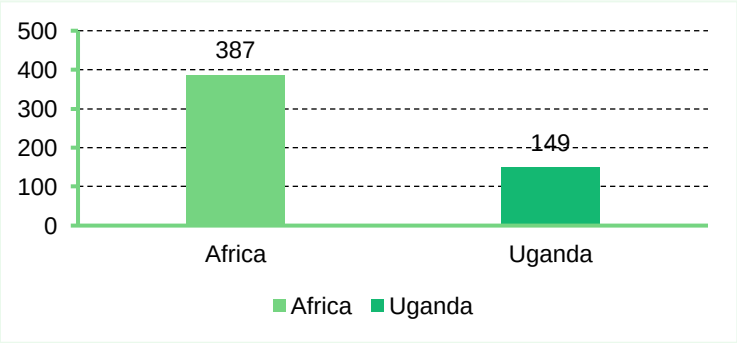
2.2 Wind Energy

Wind energy potential in Uganda can be considered as moderate compared to the average wind energy potential of all African countries (see Figure 6). According to the Ugandan government, average wind speeds usually range from 2m/s – 4m/s in flat terrains, however, in areas with more complex mountainous topology wind speed could be as high as 6m/s. Uganda's wind energy

[10] Electricity Regulatory Authority, Installed Capacity. 2023. https://www.era.go.ug/index.php/stats/generation-statistics/installed-capacity

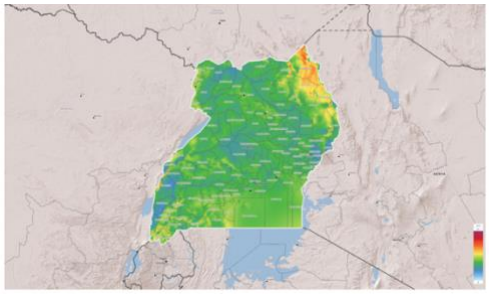
potential is also underscored by a recent study by the Energy Sector Management Assistance Programme (ESMAP) study that reported average wind speeds of 5.12m/s and average wind density of 149 w/m^2 at 100 metres.[11] While these speeds are insufficient for large-scale power generation, they are particularly sufficient for small scale power generation and low speed wind turbines.

Figure 6: Comparing Uganda's and Africa's Average Wind Power Density at 100m height (m/s)



Having said that, the Ugandan government has shown interest in harnessing wind energy resources and for that reason it has supported numerous feasibility studies in the wind sector which have identified high potential in the north - eastern regions of the country - as seen in Figure 7.[12] Small industries or communities, where electricity consumption is low, could benefit from the wind resource using low speed turbines. The ERA has approved the construction of the 20MW Tororo wind power plant by Xsabo Wind Technologies Limited.[13]

Figure 7: Uganda's Mean Wind Speed at 100m

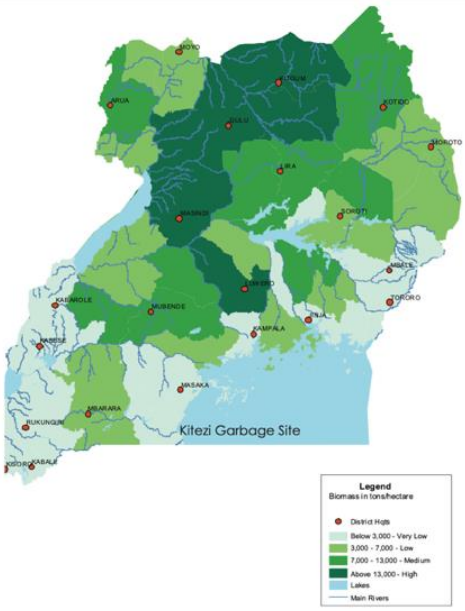


[11] Global Wind Atlas. https://globalwindatlas.info/en/area/Uganda
[12] Wind Power Association of Uganda, Wind-solar Hybrid Mini-grids and Wind Energy Developments in Karamoja, Uganda. 2020. https://gwec.net/wp-content/uploads/2021/05/Report-WPAU-ERA-site-visit-to-Napak_final.pdf
[13] Electricity Regulatory Authority, Certified Installation Permit Holders. https://www.era.go.ug/index.php/licensing/installation-permits/certified-permit-holders?resetfilters=0&clearordering=0&clearfilters=0

