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Critical Minerals and Renewable Energy Value Chains in Zambia: A Study of Actors and Initiatives

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LIST OF ACRONYMS

8NDP	Zambia's eighth national development plan
AfDB	African Development Bank
AER	Agro-ecological region
BGFA	Beyond the Grid Fund for Africa
BGFZ	Beyond the Grid Fund for Zambia
CMS	Critical minerals strategy
CO2	Carbon dioxide
COP	Conference of the Parties
CRM	Critical raw materials
CSO	Central Statistical Office
DRC	Democratic Republic of Congo
ESG	Environmental, social and governance (standards)
EU	European Union
EV	Electric vehicle
FDI	Foreign direct investment
FPIC	Free prior and informed consent
FQM	First Quantum Minerals
GCF	Green Climate Fund
GDP	Gross domestic product
GEF	Global Environment Facility
Gg CO2 eq.	Carbon dioxide equivalent
GHG	Greenhouse gas
IAPRI	Indaba Agricultural Policy Research Institute
IDC	Industrial Development Corporation
IEA	International Energy Agency
IPP	Independent power producer
IRENA	International Renewable Energy Agency
JET	Just energy transition
KCM	Konkola Copper Mine
MMMD	Ministry of Mines and Mineral Development
MNDP	Ministry of National Development Planning
MoCTI	Ministry of Commerce, Trade, and Industry
MoF	Ministry of Finance
MoGEE	Ministry of Green Economy and Environment
MtCO2e	Metric tons of Carbon Dioxide equivalent
MW	Megawatts
NDC	Nationally determined contribution
NDP	National Development Plan
NEFCO	Nordic Green Bank
PPPP	Public, private and philanthropy partnership
REE	Rare earth elements
REEEP	Renewable Energy and Energy Efficiency Partnership
SADC	Southern Africa Development Community
SDG	Sustainable development goal
TEVETA	Technical Education, Vocational and Entrepreneurship Training Authority
UNDP	United Nations Development Programme
UNECA	UN Economic Commission for Africa
UNFCCC	UN Framework Convention on Climate Change
UNIDO	UN Industrial Development Organization
US	United States
USAID	US Agency for International Development
ZCCM	Zambia Consolidated Copper Mines
ZCM	Zambia Chamber of Mines
ZDA	Zambia Development Agency
ZESCO	Zambia Electricity Supply Corporation Limited

EXECUTIVE SUMMARY

This report explores the potential for Zambia to achieve a just energy transition (JET) by leveraging its critical minerals for renewable energy development while addressing social and environmental concerns. Data that informs this research was collected through analysis and review of literature, including published sources, government policies and frameworks, and other relevant primary and secondary sources. From this comprehensive data collection and analysis, this research found that Zambia's contribution to global greenhouse gas (GHG) emissions is minimal and that its nationally determined contributions (NDCs) emphasise renewable energy and energy efficiency. The research posits that developing a robust electric vehicle (EV) battery industry in Zambia can contribute to global GHG mitigation and domestic economic growth.

Expanding energy access, particularly through off-grid solutions, is crucial to addressing energy poverty and supporting rural communities in Zambia. Key to this research is the fact that to implement a just energy transition, Zambia requires robust regulations to ensure responsible mining practices, including adherence to environmental, social, and governance (ESG) standards.

The research notes the impact of various actors participating in the exploration of critical minerals and involvement in renewable projects, which shows a positive direction towards a sustainable Zambia. In this respect, fostering international partnerships remains essential for a successful JET in Zambia.

Emanating from these findings, this report, therefore, proposed key recommendations for Zambia, which include:

- **Critical Mineral Strategy:** Develop a comprehensive critical minerals strategy. Reform minerals and energy transition framework legislation: Strengthen regulatory frameworks for the critical minerals and energy transition sector.
- **Sustainability practices in mining:** Promote sustainable mining practices and social inclusion.
- **Renewable Energy Investments:** Invest in renewable energy sources like solar, wind and hydroelectricity.
- **Managing geo-economics:** Considering several cooperation agreements and partnerships, Zambia must forge international partnerships to increase technical and financial support, including the need to facilitate knowledge transfer in renewable energy and sustainable mining.
- **Skills Development and Capacity Development:** To move up value chains, Zambia needs to build local expertise and skills in sustainable practices, management, science, technology, engineering, and mathematics to support critical minerals exploration, mining, and beneficiation.
- **Affordable Climate Finance:** Seek access to climate finance and green investment funds to support green technology value chains such as the battery manufacturing initiative.

By implementing these recommendations, Zambia and its people will reap the benefits of a just energy transition, alleviating energy poverty and ensuring universal access to clean and affordable energy. This transition should be linked to broader socio-economic transformation to improve the livelihoods of mining workers and communities. This approach supports the well-being of citizens, enhances healthcare and education services, and fosters the growth of small and medium-sized enterprises.

1. INTRODUCTION

Climate change poses several risks to the world, such as increased frequency of floods, cyclones, and droughts. Zambia is facing its fair share of climate change loss and damage. Low rainfall in the Zambezi catchment area has threatened the country's hydro-energy, plunging Zambia into long episodes of load-shedding. However, climate change has presented opportunities for the green economy. The global transition from fossil fuels to clean energy has created a demand for green technologies. Strategic minerals are required as feedstock to manufacture the technologies, ranging from batteries for electric vehicles and other storage systems to opportunities to manufacture solar panels and wind turbines.

The strategic minerals, often called transition or critical minerals (terms that will be used interchangeably in this paper), including copper, cobalt, lithium, manganese, nickel, aluminium, graphite, and rare earth elements (REEs), are abundant in Zambia. This paper connects the presence of these minerals in Zambia to the critical question of beneficiation to the level of finished products in the renewable energy production and supply chain. The paper first explores Zambia's socio-economic and climate change risks and responses, followed by the energy mix, the strategic minerals profile, renewable energy actors and initiatives, and concludes with practical recommendations and conclusions.

The global transition from fossil fuels to clean energy has created a demand for green technologies. Strategic minerals are required as feedstock to manufacture the technologies, ranging from batteries for electric vehicles and other storage systems to opportunities to manufacture solar panels and wind turbines.

2. SOCIO-ECONOMIC SITUATION AND CLIMATE VULNERABILITY

2.1 DEMOGRAPHIC PROFILE

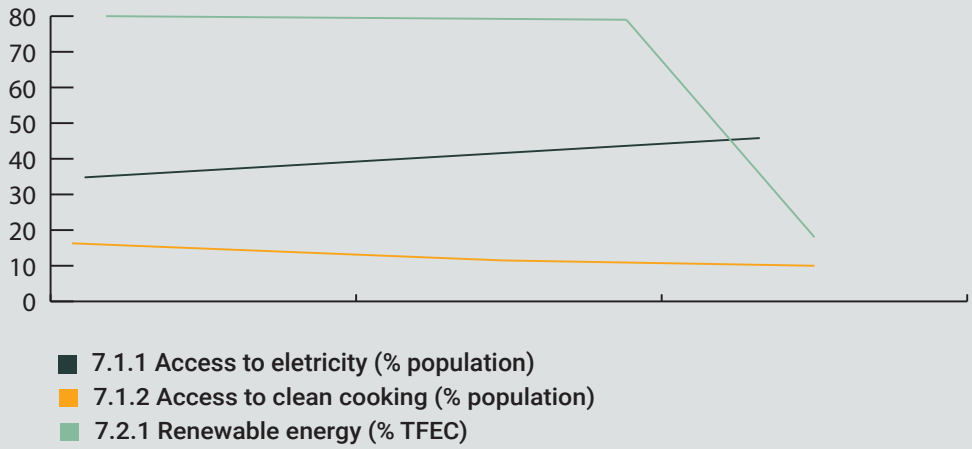
Zambia covers a total surface area of 752 614 km2, of which 99 per cent is land and 1 per cent is covered by water. The population of Zambia in 2010 was estimated at 13 092 666, representing a 32.5 percent increase compared to 9 885 591 in 2000 (CSO, 2018). Approximately 60.5 percent of the population lives in rural areas and 39.5 percent in urban areas. Zambia's agricultural sector is the rural population's socio-economic backbone, with 60 per cent dependent on the sector as their primary source of income and livelihood. Many of them are poor and engage in low-productivity rain-fed subsistence farming, having inadequate resources for purchasing inputs, inappropriate farming practices, and inability to fully develop the irrigation potential. These challenges are exacerbated by the increased frequency of extreme weather events such as rainfall variation, floods, and droughts caused by climate change.

2.2 ENERGY ACCESS

According to the International Renewable Energy Agency (IRENA), about 47 per cent of Zambians have access to electricity (see Figure 1). This leaves most rural and urban poor living in energy poverty, characterised by populations deprived of electricity for lighting, cooking, and heating. In addition to disproportionately impacting poor and marginalised households, energy access has recently affected the entire population and the economy due to load shedding, as generation capacity in the Kariba Dam has been affected by low rainfall in the Zambezi catchment area in Northern Zambia. ZESCO Ltd has effected load shedding, with citizens facing eight hours per day without power. According to the United Nations, Zambia has experienced some of its worst droughts and floods in the last two decades. This makes Zambia a climate-vulnerable country. Recent climate trends based on records from 1960 to 2003 indicate that mean annual temperature has increased by 1.3 degrees Celsius since 1960, an average rate of 0.34 degrees Celsius per decade. Temperature extremes in Zambia indicate patterns of warming increases in annual daily maximum temperature and mean temperature, which were higher in Agro-ecological Region (AER) I and lower in AER II.