2.3 Biomass Energy

Uganda has a significant potential in biomass energy production attributed to its plethora of resources such as redwood, shrubs, grasses, forest waste, agro-industrial residues, organic municipal and industrial waste which have the capability to contribute 1650 MW to the energy mix.[14] The country's total standing biomass stock reaches an estimated 284.1 million tons, offering a sustainable supply of 45 million tonnes.[15] While biomass distribution is widespread across various regions, the middle belts seem particularly promising for agro-industrial residue and forest waste utilization (see Figure 8). At present, the accessible sustainable wood biomass supply stands at 26 million tonnes, and the potential annual production of agricultural residues ranges from 1.186 million to 1.203 million tons.[16] Moreover, the sugar industry is the sole sub-sector harnessing biomass residues for electricity generation. Companies such as Kakira Sugar Works Limited (51.1 MW), Kinyara Sugar Limited (14.5 MW), Sugar and Allied Industries Uganda Limited (11.9 MW), Sugar Corporation of Uganda (25 MW), and Mayuge Sugar Limited (9.2 MW) hold licenses to generate electricity for sale to the national grid using bagasse.[17] Recognizing the potential of biomass cogeneration technologies, the Ugandan government has identified opportunities for their development.

Figure 8: Uganda's Biomass Potential

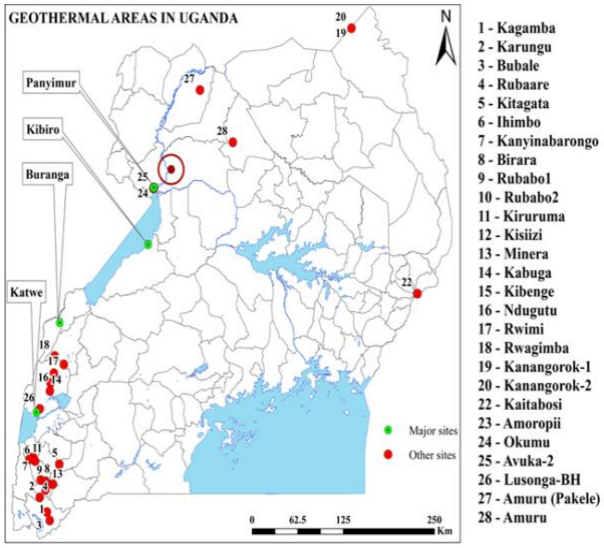


[14] The Renewable Energy Policy for Uganda. UNREEEA, 2021. https://unreeea.org/wp-content/uploads/2021/11/The-Renewable-Energy-Policy-for-Uganda.pdf
[15] Ministry of Energy and Mineral Development, Biomass Energy Strategy (2014)
[16] ibid
[17] Electricity Regulatory Authority, Installed Capacity. 2023.

2.4 Geothermal Energy

Geothermal energy presents a promising alternative renewable energy source in Uganda, complementing existing energy sources. However, Uganda's geothermal resources are currently in the exploration phase. According to Uganda Vision 2040, the country's total renewable energy capacity is estimated at 1500 MW. Previous studies have indicated that the temperature levels in these geothermal areas range between 150°C and 200°C, making them suitable for electricity generation and direct use in industrial and agricultural applications. [18] The Ugandan government has identified about 24 potential areas for more detailed exploration, many of them located in western Uganda within the western branch of the East African Rift Valley [19] (see Figure 9). Recently the government of Uganda has partnered with ASKA Infrastructure Development to develop geothermal power project in Katwe – Kikorongo, Kasese District, following further feasibility studies.[2021]

Figure 9: Geothermal Areas of Uganda

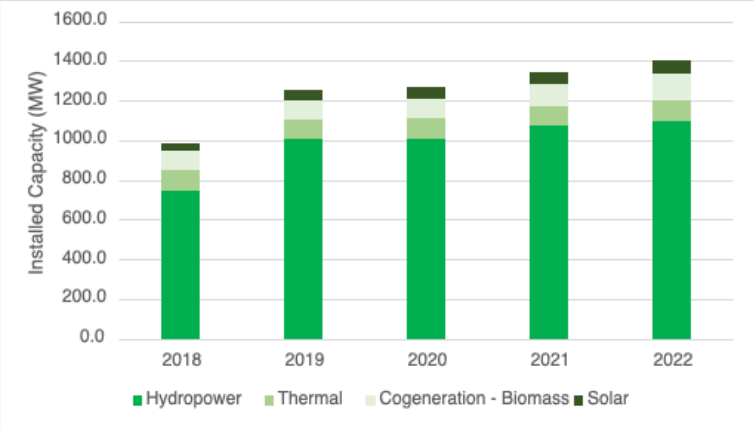


2.5 Hydropower Energy

Uganda possesses substantial hydropower potential, estimated at over 4100 MW, although the full theoretical potential remains untapped. The technically feasible capacity is approximately 20,833 GWh per year, of which only about 15% has been developed.[2223] The current installed hydropower capacity stands at 1099.6 MW. The Ugandan government has identified significant large hydropower sites along the Nile River that offer development potential. Additionally, in the hilly and mountainous regions of the Eastern and Western parts, there are opportunities for small and medium-scale hydropower projects. Approximately 50 potential sites have been identified for small hydropower near rivers, with an estimated capacity of 164 MW, and 59 potential sites for medium hydropower near rivers, with an estimated capacity of 210 MW.[2425]

[18] Glassley, W.E. *Geothermal Energy: Renewable Energy and the Environment*; CRC Press: Boca Raton, FL, USA, 2014.
[19] Fashina, A.; Mundu, M.; Akiyode, O.; Abdullah, L.; Sanni, D.; Ounyesiga, L. The Drivers and Barriers of Renewable Energy Applications and Development in Uganda: A Review. Clean Technol. 2019. https://doi.org/10.3390/cleantechnol1010003
[20] Arinaitwe, S. R., Energy Ministry Partners with Aska Group to Develop Geothermal Power Production Uganda. Uganda Update, 2022. https://ugandaupdatenews.com/energy-ministry-partners-with-aska-group-to-develop-geothermal-power-production-uganda/
[21] Fashina, A. et al., the Drivers and Barriers of Renewable Energy Applications and Development in Uganda: A Review.
[22] Electricity Regulatory Authority, Installed Capacity. 2023.
[23] Nabutsabi, D. M., Small Hydropower Situation and Needs in Uganda; Potential and Development Opportunities. https://www.hyposo.eu/pdf/4_Nabutsabi_DM.pdf
[24] Bartle, A., Hydropower potential and development activities, Energy Policy, 2002, https://doi.org/10.1016/S0301-4215(02)00084-8
[25] Fashina, A., Mundu, M., Akiyode, O., Abdullah, L., Sanni, D., & Ounyesiga, L. The Drivers and Barriers of Renewable Energy Applications and Development in Uganda: A Review. *Clean Technologies*, *2018*. MDPI AG. http://dx.doi.org/10.3390/cleantechnol1010003

Figure 10: Energy Generated by Type of Generator (2018 – 2022)



2.5.1 ENERGY SECTOR

Uganda boasts of significant renewable energy resources with its energy supply in 2021 derived from biomass (90.05%), petroleum products (7.9%), and solar, hydro and electricity (1.6%).[26] An increase in energy generation of 693.8 GWh was registered in 2022 compared to 2021.Overall, the energy generation from the power plants increased throughout the years, registering a maximum value of 5,442.6 GWh in 2022. In 2022, most of the energy was generated from hydro-power plants constituting 78% of the total energy. This was followed by Bagasse/cogeneration at 10%. The lowest amount of energy generation of 5% was obtained from solar plants (see Figure 9).

Biomass also plays a pivotal role in energy provision, particularly in rural areas where 73.84% of the population resides. [27] However, concerns regarding deforestation and the health consequences of using biomass have compelled the Ugandan government to promote greater access to clean fuel and technology. Unfortunately, the limited availability of electricity and the high cost of petroleum products hinder efforts to reduce biomass dependency.[28] Consequently, the use of clean energy has been on a slow rise, recording 0.70% access in 2021 with large rural-urban disparities.[29] Given the government's drive to enhance clean fuel and technology access and the gradual but steady adoption of clean energy, strategic investments from Chinese companies in nationwide energy infrastructure and provision hold the potential for significant returns.

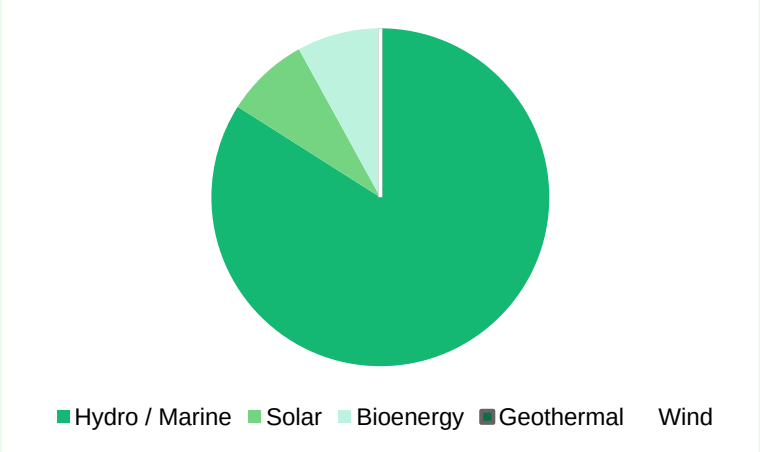
2.5.2 ELECTRICITY SECTOR

The electricity sector in Uganda, despite its potential, currently accounts for less than 2% of total energy supply due to limited accessibility compared to other energy sources. Total installed electricity capacity reached 1,401.96 MW in 2022 predominantly sourced from renewable

[26] Ministry of Energy and Mineral Development, Republic of Uganda. 2021 Statistical Abstract. https://memd.go.ug/wp-content/uploads/2020/07/2021-STATISTICAL-ABSTRACT.pdf
[27] World Bank. World Development Indicators. https://databank.worldbank.org/source/world-development-indicators
[28] The Renewable Energy Policy for Uganda. UNREEEA, 2021.
[29] World Bank. World Development Indicators.