The mean rainfall over Zambia has decreased by an average rate of 1.9 mm/month (2.3 per cent) per decade since 1960. Rainfall records have shown that southern Zambia experienced below-average rainfall from 1886 to 1925 and above-average rainfall between 1926 and 1970, expected to increase in the future in AER I and decrease in AER II and AER III. The future trends in the country are toward a higher average temperature and a possible decrease in total rainfall. Information from vulnerability assessment (Emerald Environment Limited and GIS Siavonga Limited, 2021) points to increased inter-annual variability in the frequency and distribution of rains, with extremely wet periods and more intense droughts in the future.

Figure 1: Access to Energy in Zambia.



Source: IRENA

2.3 ENERGY POVERTY: WOOD FUELS AND FORESTRY

Lack of access to electricity has increased pressure on the country's forests, negatively affecting the natural environment and carbon sinks.

While Zambia's forests continue to be under tremendous pressure from several activities such as clearance of land for agriculture, mining, and human settlements, timber and wood harvesting for fuel, wood, and charcoal have been driven by the need to access energy. The deforestation rate has been increasing from 300 000 hectares per annum to 800 000 hectares per annum. About one-sixth of the rural population depend heavily on forests and non-forest resources for their livelihood, contributing approximately 20 percent to rural household incomes. However, for as long as there is energy poverty, rural populations and sections of the urban poor will continue to rely on wood for cooking and heating.

Zambia's energy transition strategies will have to factor in the need for more innovative renewable energy sources, such as solar and wind technologies, to be accessed at a cheaper and more feasible level for off-grid communities.[1] This should be done through mini-grids, battery storage systems, and local manufacturing of green technologies to reduce the cost of deployment of renewable energy. These solutions are further addressed under the section on a just energy transition.

Whilst Zambia's forests continue to be under tremendous pressure from several activities such as clearance of land for agriculture, mining, and human settlements, it is timber as well as wood harvesting for fuel wood and charcoal that has been driven by the need to access energy.

[1] Oxfam, "Reducing Energy Poverty: The Beyond the Grid Fund for Zambia" (06/01/2021)

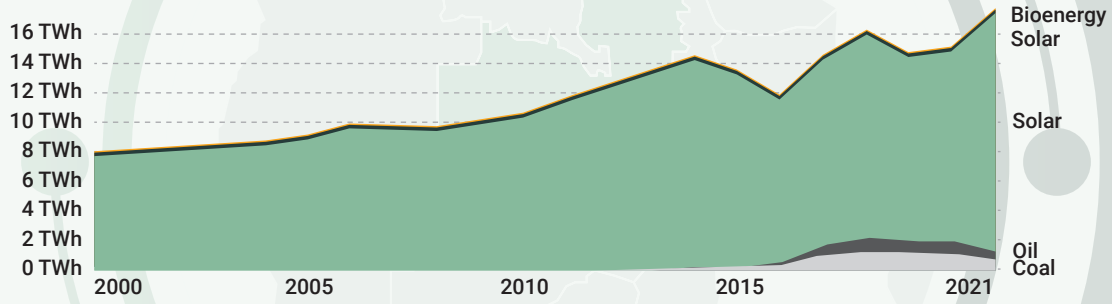
3. ZAMBIA'S ENERGY MIX

Zambia's installed electricity generation capacity is 2800MW. About 90 per cent of this is hydro based. The electricity market is dominated by the state-owned enterprise Zambia Electricity Supply Corporation Limited (ZESCO) and a few private sector companies that generate, transmit, and distribute electricity. Based on a commitment to achieve universal access to electricity, there is a deregulation of the electricity market and new independent power producers (IPPs) are entering the market with on-grid and off-grid operations.

3.1 RENEWABLE ENERGY: HYDROELECTRICITY GENERATION AND OTHER GREEN SOURCES

Water is a direct input to renewable energy in Zambia, so improved water resources development and management (MNDP, 2017) is identified as the seventh of ten critical prioritised development outcomes for realising the strategic direction of the Eighth National Development Plan (8NDP). The country is divided into six catchments on water resources, providing headwaters for the Zambezi and Congo rivers. Water resources have the potential to generate about 6000 megawatts (MW) of energy, although in 2016, only 2742MW was generated, 97 per cent of which was from hydro and 3 per cent from other energy sources (woodlands and forests, coal, and renewable sources such as solar, wind and geothermal energy).

Figure 2: Electricity Generation by Source



Source: Our World in Data[2]

Water (hydropower) is the primary energy source, accounting for over 90 per cent of Zambia's electricity production, with the primary source of renewable water being rainfall. However, due to high temperatures and high evapo-transpiration because of climate change, Zambia has a precipitation deficit of 100 to 1100mm and is therefore vulnerable to climate change. Inadequate incentives to attract investments in the energy sector, along with the effects of climate change (e.g., low rainfall), make Zambia's high dependence on hydropower unreasonable, despite the envisaged growth of other sources of energy to about 15 per cent by 2030.

3.2 FOSSIL FUELS CONSUMPTION

Zambia's total energy consumption includes electricity generation, transport, and heating. The country consumes many fossil fuels, including coal, oil, petroleum, and natural gas. Although the percentage of fossil fuels is relatively low, this remains significant regarding GHG emissions and air pollution.[2] In its nationally determined contribution (NDC), Zambia has made climate mitigation commitments to reduce the consumption of fossil fuels in its energy mix, replacing these with an increased share of renewable energy sources.

It is evident water (hydro power) is the main source of energy accounting for over 90% of Zambia's electricity production with the main source of renewable water being rainfall.

[2] https://ourworldindata.org/energy/country/zambia
[3] Hannah Ritchie, Max Roser and Pablo Rosado (2020) - "CO_2 and Greenhouse Gas Emissions"(Published online at OurWorldInData.org.) https://ourworldindata.org/co2-and-greenhouse-gas-emissions' accessed 16

4.MINING AND TRANSITION MINERALS IN ZAMBIA

Zambia is home to several transition minerals, most of which remain unexplored. Zambia's top critical minerals are copper, cobalt, nickel, manganese, and lithium, used in many technologies and industrial sectors.

Figure 3: Critical minerals locations in Zambia and lithium in the Congo DR

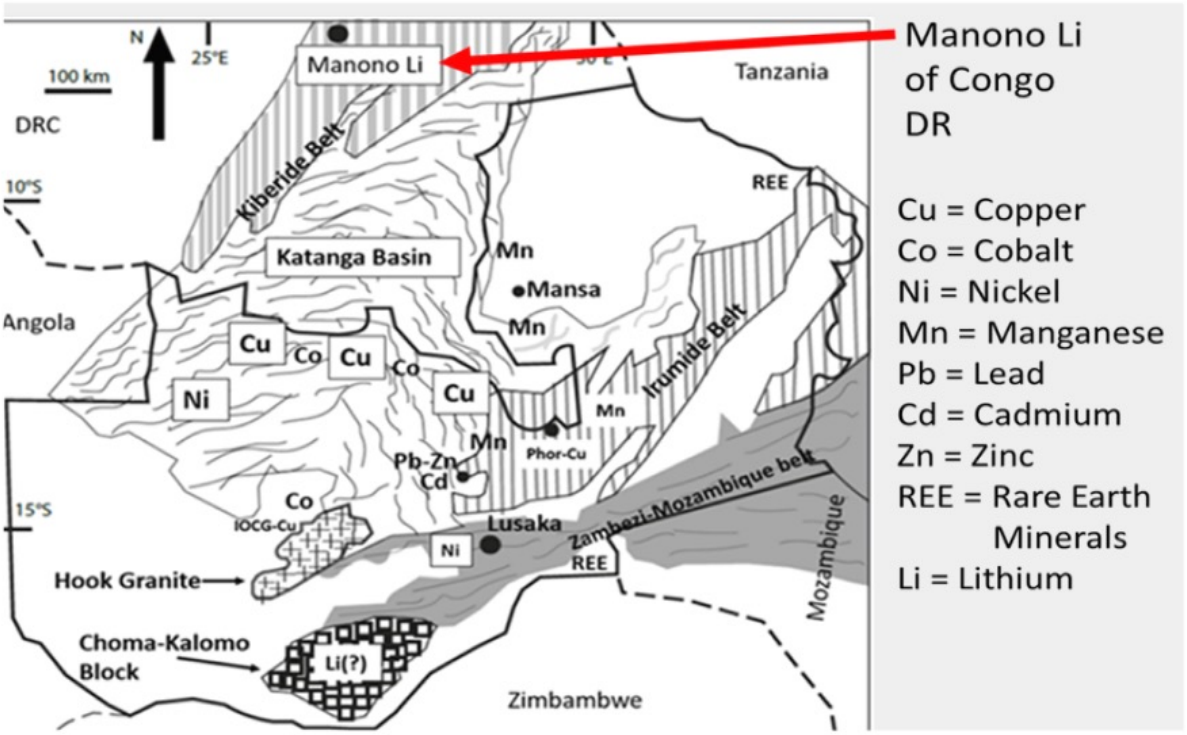


Figure 3 above gives other potential locations for minerals in Zambia, including manganese (Luapula and Central provinces), rare earth elements (Isoka District—Nkombwa Hill; Luangwa District—Rufunsa Carbonatite; Lusaka—Mkwisi Carbonatite; Kafue—Kesya Carbonatite), and lithium (Choma-Kalomo block—Southern Province). Six major battery-based critical minerals (metals) mined and known to occur in Zambia are summarised in Table 1 below. This has informed the establishment of special economic zones where battery plants will be set u to refine minerals to the purity needed to make batteries, thereby creating jobs.

Table 1: Six major battery-based critical minerals (metals) mined and known occurrences in Zambia

Parameter/ Metal	Copper	Cobalt	Manganese	Nickel	Graphite	Lithium
Mining Location	Copperbelt Mines, Lumwana, FQM's Sentinel Mine, Northwestern Province	DRC is the largest producer in the region (68% globally) & Zambia is a significant producer – Copperbelt mines.	Chipili, Mansa, Luapula Province, Mkushi, Serenje; Central Province.	Munali Mine – Southern Province, Kulumbila Mine, Northwestern Province, Major global Indonesia, Canada, and Australia.	Known occurrences Eastern, Central, Northwestern & Southern Provinces, Mozambique in Southern Africa.	Discovered in Mapatizya area of Zambia in 2023, Southern Province. Manon, DRC
Capacity	Zambia-DRC's production capacity is subject to market demands and mining operations.	Zambia and the DRC have global cobalt supply, with production capacity subject to market demands and mining operations.	Over 40 million tonnes starting to mine in Zambia. South Africa – largest producer over 36% of global production).	The new FQM Zambia nickel mine is now the largest nickel mine in Africa.	The production capacity for graphite varies with market demand.	None in Zambia Bikita Mine, 412,000tpa; Arcadia Mine, 400,000 tpa, Zimbabwe.
Purity in EV Batteries	High-purity copper 99.99% cathodes refined at Nkana after smelting at Mufulira Mopani & Nchanga, KCM.	High-purity cobalt (98.8% or higher) to ensure optimal performance and safety.	High purity to meet specific standards for lithium-ion batteries.	High-purity nickel (9.8% or higher) to ensure optimal performance and longevity.	High-purity graphite is crucial for lithium-ion batteries, often requiring a purity of 99.95%.	High-purity lithium carbonate is essential to produce performance battery cathodes.
Form/State	Copper foil for Lithium Ion Battery (LiB) is a key material of EVs.	Cobalt is used as lithium cobalt oxide (LiCoO2) in the cathodes of lithium-ion batteries.	Often used in lithium-ion battery cathodes, such as lithium manganese oxide (LiMn204)	Nickel-cobalt-manganese (NCM) or nickel-cobalt-aluminium (NCA) are part of the cathode material in lithium-ion batteries.	Graphite is used as an anode material in lithium-ion batteries.	Lithium Carbonate in Battery Manufacturing from lithium brine or spodumene.

Rare earth element (REE) deposits are of different types, mainly occurring in carbonatites (the world's largest resources of REE), alkaline igneous systems, vein and skarn, ion-adsorption clay deposits, placer deposits (mineral sands), bauxites, laterites and in coal deposits.

With a renewed commitment to democratic principles, growing bilateral relationships with high-income countries, abundant clean energy potential, and critical resources necessary for the global energy transition, Zambia is well-positioned to leverage its strengths to build a low-carbon, reliable energy system that will spur economic growth and close the poverty gap.[4]

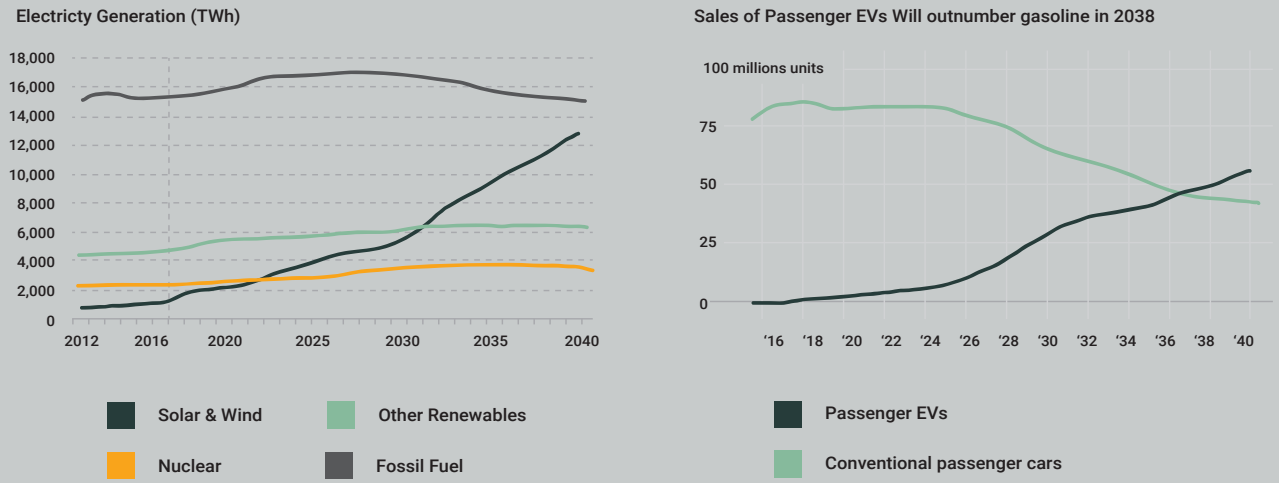
[4] Maia Sparman and William Tobin, "Country spotlight: Unlocking a high-energy future for Zambia". <https://www.atlanticcouncil.org/blogs/energysource/country-spotlight-unlocking-a-high-energy-future-for-zambia/#:~:text=With%20renewed%20commitment%20to%20democratic%20principles%2C%20growing%20bilateral,spur%20economic%20growth%20and%20close%20the%20poverty%20gap.> accessed 17 April 2024.

5. THE GLOBAL ENERGY TRANSITION AND ZAMBIA'S STRATEGIC MINERALS ENDOWMENT

5.1. GLOBAL SUPPLY CHAINS AND THE DEMAND FOR CRITICAL MINERALS

The UN Climate Change Conference of the Parties (COP28) held in 2023 agreed to reducing the use of fossil energy and attaining net zero emissions by the middle of this century. Global commitments like these are accelerating the adoption of clean energy technologies and the demand for energy transition minerals. With this impetus, clean energy technologies are now growing and set to overtake fossil fuels before the end of this century (Figure 4).

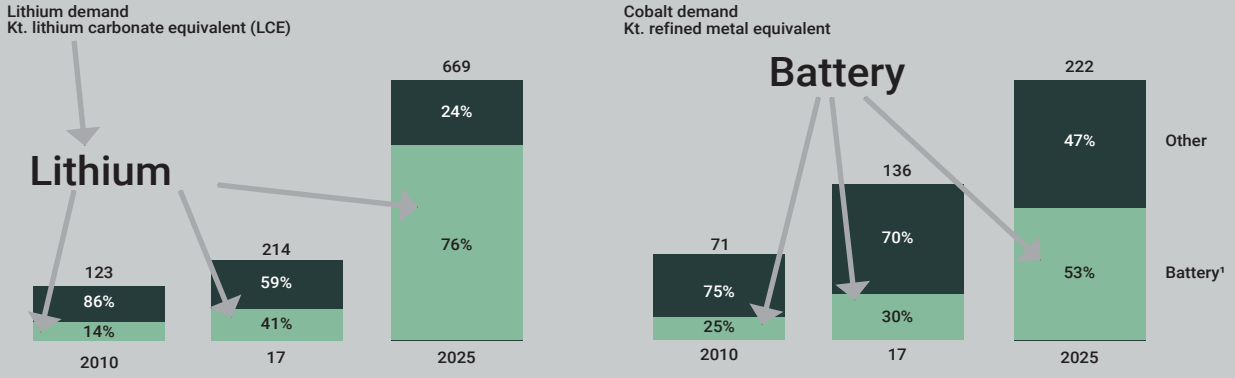
Figure 4: World Demand growth of clean energy technologies to eventually overtake fossil fuels sales