(92.77%) and thermal (7.23%) energy.[30] Hydroelectricity contributes the highest to installed capacity covering 84.51% of total renewable electricity capacity[31] followed by biomass and solar energy (see Figure 11).

Figure 11: Uganda's Renewable Electricity Capacity in 2022 by Renewable Resource



Uganda's total installed capacity exceeded its peak demand of 843 MW in 2022. Despite this, less than half of the population has access to electricity while accessibility varies sharply between rural and urban areas, with rural figures as low as 35.93%. With 18 million households remaining unelectrified, Uganda has one of the lowest annual per capita electricity consumption rates globally estimated at 83.52kWh, far below peer countries (180kWh/year for Kenya and 46.4% of the African average (180kWh/year).[32][33][34]

In 2022, Uganda generated a total of 5,489.6 GWh of electricity, with hydropower accounting for a substantial 89.7%.[35] However, despite the high generation capacity, only 5,224 GWh was consumed, primarily due to transmission losses of about 4.83%. While transmission losses have reduced over the past decade, they highlight the critical need for increased investments in the transmission and distribution infrastructure.[36][37] Even though Uganda has made strides in expanding its transmission network from 2570km in 2018 to about 3761.3km in 2022, and its distribution network has grown by 39%, reaching 63,303 km in 2022, there remains a significant portion of the population without access to the electricity that is being produced.

[30] Electricity Regulatory Authority. Electricity Supply Industry Performance Report for the Year 2022. 2023. https://www.era.go.ug/index.php/resource-centre/publications/reports/793-electricity-supply-industry-performance-report-for-the-year-2022/download
[31] Ibid
[32] Ministry of Energy and Mineral Development, Republic of Uganda. 2021 Statistical Abstract.
[33] Enerdata, Kenya Energy Information. https://www.enerdata.net/estore/energy-market/kenya/
[34] African Development Bank Group, Light Up and Power Africa – A New Deal on Energy for Africa. https://www.afdb.org/en/the-high-5/light-up-and-power-africa-%E2%80%93-a-new-deal-on-energy-for-africa
[35] Electricity Regulatory Authority. Energy Generated to the National Grid, 2023. https://www.era.go.ug/index.php/stats/generation-statistics/energy-generated
[36] Electricity Regulatory Authority. Energy Purchases, Sales and Losses, 2023. https://www.era.go.ug/index.php/transmission/energy-purchases-sales-and-losses
[37] Mukwaya, J., Electricity Supply Industry Performance Report for the Year 2022. Electricity Regulatory Authority. 2023. https://www.era.go.ug/index.php/resource-centre/publications/reports/793-electricity-supply-industry-performance-report-for-the-year-2022/download

Looking ahead, Uganda urgently needs to expand its energy capacity due to rising electricity demand. By 2025, peak demand is set to reach 2,000 MW, driven by household electrification in line with the government's 60% electrification goal by 2030. To achieve this, the government plans to quadruple its current 1,401.96 MW capacity to 4,200 MW by 2030. Strategic investments are crucial to diversify energy sources and improve distribution and transmission networks nationwide.

2.6 Electricity Market

Uganda's energy sector reforms introduced the single buyer model, where the transmission operator serves as the exclusive purchaser and wholesaler of electricity. Private sector involvement significantly contributes to both power generation and distribution, competing alongside state entities like the Uganda Electricity Generation Company Limited (UEGCL), Uganda Electricity Transmission Company Limited (UETCL), and Uganda Electricity Distribution Company Limited (UEDCL).

Most of the fixed assets along the electricity supply chain are held by three public enterprises: UEGCL manages state-owned power generation, with a significant private sector presence seen in the multitude of licensed Independent Power Producers (IPPs) companies. UETCL stands as the state-owned power transmission company and off taker for all grid-connected power in the country, responsible for electricity purchase and wholesale distribution. UEDCL oversees power distribution, with the distribution segment demonstrating a high degree of liberalization, evident in the growing number of private electricity distribution companies licensed by UEDCL. Notably, UMEME Limited holds a major privately-owned position, servicing approximately 90% of end-users. UEDCL leased its distribution assets in key load centers to UMEME Limited in 2005 through a 20-year concession agreement set to expire in 2025. Beyond UMEME's concession, other distributors receive exclusive concessions to provide electricity.

Additional stakeholders in the sector include ERA, responsible for overseeing all sector activities, including tariff regulation and compliance, the Ministry of Energy and Mineral Development (MEMD) which is responsible for policy formulation, sector coordination, and comprehensive energy sector planning as well as the Rural Electrification Board (REB) which supervises rural electrification initiatives, with operational support provided by the Rural Electrification Agency (REA).