from Bloomberg BusinessWeek, 2017; Bloomberg New Energy Finance, 2017

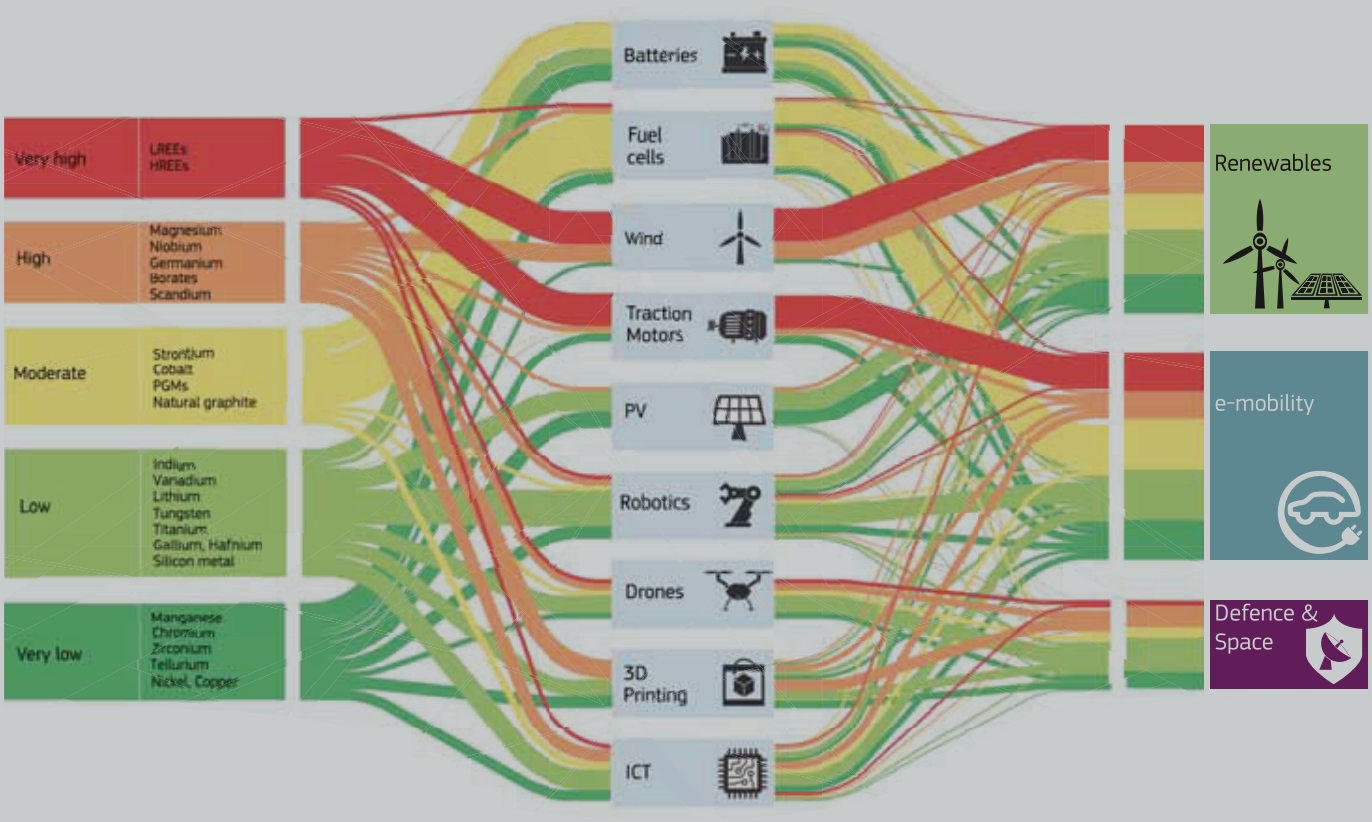
The demand for energy transition minerals is rising. Because clean energy technologies consume specific metals, the demand for these is expected to rise by 500 per cent by 2050. The world will need to extract 3 billion tonnes of these minerals to meet demand (World Bank, 2020). For metals like lithium (Li) and cobalt (Co), this energy transition is already the driving force behind their growing demand (Figure 5). A breakdown of inputs into a typical EV battery pack demonstrates the quantity of minerals required: about 8 kilograms of lithium, 35 kilograms of nickel, 20 kilograms of manganese, and 14 kilograms of cobalt. Infrastructure, such as battery charging stations, requires copper. In respect of renewable energy, solar panels use large quantities of copper, silicon, silver, and zinc. Wind turbines require iron ore, copper, and aluminium. Hence, the energy transition has created an unprecedented demand for critical minerals, which is projected to grow through increased renewable energy consumption to meet the Paris Agreement net-zero target by 2050.

Figure 5: Lithium and cobalt demand evolution split by battery and other applications.



The exploration, extraction, and demand growth of critical raw materials (CRMs) will secure Zambia's strategic economic sectors based on competitive participation in an industrial EV battery supply chain. Multiple technologies and sectors (Figure 6) need these raw material resources, which are critical for the clean energy transition and effectively compete with one another (IEA, 2021).

Figure 6: Use of the CRMs in multiple technologies and sectors (EU, 2020)



From the above examples of clean energy technologies, Zambia's policy focuses on integrating the country's critical minerals into the global electric vehicle value chain by manufacturing lithium-ion batteries locally. The transition to clean energy technologies offers economic benefits to resource-rich countries like Zambia (World Bank, 2020). Zambia is already a major supplier of some clean energy mineral commodities, but demand is set to rise.

In response to the surge in demand for critical minerals, Zambia is ramping up its investments in exploration activities to optimise its production and supply capacity. Measures are being taken to boost copper production, aiming to increase annual copper output to 3 million tonnes in the next decade from 830 000 metric tons. The scaling up of copper production is supported by the World Bank and is part of Zambia's Energy Transition Minerals Road Map and the Critical Mineral Strategy.[5] Reuters reports that Zambia's copper output could rise to about 1 million tons by 2026. Companies such as Canadian-owned First Quantum Minerals (FQM) have recently invested in expanding production at their mines.[6] Overall, the increase is aligned with the strategy to add value to the minerals, a move aligned with industrial-scale renewable energy initiatives to manufacture green technologies such as electric batteries. Value addition is an important de-risking exercise as raw minerals markets are uncertain. A 2024 IEA Critical Minerals Outlook states that the critical minerals market experienced turbulence in 2023, with the main story being falling prices: "Battery minerals saw particularly large declines with lithium spot prices plummeting by 75% and other key materials such as nickel, cobalt, manganese, and graphite seeing declines of 30-45%."[7] Copper was the exception, as prices remained relatively resilient. However, despite demand growth, the IEA reports the market size for energy transition minerals contracted by 10 per cent to US$325 billion in 2023.[8]

[5] Copper Belt Katanga Mining, "Zambia and World Bank Partner to Boost Copper Production" (Copper Belt Katanga Mining, February 28, 2024) <https://copperbeltka-tangamining.com/zambia-and-world-bank-partner-to-boost-copper-production/> accessed 16 April 2024.)
[6] Reuters, "Zambia's copper output may rise to 1 million tons by 2026 as mines expand" (April 5, 2024)
[7] IEA, "Global Critical Minerals Outlook 2024: Market review", <https://www.iea.org/reports/global-critical-minerals-outlook-2024/market-review> accessed 20 May 2024.
[8] Ibid

6.RENEWABLE ENERGY INITIATIVES IN ZAMBIA

6.1. DRC COOPERATION AGREEMENT ON CRITICAL MINERALS

In May 2022, Zambia and the DRC signed a bilateral trade cooperation agreement for the local manufacture of electric batteries. As noted above, Zambia has significant amounts of copper, nickel, and manganese. The DRC has over 70 per cent of the world's known cobalt reserves; the two neighbouring countries have a unique opportunity to beneficiate their minerals in response to the developing multi-trillion-dollar electric vehicle battery industry.

6.2. PUBLIC, PRIVATE AND PHILANTHROPY PARTNERSHIPS AND THE BGFZ

The Zambian government and other stakeholders have been supporting the development of a more off-grid and private-sector investment-friendly regulatory environment. Initiatives such as the Beyond the Grid Fund for Zambia (BGFZ), launched in 2016, exemplify philanthropy-led efforts to bring modern, affordable energy services to households.[9] The BGFZ targeted at least 192 000 households (about one million Zambians) by 2021. It was funded by Sweden and implemented by the Renewable Energy and Energy Efficiency Partnership (REEEP).[10] As a model of energy access financing, the initiative demonstrates a public-private-philanthropy partnership (PPPP) designed to accelerate private-sector growth in energy generation and distribution in Zambia, improve livelihoods, and catalyse economic activity in rural and peri-urban areas. In September 2021, the target was reached. The initiative was scaled up into the Beyond the Grid Fund for Africa (BGFA) in 2019, benefitting five additional countries.

[9] Ibid
[10] REEEP states on its website that it has managed over €60 million in public funds through core funding and programmatic activities with contributions from the governments of Austria, Australia, Canada, Germany, Ireland, Italy, Netherlands, Norway, Sweden, Switzerland, Spain, United Kingdom, United States and the EU, as well as from international organisations and international financial institutions such the World Bank, UNIDO and NEFCO.

7. STAKEHOLDER MAPPING AND ANALYSIS

In Zambia, various stakeholders, such as the EV battery chain industry, are already involved in renewable energy projects linked to critical mineral value addition, but the scale is not edifying. This section will explore stakeholder mapping and analysis focusing on governments, quasi-government institutions, international cooperating partners, the private sector, civil society, communities, and the media.

7.1. GOVERNMENT AND QUASI-GOVERNMENT INSTITUTIONS

Zambia's draft National Critical Minerals Strategy: 2024-2028 (CMS) is being developed through a multi-stakeholder process and steered by the Ministry of Mines and Minerals Development (MMMD). The strategy is aligned with Zambia's 2022-2026 Eighth National Development Plan (8NDP), 2022-2027 National Mineral Resources Development Policy, and the Zambia 2022-2026 Mines and Minerals Development Strategic Plan. The draft CMS aims "to harness and utilise the critical minerals to support Zambia's socio-economic development towards the attainment of an industrialised middle-income country by 2030.". It is worth noting that the presidency has been strategic in promoting the country's green industrialisation strategies through critical minerals beneficiation. More executive coordination is achieved through the support of the following line ministries: Finance and National Planning; Commerce, Trade and Industry; Green Economy and Environment; Foreign Affairs and International Cooperation; and Higher Education.