3 INSTITUTIONAL AND REGULATORY FRAMEWORK

Over the past years, Uganda has focused on creating a regulatory framework to promote renewable energy investments in the country. One of the governments strategic decisions was to establishm a well-developed rural electrification agency, the ERA, which among others has streamlined numerous processes by setting regulations and standards, creating Standardized Power Purchase Agreements (PPAs) or Implementation Agreements (IAs), as well as playing a crucial role in licensing and oversight.[38]

Moreover, Uganda has developed a Renewable Energy Policy (2007) that provides a strategic framework for promoting investments in the renewable energy sectors while at the same time it

[38] Electricity Regulatory Authority. Renewable Energy Investment Guide. https://www.era.go.ug/index.php/opportunities/renewal-energy-investment-guide

has implemented feed-in tariffs for various renewable energy technologies, offering guaranteed prices for electricity generated from renewable sources. These FiTs have mainly been designed to attract investment in the sector. Despite these efforts however, the country has faced challenges in the regulatory environment, including issues related to grid integration, land acquisition, and compliance with environmental and social safeguards.

To support potential investors in better understanding the governance of Uganda's renewable energy sector, Table 2 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: Uganda's Renewable Energy Sector: Key Actors and Regulatory Framework

Key Actors	Responsibilities
Ministry of Energy and Mineral Development (MEMD)	Formulates policies, implements legislation, and oversees the energy and mineral sector in Uganda. https://memd.go.ug
Electricity Regulatory Authority (ERA)	Sets electricity tariffs, enforces technical standards, issues licenses, and regulates power sector. http://www.era.or.ug/
Rural Electrification Agency (REA)	Implements rural electrification projects and manages related funds, focusing on grid extension and off-grid electrification. http://www.rea.or.ug/
Uganda Electricity Generation Company Limited (UEGCL)	State-owned power generation company overseeing power plants and contracts for government projects and IPPs. http://uegcl.com/
Uganda Electricity Transmission Company Limited (UETCL)	State-owned authorized sole off taker for all grid-connected power and operates transmission infrastructure. http://www.uetcl.com/
Uganda Electricity Distribution Company Limited (UEDCL)	Manages state-owned distribution assets and supervises private distribution concessions. http://www.uedcl.co.ug/
UMEME Limited	Private company with a concession to distribute and retail electricity, responsible for 97% of distribution till 2025. http://www.umeme.co.ug/
National Environment Management Authority (NEMA)	Regulates environmental impact, reviews assessments, and issues environmental clearance certificates for power projects. https://www.nema.go.ug/new_site/
Directorate of Water Resource Management (DWRM)	Issues permits for water abstraction and construction related to hydropower projects. https://www.mwe.go.ug
Electricity Disputes Tribunal (EDT)	Resolves disputes between consumers and entities responsible for electricity generation, transmission, and distribution. https://edt.go.ug
Uganda National Renewable Energy and Energy Efficiency Alliance (UNREEEA)	An umbrella organization promoting renewable energy and energy efficiency in Uganda through various associations. http://unreeea.org/
Uganda Investment Authority (UIA)	Provides services for investors, facilitates business registration and licensing processes. https://www.ugandainvest.go.ug
Uganda's National Bureau of Standards	Formulates and promotes national quality standards, including standards specific to renewable energy. https://www.unbs.go.ug
Relevant Regulatory Frameworks and Legislation	• Vision 2040 • National Development Plan 2010-2014/15 • Uganda Feed-In-Tariff (FIT) Strategy • Energy Procedure • Renewable Energy Policy 2007 • Energy Policy 2002 • Electricity Act 1999

4 INVESTMENT INCENTIVES

To attract investors in the renewable energy sector, Uganda offers several incentives. For non-resident companies, there may be an additional 15% income tax on repatriated branch profits. The Investment Code Act safeguards investors, allowing expropriation only for public use or essential public interests, with fair compensation and legal recourse. Moreover, incentives are also provided depending on the technology used.[39] For example, solar panels are VAT-exempt with no import duties while wind turbines are subject to 18% VAT but no import duties. Batteries incur an 18% VAT charge. Import duties for standard batteries are 25%, while less common batteries face a 35% duty.[40] Uganda has also established the Uganda Energy Credit Capitalization Company (UECCC) to provide credit-enhancement and technical support for renewable energy on-and off-grid projects. The Ministry of Energy and Mineral Development includes a dedicated division to promote renewable energy development.