Table 2: Government and Quasi-Government Institutions

No.	Description	Role
	Government	
1.	Ministry of Commerce, Trade, and Industry (MoCTI)	The role of government ministries is critical. This includes regulatory support for renewable energy value addition. For example, the MoCTI and other key ministries oversee the EV battery supply chain industry. It implements policies and disseminates information through the ministries' public relations offices. The MMD is developing a Critical Minerals Strategy to define a coherent strategy for beneficiation activities.
2.	Ministry of Finance and National Planning	
3.	Ministry of Small and Medium Enterprise Development	
4.	Ministry of Green Economy and Environment	
5.	Ministries responsible for Education, Science and Technology	
6.	Ministry of Mines and Minerals Development	
7.	Ministry of Energy	
8.	Foreign Affairs and International Cooperation	
9.	Ministry of Transport and Logistics	
	Quasi-Government Institutions	
10.	Industrial Development Corporation (IDC)	Mobilisation of industrial and investment partnerships between local and foreign industrialists within the scope, for example, of the EV battery initiative.
11.	Zambia Development Agency (ZDA)	
12.	Ndola City Council	Land use licensing and planning for special economic zone

The work of central government agencies is supported by specialised agencies such as the Industrial Development Corporation and the Zambia Development Agency. This brings into focus the need for better public coordination and coherence in promoting transition minerals. The localisation of green initiatives is dependent on local governance, especially authorities in the Copperbelt region such as Ndola City Council. Local authorities have been central and will continue to be vital as the Zambian EV initiative will be implemented through special economic zones, impacting on land use licensing, planning and infrastructure development. What is important is for better government coordination to ensure that policy uncertainty in renewable energy supply chains is addressed to facilitate clean energy initiatives in Zambia.

7.2. FDI AND PRIVATE SECTOR INVOLVEMENT IN RENEWABLE ENERGY VALUE CHAINS

Due to the energy transition, renewable energy has attracted investor interest in Africa. However, the continent still accounts for less than 1 per cent of the billions invested in renewables worldwide. The Zambian government, supported by the international community and donors, has been promoting foreign direct investment (FDI) as a key policy objective for critical minerals and renewable energy investments. Policy incentives such as special economic zones are key to Zambia's quest to attract FDI flows. Accordingly, the role of the private sector is important mobilising capital for the manufacture of green technologies. However, Zambia's manufacturing sector is under-capacitated to supply green technology in the context of the current high demand.

7.2.1. Concentration Upstream of the REN Value Chain

Zambia's manufacturing sector contributes to about 8 per cent of the country's GDP and has been on a growth path. However, Zambia's private sector is concentrated upstream of the renewable energy value chain, concerning supply chain activities such as extracting and sourcing raw material inputs and sending these to manufacturers. There is a sizeable number of manufacturing activities linked to energy transition minerals, most notably in copper.

There is, therefore, a gap in industrial processing for manufacturing finished green technologies in the country. Whilst Zambia's EV battery manufacturing initiatives have attracted a lot of attention, mainly due to high profile bilateral and multilateral cooperation, there is hardly any mention of specific projects involving private sector investment or participation in the initiative, especially in the envisaged special economic zones. The role of private sector investment promotion bodies such as the Zambian Chamber of Mines, Zambia Chamber of Commerce and Industry and the ZCCM Investment Holdings (a successor company to Zambia Consolidated Copper Mines Limited, ZCCM Ltd).

Table 3: Private Sector and State-Owned Enterprises Roles and Initiatives

No.	Name of Stakeholder	Role
1.	Zambia Chamber of Mines (ZCM)	ZCM is registered as an association for mining and allied companies, large and small. It liaises with the government to increase local levels of inclusion in mining.
2.	Zambia Chamber of Commerce and Industry	Advocacy, policy influence, networking and business development
3.	ZCCM Investments Holdings Plc	Ensures responsible and transparent management of Zambia's mineral resources, investments and partnerships.
4.	Group of 7 Partnership for Global Infrastructure and Investment (PGI) Lobito Corridor Private Sector Investor Forum	Partnership for Global Infrastructure and Investment (PGI) Lobito Corridor Private Sector Investor Forum is an example of local and international platforms for investment mobilisation to support renewable energy infrastructure development. On 8 February 2024, the PGI Investor Forum brought together over 250 business and government leaders from Angola, the DRC, the EU, the US, and Zambia, international investors and industry leaders to accelerate private sector investment in the Lobito Corridor, which includes cooperation on critical minerals and designed to connect the DRC and Zambia with global markets through Angola.

Most importantly, successful energy transition will involve clarity on manufacturing initiatives. These will involve both domestic and international capital investment into renewable energy value chains.

7.2.2. Renewable Energy Manufacturing Initiatives in Zambia

Opportunities for energy transition minerals beneficiation are demand-driven, but heavily constrained by supply side constraints such as lack of capital and unreliable energy. As already indicated, the clean energy transition is raising demand linked to deployment of renewable energy technologies such as solar, wind and hydroelectricity. Electrification relies on grid capacity, and, among others, Zambia's electrical cables and wires manufacturing industry has an opportunity to grow as part of the energy transition. The ZamCables and Metal Fabricators of Zambia Plc (ZAMEFA) are among the prominent manufacturers of cable solutions (copper and aluminium) that have a market presence spanning the SADC region and expanding to sub-Saharan Africa in general.

Table 4: FDI, Corporate Sector REN Actors and Initiatives

No.	Manufacturer	Ownership	Capabilities in the REN Value Chain
1.	ZamCables Manufacturing	Zambian Company (shareholding details not obtained).	Provides cable solutions that cater to the needs of power utility companies and engineering, procurement and construction (EPC) contractors. It manufactures and supplies overhead aluminium conductors, aerial bundle conductors (ABC), and cable accessories in Zambia and in neighboring sub-Saharan African countries. Their line of products includes all aluminium conductors (AAC), all aluminium alloy conductors (AAAC), aluminium conductors steel reinforced (ACSR), and a complete range of LV/MV cable and conductor accessories. On its own account, the company states that it has installed state-of-the-art manufacturing equipment and laboratory facilities. It also indicates that it has experienced personnel and is therefore competitive. It supplies both the domestic and the African market.
2.	Metal Fabricators of Zambia Plc (ZAMEFA)	The company is publicly listed on the Lusaka Stock Exchange (LuSE). The holding company for ZAMEFA is Reunert Ltd of South Africa, listed on the Johannesburg Stock Exchange. Reunert Ltd holds its investment in ZAMEFA through its wholly owned subsidiary, Reunert International Investments (Mauritius) Ltd incorporated in Mauritius.	It has capability to process copper cathode as an input raw material and produce cable as a finished product. It is strategically situated in the Copperbelt and has cable production programmes. Copper cathode is a pure form of copper used to manufacture various copper products. There is value addition in that the cathode is produced by refining raw copper ore through electrolysis. In the REN value chain, the copper cathodes work as raw material feedstock for the production of high purity copper and copper alloy products.
3.	Vedanta	In Zambia, Vedanta is represented by Vedanta Resources Holdings Ltd and the Zambian subsidiary Konkola Copper Mines (KCM), the country's largest integrated copper producer, with an entire production value chain comprising open pit and underground mines, concentrators, a state-of-the-art smelter, tailings leach plant, and a refinery. It has operations in four locations (Chingola, Chililabombwe, Nampundwe, and Kitwe) playing a key role in the communities around these mining areas. The company's product or service includes copper cathodes, copper-cobalt alloys, sulphuric acid, pyrite, and anode slimes. In the envisaged deal, Vedanta will hold 60% of the equity in the JV while Foxconn (Taiwanese company) will own 40%. Foxconn is the world's leading and largest electronics manufacturer and technology solution provider	Vedanta is considering the prospect of investing in the EV battery manufacturing sector in the context of the DRC-Zambia initiative. it signed a memorandum of understanding with the Indian state of Gujurat to set up a semiconductor fabrication plant commonly referred to as a fab unit, a display fab unit, and a semiconductor assembling and testing unit in Ahmedabad in western India and replicating it in Zambia.

No.	Manufacturer	Ownership	Capabilities in the REN Value Chain
4.	Kobaloni Energy	The Zambian company seeks to produce EV batteries using a new source of high quality, processed, and traceable cobalt to help diversify global supply chains. It will produce an initial 6000 tpa of cobalt sulphate (metal contained) from its refinery. AFC signed an expression of interest with Kobaloni Energy to provide $100 million in financing for a cobalt refinery in Chingola, Zambia, with the objective of building the first electric vehicle battery grade cobalt sulphate plant on the African continent.	The company aims to produce cobalt for 1 million EVs per year and seeks to double capacity in Phase II. It is developing Africa's first cobalt sulphate refinery to supply reliable, traceable battery grade cobalt for electric vehicles. The company is located close to sources of feedstock and notes its capacity to supply global automotive customers, reducing the time to market, transport costs, and emissions. It indicates its sustainability credentials as its use of renewable energy to power its operations and producing zero waste. It has completed a Class 3 feasibility study, and it is backed by Vision Blue Resources of the United Kingdom.
5.	REV-UP Solar Ventures Zambia	This is a US-Zambia Joint Venture developing a portfolio of solar plus storage IPP projects in Zambia. Its core team includes former senior officials of the US government's Department of Energy, the World Bank Group, the White House, and the Zambian mineral and energy sectors.	The United States Trade and Development Agency (USTDA) announced a feasibility study grant to REV-UP Solar Ventures Zambia to develop an estimated 200-megawatt solar power plant and battery energy storage system in Solwezi, Zambia. The project will supply clean, stable electricity to Zambian industry and households and has the potential to provide power for two critical mineral mines in the DRC.
6.	China Non-Ferrous Metals Mining Group Company (CNMC)	Investment in critical minerals projects.	In September 2023, China Non-Ferrous Metals Mining Group Company (CNMC) announced an additional $1.3 billion investment in Zambia over five years across diverse sectors. The investments were to be to investment portfolio that included commitment to critical minerals projects: 1) an investment of $400 million to the Chambeshi copper mine project, 2) $600 million for the reopening of the number 28 shafts at the Luanshya copper mine and 3) $200 million allocated towards Sino metals and other warehousing projects, including support for corporate social responsibility initiative to expand Luanshya vocational training school in line with support to support the education, science, and technology sectors.
7.	Sinomine	Chinese public sector company	Historically provided geological, engineering and logistics services to mining firms and started producing copper in Zambia on its own account for the needs of Chinese industry in 2024.
8.	Jiangxi United Limited	Investment Agreement: The Zambia Development Agency (ZDA) signed an Investment Promotion and Protection Agreement (IPPA) with Jiangxi United Limited for the operation and construction of the MFEZ1. This agreement aims to promote investment.	This is an important initiative for energy transition mineral value addition and has been involved in recent investments in battery storage. The launch of the Jiangxi Multi Facility Economic Zone in Chibombo district aims at car battery production by the end of July 2024. This is a milestone in the country's renewable energy manufacturing value chain. Essential battery manufacturing equipment has already been imported, with equipment testing and plant finalisation. The facility intends to manufacture 400 000 batteries in the initial phase and 800 000 when fully operational. The facility has nine investment agreements that include electricity cable production, with additional equipment from Jiangxi Copper, China.
9.	Zambia Association of Manufacturers	ZAM is a business association which represents the interests of the entire manufacturing sector and other related economic and production sectors in Zambia.	Private sector to play its role in mineral beneficiation.

The above initiatives represent tangible projects for Zambia's critical minerals and the general renewable energy value chain. The projects are led by the private sector and are backed by either western governments or China. In the region, there are also South African companies such as ZAMEFA, which is listed on the Johannesburg Stock Exchange, and Rainbow African Minerals. Canada has First Quantum Minerals (FQM), a mining and exploration company; Vedanta Resources is an Indian diversified metals and mining group; Glencore, the Swiss-based commodity-trading and mining company; Eurasian Natural Resources Corporation, headquartered in London; and Vale of Brazil.

In as much as these players and initiatives have a face value of geo-economics, geo-politics is intensifying competition among industrialised countries for control of critical minerals.

7.3. GEO-POLITICS: THE ROLE OF INTERNATIONAL TRADE AND INVESTMENT COOPERATION

Zambia has signed several agreements to promote the beneficiation of its battery minerals. The most prominent international agreement is the DRC-Zambia Cooperation Agreement. The two countries have formed a DRC-Zambia Battery Council to oversee the implementation of the cooperating agreement. This agreement seeks to reverse the historic status of Africa's mining economies from exporters of cheap raw materials to value addition through the manufacture and supply of battery precursors. On the back of this bilateral agreement, Zambia is part of the memorandum of understanding (MOU) between the US, DRC, and Zambia concerning the support for developing a value chain in the EV sector. The country is also a beneficiary of the AfDB-UNECA MOU to finance the EU-Zambia-DRC project.

Table 5: The Role of International Cooperating Partners

No.	Name of Stakeholder	Role
1.	DRC-Zambia Battery Council	The DRC-Zambia Battery Council will oversee the implementation of the cooperating agreement for the electric car battery value chain, which will benefit the two countries.
2.	DRC-Zambia-USA Trialateral MOU	The MOU recognises that EV battery manufacturing would help the international community reduce carbon emissions and support the Paris Agreement's aim to strengthen the global response to climate change, including by holding the increase in the global average temperature to well below 2 degrees Celsius above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 degrees Celsius
3.	Zambia, DRC and Angola Lobito Corridor Transit Transport Facilitation Agency agreement	Lobito Corridor Transit Transport Facilitation Agency agreement signed by the three African governments in January 2023.
4.	The African Export-Import Bank (Afreximbank) and the United Nations Economic Commission for Africa (UNECA)	The parties signed a framework agreement with the DRC and Zambia to establish special economic zones (SEZs) to produce battery electric vehicles (BEVs) and related services.
5.	EU-Zambia and others to develop the Lobito Corridor. The other partners are the US, Angola, DRC, African Development Bank and Africa Finance Corporation (AFC).	On 26 October 2023, Global Gateway Forum in Brussels, Belgium, the US and the EU committed to work with Zambia, Angola, and the DRC to develop the Lobito Corridor which connects southern DRC and northwestern Zambia to regional and global trade markets via the Port of Lobito in Angola. This initiative includes investment and technical support for the development of clean energy projects to support diversified investment in critical minerals and clean energy supply chains. AFC will work with the parties to launch the feasibility and preparatory studies necessary to further prepare this extensive infrastructure project.
6.	UK-Zambia Energy	The British government agreed to a partnership with Zambia covering clean energy and critical mineral supply worth more than $3.7bn (£2.91bn).

While the role of the above global actors is unclear, DRC and Zambia must be mindful of the geopolitics at play. According to the Africa Report, there is growing evidence that the US is turning to Africa to diversify the supply chain for the strategic minerals critical to the green energy revolution.[11] Zambia is one of the countries the USA has turned to, as expressed through the trilateral agreement among Zambia, the DRC, and the USA.[12]

[11] Folashadé Soulé, "What a U.S.-DRC-Zambia Electric Vehicle Batteries Deal Reveals About the New U.S. Approach Toward Africa" (The Africa Report) <https://www.theafricareport.com/243847/us-looks-to-africa-to-diversify-supply-chain-for-critical-minerals/> accessed 6 April 2024.
[12] Ibid

7.4. INVESTMENT IN RESEARCH AND INNOVATION CENTRES AND GEOLOGICAL COLLABORATION

The challenges that threaten the growth of the battery sector in Zambia include the unavailability of relevant skills. The skill base required to operate and support renewable energy value chains does not exist in the country to the extent required. It is necessary for the planners of vocational and university training to urgently develop and implement the appropriate curricula so that the country can acquire the necessary human capital. In the short term these skills will need to be imported. For example, the University of Zambia's Geology Department has decided to provide capacity building as part of a project called Mines of the Future. This project has chosen, among other initiatives, to focus on the battery value chain. The university participates in the DRC-Zambia Battery Council, which is supporting capacity building work, including scientific knowledge, for the initiative.

Table 4: Research and Academic Institutions

No.	Name of Stakeholder	Role
1.	University of Zambia	Battery Research and Innovation
2.	Copperbelt University	• Battery research and innovation • Skills training • Community training • Research on socio-economic and environmental impacts
3.	TEVETA	Technical skills training

Research and academic institutions in Zambia are essential in providing battery research and innovation. For example, the University of Zambia is part of a collaboration of energy transition minerals coordinated by the AGEMERA (Agile Exploration and Geo-modelling for European Critical Raw Materials) for geological and geophysical data to facilitate the use of new methods in minerals exploration, validation and data analysis. The EU-funded AGEMERA project seeks to perform local geological and geophysical surveys to map CRM resources in six EU member states and Zambia. The initiative will specifically focus on data to enhance the genetic mineral system models of deposits containing CRMs such as lithium and cobalt to develop a mining Cadastre Map.

7.5. MULTI-STAKEHOLDER CONSULTATION: THE ROLE OF CIVIL SOCIETY AND COMMUNITIES

There is little publicly available information on Zambia's major battery initiative. Communities are key stakeholders, and in any project affecting them, enough information must be made publicly available (for example, on special economic zones for EV battery manufacturing).

Table 6: Civil Society Organisations

No.	Name of Stakeholder	Role
1.	Zambian Electric Mobility Innovation Alliance	• Facilitate partnerships between critical mineral suppliers and EV manufacturers. • Promote research and development into sustainable battery technology
2.	Pamoja Critical Minerals Alliance	• Promote best practices in environmental and social responsibility for mining companies.

In addition to the above stakeholders, media houses such as the Zambia National Broadcasting Services and private media have an important role in disseminating EV battery information and public interest communications. Furthermore, media houses should investigate deals that are against the interest of the country, its people and the environment. More transparency can be brought by an aware media and civil society watchdogs. The creation of an enabling environment presumes the existence of a regime promoting freedom of information and expression, especially one that protects human rights and environmental defenders.

8. A JUST ENERGY TRANSITION IN ZAMBIA

By all accounts, Zambia's GHG emissions are a tiny fraction compared to the major polluters. The total GHG globally is 50 billion MtCO2e, and Zambia is responsible for 7.69 million MtCO2e, contributing only 0.01 per cent share of the world's CO2 emissions (FAO, 2023; UNFCC, 2022). To cool the planet and address climate change adaptation, Zambia set out its contributions in the form of targets, policies, and actions, framed as NDCs submitted and ratified after the Paris Agreement.