Finally, Uganda also participates in international investment and dispute resolution mechanisms which underscores its commitment to fostering a conducive environment for foreign investors. The country is a member of the Multilateral Investment Guarantee Agency (MIGA), which is part of the World Bank Group and offers political risk insurance and credit enhancement to encourage foreign investment. Additionally, Uganda is a member of the International Centre for Settlement of Investment Disputes (ICSID), providing a forum for the resolution of investment disputes through arbitration, thereby promoting transparency and adherence to international standards in investment matters. These memberships signify Uganda's dedication to creating a secure and predictable investment climate, which is essential for attracting and retaining foreign capital and expertise.

5 FOREIGN RENEWABLE ENERGY INVESTMENTS AND COLLABORATIONS

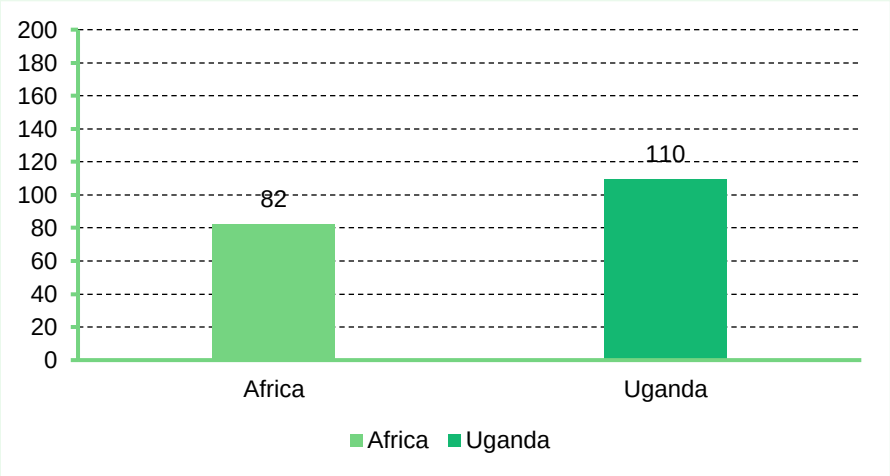
5.1 Chinese Investments in Uganda's Energy sector

Uganda maintains robust political and economic ties with China. It is the 14th largest Chinese FDI stock destination and 13th largest destination for Chinese loan commitment.[41][42] In comparison to the average Chinese FDI received by all other African nations, Uganda's intake is significantly higher (see Figure 12). According to Boston University's database, between 2002 and 2022, Uganda secured USD 3.638 billion in loans from China, through the China Export-Import Bank (CHEXIM), for 15 infrastructure projects. Of this, $2.215 billion (or 33%) is allocated to five energy projects aimed at bolstering electricity infrastructure in power generation and transmission. Three of the energy projects are renewable energy projects which can add 1,383MW to the installed electricity capacity. On a micro level, Chinese private and state enterprises are actively engaged

[39] Electricity Regulatory Authority. Renewable Energy Investment Guide.
[40] ibid
[41] 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
[42] BU Global Development Policy Center. (2023). A New State of Lending: Chinese Loans to Africa. Retrieved from https://www.bu.edu/gdp/2023/09/18/a-new-state-of-lending-chinese-loans-to-africa/

in the Ugandan energy sector through Engineering, Procurement and Construction (EPC) Contracts, and Direct Agreements and power technology manufacturing and supply.[43]

Figure 12: Comparing Chinese FDI received by Uganda and all other African countries on average from 2017 – 2021 (million)



In addition to the financing ties between the two countries, Uganda has seen an increasing presence of Chinese companies operating in various sectors of the country. Chinese firms have engaged in projects related to infrastructure development, construction, telecommunications, renewable energy, and more. As a response to the increasing interest, the Ugandan government has taken steps to create a favorable investment climate, offering incentives and protective measures for investors. These efforts include policies to promote public-private partnerships and attract foreign direct investment. Table 3 below provides a sample list of Chinese companies operating in Uganda as of 2023.

Table 3: Sample List of Chinese Companies in Uganda (2023)

Companies	SOE or Private	Areas	Projects
Sinohydro Corporation Limited	SOE	Hydropower, renewable energy, hydroelectricity	The 600-megawatt Karuma Dam, a part of the Karuma Hydroelectric Power Station an investment of USD 1.7 billion.
China Energy Engineering Corp (CEEC)	SOE	Hydropower, renewable energy	CEEC will develop 500 MWp of solar photovoltaic energy in Uganda. Its megaproject is expected to require an investment of at least $500 million.
China International Water & Electric Corporation (CWE)	Private	Water hydropower	Awarded the contract of 183MW Isimba Hydropower Plant and Isimba-Bujagali interconnection Project by Ministry of Energy and Mineral Development
Tiantang Group	Private	Industrial park connstruction, manufacturing	Sino-Uganda Mbale Industrial Park

[43] China Chamber of Commerce in Uganda, Chinese Enterprises in Uganda Social Responsibility Report 2022. http://images.mofcom.gov.cn/ug/202304/20230406162019764.pdf