8.1. ZAMBIA: A SOLUTION TO GLOBAL GHG MITIGATION

Because this paper is focused on the nexus between critical minerals and the energy transition, focus is placed on the renewable energy and energy efficiency component as outlined in Zambia's NDC and other government policies. Implementing the EV battery industry in the Transport Sector in Zambia limits carbon emissions as vehicles will no longer depend on fuel but on renewable batteries. In the process, Zambia will be contributing to the reduction in global GHG emissions. Domestically, Zambia's intention to increase EV mobility will significantly reduce its GHG emissions, especially when the electricity used to power them comes from renewable sources such as batteries and hydro-energy, not fossil fuels. The energy transition is, therefore, an opportunity for Zambia to present itself as one of the solution countries to the global climate emergency and, like South Africa, advocate for prioritisation to become a Just Energy Transition Partnership (JETP) country. However, this will not be complete without addressing the issue of electrification and energy access for all and overcoming energy poverty.

8.2. ELECTRIFICATION AND ADDRESSING ENERGY ACCESS: ENDING ENERGY POVERTY THROUGH OFF-GRID SOLUTIONS

Transitioning to cleaner and more sustainable energy sources is a matter of economic and social justice. This cardinal point is espoused in SDG 7, which contemplates access to affordable, reliable, sustainable, and modern energy for all. However, like many other countries in sub-Saharan Africa, Zambia faces significant challenges in addressing energy poverty. Unreliable rainfall patterns and climate change have affected Zambia's heavy reliance on hydropower for electricity, and grid solutions are restrictive in extending energy access, especially to rural communities. More frequent power outages and energy shortages are being experienced. This allows Zambia to diversify its energy mix by adding off-grid solar and wind solutions (Manberger and Joahanson, 2019). There cannot be prosperity or growth without access to reliable and affordable energy. With about 69 per cent of Zambians (around 11.8 million people) still lacking access to energy, extending the grid to rural areas, where 96 per cent of people lack electricity access, is unfeasibly expensive and would take decades for a developing country like Zambia.[13] Off-grid clean energy solutions offer a reliable, clean, affordable, and quick-to-deploy alternative to grid electricity, and people are willing to pay for them. However, companies selling these solutions face many challenges in establishing themselves in markets like Zambia due to a lack of investor confidence and market intelligence, an unfavourable regulatory environment, and a high poverty rate.[14]

Expanding electricity access using renewable energy sources ("sustainable electrification") presents additional opportunities to enhance women's economic power by mainstreaming gender in the industry's development (Clark 2021)

A practical example of the 2014/2015 power shortage and the extent to which it disrupted economic activities and slowed down economic growth further illustrated how Zambia's economy depends on energy and water. Hence, a just energy transition in Zambia aims to address energy poverty, improve access to electricity, and mitigate potential implications for mining households and communities. The energy transition can impact poverty and off-grid populations by implementing decentralised renewable energy solutions such as solar mini-grids and off-grid solar home systems to provide electricity access, particularly to rural populations, creating job opportunities, and alternative

[13] United Nations Climate Change, "Beyond the Grid Fund for Zambia" <https://unfccc.int/climate-action/momentum-for-change/financing-for-climate-friendly-investment/beyond-the-grid-fund-for-Zambia> accessed 8 May 2024.
[14] Ibid

livelihoods. These solutions can enable households to power essential appliances, access lighting, and support income-generating activities.

Clark (2021), in the journal article Powering Households and Empowering Women: The Gendered Effects of Electrification in sub-Saharan Africa, makes an important case that "electrification can alleviate women's time poverty, create opportunities for women and girls to enter the labour force or focus on school, decrease exposure to harmful indoor air pollutants, improve maternal health, reduce exposure to and acceptance of gender-based violence, and change social norms through access to information."[15] Hence, expanding electricity access using renewable energy sources ("sustainable electrification") presents more opportunities to enhance women's economic power by mainstreaming gender in the industry's development.[16]

8.3. ESG STANDARDS: COMMUNITY INVOLVEMENT AND ELECTRIC BATTERY VALUE CHAINS

Transitioning from internal combustion engine vehicles to electric mobility, the critical minerals demand must not repeat social and environmental risks associated with earlier extractive industry practices that have negatively impacted people and the environment on the Copperbelt and elsewhere. For a just outcome, as Zambia intensifies its efforts to supply the energy transition with critical minerals, mining practices must be governed by a rule-based system in which the state enforces the rule of law to promote responsible mining. This includes the application of the state's constitutional obligations to uphold community rights such as public participation, labour rights, and equality in sustainable development, especially in the localisation of development planning and management. Critical minerals value chains, especially the activities of Zambia's project to manufacture electric batteries, must foster transparency in supply and value addition chains. As Zambia attracts new mining investments, strengthening corporate accountability laws and regulations should be integral through tighter social, environmental, and governance (ESG) standards.

The energy transition can impact poverty in off-grid populations by implementing decentralised renewable energy solutions such as solar mini-grids and off-grid solar home systems to provide electricity access particularly for rural populations, creating job opportunities and alternative livelihoods. These solutions can enable households to power essential appliances, access lighting and support income-generating activities.

Most of these ESG standards are given expression in statutory provisions, predominantly contained in Zambia's Environmental Management Act No. 12 of 2011, mining laws, corporate laws, etc. As the rush for critical minerals increases, administrative institutions must be able to exercise their regulatory powers to enforce ESG and other standards, including the use of the GRI 14: Mining Sector 2024 "which addresses the pressing need for consistent, granular, and complete reporting on the sector's wide-ranging impacts and contributions to sustainable development."[17] If a just energy transition is to be realised, "the dual nature of the mining sector – providing essential minerals and metals that society relies on, while having significant impacts on the environment, communities, and workers"[18] must be pursued. For example, indigenous people's consent rights must be adhered to as the governm – ent creates special economic zones for EV battery manufacturing supported by investment from Afreximbank and the UN Economic Commission for Africa.[19] Free, prior, and informed consent (FPIC) principles entitle local people to meaningful and beneficial participation in environmental impact assessments and the entire project cycle. Beneficial participation means local communities must have preferential access to opportunities such as creating manufacturing hubs for decent jobs through sustained skills development, reskilling, and upskilling to access the climate change and energy transition-aligned "green jobs."

[15] Clark, "Powering Households and Empowering Women: The Gendered Effects of Electrification in sub-Saharan Africa" https://jpia.princeton.edu/news/powering-households-and-empowering-women-gendered-effects-electrification-sub-saharan-africa
[16] Ibid
[17] Global Reporting Initiative, "Sector Standard for Mining: A Standard for a responsible mining sector", <https://www.globalreporting.org/standards/standards-development/sector-standard-for-mining/> accessed May 2024.
[18] Ibid
[19] Africa Renewal, "Afreximbank and UNECA sign agreement to establish special economic zones for the production of Battery Electric Vehicle" (UN,17 April 2023) <https://www.un.org/africarenewal/magazine/april-2023/afreximbank-and-uneca-sign-agreement-establish-special-economic-zones-production> accessed 17 April 2024

Transitioning to cleaner energy sources can support sustainable development goals and enhance the social license to operate for mining companies.

A just transition means strict monitoring of environmental risks through participatory impact assessments, pollution control, and overall environmental management by agencies such as the Zambia Environmental Management Agency (ZEMA). This must result in sustainable environmental practices in the exploration, extraction, and value addition of critical minerals. In the current context, sustainability measures are insufficient; the minerals rush is oriented towards extraction, and there is less emphasis on recycling green technology waste in line with circular economy principles as in the European Union bloc.[20] Transitioning to cleaner energy sources can support sustainable development goals and enhance the social license to operate for mining companies. Providing training and employment opportunities in the renewable energy sector for workers in mining communities can support their transition to alternative livelihoods as the demand for renewable energy technologies grows. Through skills development and job diversification, a just energy transition can help mitigate potential socio-economic challenges that workers and their families face in mining communities, creating new avenues for sustainable employment and economic resilience.

[20] See Europa, "Circular economy: definition, importance and benefits: The circular economy: find out what it means, how it benefits you, the environment and our economy." <https://www.europarl.europa.eu/topics/en/article/20151201STO05603/circular-economy-definition-importance-and-benefits> accessed 5 April 2024.

9. PRACTICAL RECOMMENDATIONS

9.1. DEVELOP AND IMPLEMENT A CRITICAL MINERALS STRATEGY

Immediate work is needed on the comprehensive status of the critical raw materials from upstream (exploration and reserves), middle (mining production and processing plants), value addition (setting up EV battery plants) to life-end of the industry (environmental impacts and clean-up). Zambia's Draft Critical Minerals Strategy, a first in the region, needs to be supported and developed into a more comprehensive framework for green industrialisation and climate resilient socio-economic development.

9.2. DEVELOP AN ENHANCED MINING CADASTRE MAP FOR CRITICAL MINERALS IN ZAMBIA

Since only half of Zambia's territory has been explored, Zambia must continue to invest in exploration for critical minerals. This should involve the production of updated cadastral maps, specifying existing minerals rights, and outlining protected areas in which mining and exploration activities are prohibited for environmental or national heritage reasons. These cadastral maps should be easily accessible for public scrutiny.