Kampala Electric Mart	Private	Leading enterprise in industrial electrical equipment field in China and the whole world	Clean energy electrical infrastructure supplier market leader in Uganda
TBEA Co. Ltd.	Private	Clean energy solutions and manufacturer	Part of the Uganda electrification project

6 OTHER FOREIGN INVESTMENTS

Global climate finance inflows and investment in Uganda's energy sector has been relatively low and yet to reach significant levels. As of 2022, Uganda was the 12th highest destination for climate finance on the African continent, receiving USD 712 million. 97% of these investments were financed by multilateral and bilateral Development Finance Institutions (DFIs).[44] Out of the finances received, only about 19% focused on energy systems with projects targeting power and heat infrastructure such as generation, transmission, and distribution.

Beyond global climate finance, Uganda's energy sector has also benefited from strategic partnerships and international support. International donors and investment partners such as African Development Bank (AfDB), The World Bank Group (WBG), European Union, and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) are active in Uganda's energy sector. For example, Uganda's feed-in-tariff (FiT) scheme was introduced through the Global Energy Transfer for Feed-in-Tariff (GET FiT), where ERA in collaboration with donors and instrumental organizations such as the KfW introduced topping up government approved tariffs with an additional premium to increase tariff rate to attract investment.[45] As of 2022, GET FiT has attracted more than US$ 455 million of leveraged private investment. The portfolio of 17 renewable energy projects in solar, hydro, and biomass of 158MW yielding approximately 760 GWh.[46] Another example is the support provided by the World Bank through Partial Risk Guarantee (PRG) facilities to catalyze small-scale Renewable Energy projects in Uganda facilitating the provision of short-term liquidity support for PPA obligations.[47][48]

7 BARRIERS TO RENEWABLE ENERGY DEPLOYMENT IN UGANDA

- **Access to affordable finance**: In Uganda, similar to many African nations, securing affordable long-term financing remains a challenge, particularly for small to medium-sized businesses. This limitation arises from two main factors: the banks' limited net worth and the strict exposure limits imposed on commercial institutions. The East African Development Bank (EADB) offers ten-year maturity loans; however, its capacity is limited by its net worth and dependencies on credit sources, such as the African Development Bank (AfDB) and bonds. In contrast, commercial banks lean towards offering shorter, five-

[44] 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/

[45] Get Fit Uganda, Annual Report 2022. https://www.getfit-uganda.org/annual-reports/annual-report-2022/

[46] ibid

[47] Finance, Economics & Urban Department, Sustainable Development Network Vice – Presidency. Financial Solutions: Partial Risk Guarantee. World Bank, 2007. https://documents1.worldbank.org/curated/en/277161535631503874/pdf/BRI-PUBLIC-ADD-SERIES-see-35902-UgandaBujagaliNew.pdf

[48] Electricity Regulatory Authority. Renewable Energy Investment Guide.

year loans, influenced by exposure limits and a designated capital allocation to specific sectors, such as the 15-20% earmarked for the electricity sector. Furthermore, the lending environment is marked by high lending interest rates, considerably higher than regional peers such as Rwanda and Kenya which causes constraints.

- **High transportation and distribution cost*:*** Uganda's insufficient road and telecommunications infrastructure not only impede smooth transportation but also inflates the cost of services, particularly when moving equipment between states. Being landlocked, Uganda faces inherent logistical challenges, relying heavily on external ports such as Mombasa and Dar Es Salam for transportation. Transporting goods from Mombasa to Kampala ranks among the world's most expensive routes, costing roughly 60% more than shipping from Mombasa to Shanghai. This disparity is magnified by Uganda's underdeveloped road network and the high costs associated with its telecommunications services.
- **Limited transmission infrastructure**: A major obstacle is the lack of robust transmission infrastructure. Investing in electricity transmission from generation to distribution is challenging due to the high construction costs, and the distinct challenges of building, operating, and maintaining transmission and distribution lines compared to the power generation sector.
- **Electricity cost and ability to pay**: Affordability poses yet another barrier in increasing renewable energy investment in Uganda. A significant portion of Uganda's population, approximately 20.3%, lives below the poverty line.[49] With many depending on the unpredictable agricultural sector and grappling with currency devaluation, imports become more costly. Consequently, a large number of households, particularly in rural areas, cannot afford renewable energy solutions due to its relatively high cost compared to traditional energy sources, further exacerbating the disparity in access to power.
- **Regulatory challenges**: Regulatory obstacles also impede progress. Issues range from land acquisition complexities and water abstraction permit challenges to the need for standardized feasibility studies and focused skill development. The ERA has highlighted that high power tariffs, the national grid's limited reach, and scattered institutional planning as barriers to the energy sector's growth.

8 CONCLUSION AND RECOMMENDATIONS

This briefing offers a comprehensive analysis of Uganda’s renewable energy landscape, emphasizing the several opportunities for Chinese investors within the sector. As evident from the analysis, the country has potential to utilise its renewable energy resources and the fact that the government has placed focus on creating a favorable regulatory environment to attract renewable energy investments is vital for future investors. However, despite the potential of the country, it is important to highlight that there are certain barriers as outlined above, that affect the deployment of country- specific renewable energy investments and for this reason, this briefing concludes with targeted recommendations to help Chinese investors navigate through these challenges.

[49] Atamanov, A., Poverty & Equity Brief-Uganda. World Bank Group, 2023. https://databankfiles.worldbank.org/public/ddpext_download/poverty/987B9C90-CB9F-4D93-AE8C-750588BF00QA/current/Global_POVEQ_UGA.pdf

8.1 Recommendations

- **Prioritise solar and biogas energy projects**: While the renewable energy potential of Uganda is promising, certain sectors have greater potential. In particular, as aforementioned, Uganda presents great solar energy potential and therefore there are numerous opportunities in this area such as investing in grid-connected and off-grid power plants, floating solar technology, mini-grids, and / or backup generators. The Municipality of Kasese could serve as a strategic entry point for Chinese investors. Supported by IRENA, the district government of Kasese has initiated an ambitious 100% renewables program. The goal is to extend clean energy services to every household in the city. This initiative creates a significant opening for Chinese investors to actively participate in and contribute to this sustainable energy endeavour. Similarly, in the biogas and biomass sector there are opportunities to invest in grid-connected/CHP power plants and biofuel for domestic use. Other opportunities also exist for Chinese investors in the hydropower sector with the development of large-scale and small-micro hydro plants in areas such as the Eastern part of Uganda (The Mountain Elgon region) and the Western Districts of Ibanda, Rubiriizi, Buhweju, Kabale, Kisoro, Kabarole and Rukungiri which have been highlighted as a site with great potential.
- **Invest in other areas that will support the integration of renewable energy**: As aforementioned, a major obstacle to further bolster Uganda's renewable energy sector and support in electricity transmission is the lack of robust distribution networks and infrastructure. There is hence an opportunity for Chinese investors to use their engineering and construction expertise to invest in the national infrastructure either by building, operating, and / or even maintaining transmission and distribution lines. The Rural Electrification Agency (REA) as well as Uganda's Electricity Transmission Company Limited (UETCL) should be the first two entities to liaise with.
- **Establish Public and Private Partnerships (PPPs):** Chinese investors should engage in dialogue with relevant government agencies such as the Uganda Investment Authority (UIA) as a first priority as well as with utility companies in order to establish public and private electrification partnerships. By doing this, investors will be able to work closely with the government to overcome some of the identified barriers such as long waiting times for project approvals and permits. Moreover, through PPPs Chinese investors will have the chance to get involved in shaping an even more favourable regulatory environment to accelerate investments while at the same time distributing the risks and responsibilities between themselves and the government.
- **Consider cost-effective Renewable Energy Technologies (RET) interventions:** Chinese companies should explore and implement cost-effective RET interventions in Uganda to leverage the opportunities presented by Uganda's large market. In other words, Chinese firms should consider investing in renewable energy projects or technologies in Uganda that are affordable and efficient. By doing so, they can benefit from the significant business prospects and demand for renewable energy solutions within the Ugandan market. This approach implies a focus on solutions that provide sustainable and clean energy while being economically viable and competitive in the local context. To achieve this, Chinese investors should, as a first step, liaise with the Uganda Investment Authority (UIA) which is responsible for facilitating private sector investments in the country.
- **Focus on innovative projects**: Considering the land acquisition challenges within Uganda for traditional solar installations, Chinese investors should focus on investing in innovative projects such as floating solar technology in hydro reservoirs – as currently

being done by a foreign engineering company Sweco.[50] The option of using water surfaces will not only be more cost-efficient (as opposed to acquiring land for solar projects), but it will also help conserve valuable land resources for other purposes, such as agriculture or housing and will allow the dual use of the resource for energy generation and water conservation.

- **Consider exploiting economies of scale:** Considering that Uganda is part of the East African Community (EAC) (a regional intergovernmental organization which includes 7 East African countries, creating therefore a market of 300 million people) as well as part of the African Continental Free Trade Area (AfCFTA) (which creates a vast market of over 1.4 billion people), Chinese investors are encouraged to leverage the immense potential offered within these economies of scale. Exploiting these economies of scale can lead to significant advantages for Chinese businesses seeking to expand their operations in the region.

[50] Ingram, E., Sweco to study floating solar technology in hydro reservoirs. Hydro Review, 2022. https://www.hydroreview.com/news/sweco-to-study-floating-solar-technology-in-hydro-reservoirs-in-uganda/