9.3. PROMOTE INCLUSIVE AND SUSTAINABLE MINING PRACTICES

Zambia must promote sustainable mining practices by encouraging the adoption of environmentally responsible and socially inclusive mining practices for critical minerals, such as cobalt and copper, to minimise ecological impact. The mining investment companies must always obtain social licences to operate and adhere to international human rights laws and standards for respecting indigenous people's rights under the doctrine of free, prior and informed consent. Mining companies must conclude community benefit programmes that clearly regulate the flow of production-sharing agreements or profit-sharing agreements, and community infrastructure such as schools, health facilities, and social amenities. Presently, companies of foreign origin dominate the sector. There is need for the government to facilitate the ownership and participation of a broad cross-section of Zambians in the critical minerals value chain.

9.4. EMPHASISE RESOURCE EFFICIENCY AND CIRCULARITY OF REN EQUIPMENT

Develop and enforce regulations that promote efficient use of natural resources, waste reduction and proper disposal of mining by-products to minimise environmental degradation. This should be tied to recycling and circularity in the use or reuse of end-of-life renewable energy technologies such as solar panels, EV batteries, etc.

9.5. INVEST IN RENEWABLE ENERGY CAPACITY

Invest in renewable energy by prioritising the development of renewable energy sources, such as solar and hydroelectric power, to diversify the energy mix and reduce reliance on fossil fuels. Incentivise renewable energy projects: offer financial incentives, tax breaks or subsidies to attract investments in renewable energy infrastructure, such as solar farms and small-scale hydropower plants.

9.6. FORGE INTERNATIONAL PARTNERSHIPS UNDER A JUST ENERGY TRANSITION FRAMEWORK

Foster international partnerships through engaging in collaboration with other countries, international organisations, and private sector stakeholders to access technical expertise, financial support, and knowledge exchange relevant to critical mineral extraction and sustainable energy development.

9.7. SEEK CLIMATE FINANCE AND INVESTMENT OPPORTUNITIES

Linked to the search for international cooperation, there is a need to explore avenues for accessing climate finance and green investment funds to support the energy transition and critical minerals sector in line with climate change ambitions. The finance solution should not create new sources of unsustainable lending in a situation where it is common cause that Zambia has been debt distressed for years.

9.8. FACILITATE SKILLS AND KNOWLEDGE TRANSFER

Facilitate knowledge transfer by establishing mechanisms to facilitate the transfer of technological know-how and best practices in critical mineral extraction and renewable energy deployment, potentially through partnerships with technology-rich countries or international organisations. Invest in skills development: training programmes and education to build local expertise in sustainable mining practices, renewable energy technologies, and energy management,

9.9. STRENGTHEN REGULATORY REGIMES

Strengthen policies, laws, and regulatory frameworks by implementing and enforcing robust environmental, social, and corporate governance regulations governing the critical minerals sector to ensure responsible and ethical extraction practices. Enhance governance and transparency: Promote good governance, transparency, and accountability in managing critical mineral resources and energy projects to build investor confidence and mitigate risks.

9.10. STRENGTHEN UNDER-DEVELOPED VALUE CHAINS THROUGH REGIONAL COOPERATION

The supply chain for the EV batteries is virtually undeveloped in Zambia. This will be a threat to the value chain. There may be a need to take advantage of regional supply chains and set regional manufacturing hubs for green technologies.

By implementing these practical recommendations, Zambia can enhance its climate change ambitions by leveraging critical minerals for the energy transition, promoting sustainable mining practices, and scaling up renewable energy deployment. These measures can contribute to a more resilient and low-carbon future while supporting sustainable economic development.

10. CONCLUSION

Conclusively, a just energy transition in Zambia (e.g., to solar and wind farms) can have tangible impacts on addressing energy poverty alleviation, energy needs of off-grid populations, improving livelihoods, and enhancing social and economic opportunities for rural communities while expanding electricity access and managing the transition for mining communities. By integrating renewable energy solutions and fostering inclusive strategies, Zambia can advance towards a more sustainable and equitable energy future while supporting the well-being of its citizens, enhancing healthcare and educational services, and supporting the growth of small- and medium-sized enterprises.

This study confirms the concerns of many stakeholders that most green energy initiatives are failing due to failure to reach financial closure. More cooperation is required, especially within the framework of climate finance. This will involve international cooperating partners, in particular multilateral agencies, to bring into practice climate finance pledges made as important mechanisms for supporting developing countries in their climate action efforts under the Paris Agreement. Additionally, FDI should play a pivotal role in driving private capital investment towards renewable energy projects, thereby contributing to the global transition to a low-carbon, climate-resilient economy. In this context, transition mineral beneficiation becomes an important lever for domestic resource mobilisation to feed into Zambia's finance for climate resilient development.

11. REFERENCES

ACT Alliance, (2018). A Resource Guide to Climate Finance: An orientation to sources of funds for climate change programmes and action. Available online: https://actalliance.org/wp-content/uploads/2018/06/ENGLISH-quick-guide-climate-finance.pdf

Adaptation Fund, (2015). Accessing Resources from the Adaptation Fund Handbook.

Chavi, M, Rajashree P,i, Pedro de Aragão F, Balm,N, Githungo W, Chiriac, D, Tonkonogy, B and Dharshan, W, (2022). Landscape of Climate Finance in Africa. Climate Policy Initiative. Available online: https://www.climatepolicyinitiative.org/publication/landscape-of-climate-finance-in-a

Chiriac, D, Tonkonogy, B and Dharshan, W, (2019). Global Landscape of Climate Finance 2019. Available online: https://www.climatepolicyinitiative.org/wp-content/uploads/2019/11/2019-Global-Landscape-of-Climate-Finance.pdf.

Emerald Environment Limited and GIS Siavonga Limited, (2021). Climate Change Risk and Vulnerability Assessment Report Draft Report: Republic of Zambia, 221p.

European Union, (2020). Critical Raw Materials for Strategic Technologies and Sectors in the EU: A Foresight Study

Food and Agriculture Organization of the United Nations, (2023). Carbon Taxes and Agriculture: The Benefit of a Multilateral Agreement," "Key Facts and Findings," Climate Policy, 2023,https://doi.org/10.1080/14693062.2023.2171355.45 https://japannews.yomiuri.co.jp/business/economy/20221216-77508/.

Glemarec, Y, (2020a). GCF handbook: Decisions, policies and frameworks. Available online: https://www.greenclimate.fund/document/gcf-handbook.

Glemarec, Y, (2020b). GCF programming manual: An introduction to the Green Climate Fund project cycle and project development tools for full-size projects. Available online: https://www.greenclimate.fund/document/programming-manual.

Glencore, (2022). Climate report. Available online: www.glencore.com/sustainability/esg-a-z/

Global Reporting Initiative (GRI). (2024). Sector Standard for Mining: A Standard for a responsible mining sector. Retrived from; https://www.globalreporting.org/standards/standards-development/sector-standard-for-mining/

Government of Zambia, 2020. Third National Communication to the United Nations Framework Convention on Climate Change (UNFCCC),

Government of Zambia, 2020. Zambia NDCs Update to the UNFCCC 2020, 18p.

Government of Zambia, 2021. Final Zambia Revised and Updated NDC 2021, 21p.

Hayley Price-Kelly, Anne Hammill, Julie Dekens, Timo Leitr, and Julia Oliver, 2015. Developing national adaptation monitoring and evaluation systems: A guidebook, 60p.
https://library.wmo.int/index.php?lvl=notice_display&id=21880#.YHg0ABMzZR0.

International Energy Agency (2021), The Role of Critical Minerals in Clean Energy Transitions, IEA, Paris https://www.iea.org/reports/the-role-of-critical-minerals- in-clean-energy-transitions

Manberger, A and Joahanson, B, (2019). The geopolitics of metals and metalloids used for the renewable energy transition: Energy Strategy Reviews; Volume 26, November 2019, 100394
Ministry of Green Economy and Environment (MoGEE), (2023). National Adaptation Plan for Zambia (Summary Version).

Ministry of National Development Planning, Ministry of lands, Natural Resources and Environmental Protection, 2016. National Policy on Climate Change,

MNDP, (2022). 8th National Development Plan. Lusaka. Ministry of Finance and national planning;
Springer Nature Limited, 2021. COP26: Inside the science. Available online at file:///C:/Users/Imasiku/Desktop/NDC%20Zambia%20Consultancy/COP26%20Inside%20the%20science.htm

UNEP, (2018). Implementation Plan for Zambia's Nationally Determined Contributions,

UNFCCC, (2019). Climate change and Energy pathways: Assessment Report. 14p 19p.

United Nations Framework Convention on Climate Change, (2021). New York. UNCC, 5p

United Nations, (2022). Implications of the Energy Transition on Sustainable Critical Minerals Development in Africa; Aligning Extractive Industries with the Sustainable Development Goals. United Nations Climate Change

Unknown, (2020). Communication and update on Zambia's Nationally Determined Contribution (NDC) in accordance with the UNFCCC Decision 1/CP.21 of Paris Agreement.

World Bank, (2023). State and trends of carbon emissions, Geneva, Switzerland. https://carbonpricingdashboard.worldbank.org/

World Meteorological Organization (2020). State of the Global Climate 2020 - Provisional Report. 38. Available at: https://library.wmo.int/doc_num.php?explnum_id=10444.

World Meteorological Organization (2021). State of the Global Climate 2020 (WMO-No. 1264). Geneva, Switzerland.

World Meteorological Organization, (2023). Global Trends and Carbon Inventories. Switzerland.

Yila O, (2023). Climate Finance Toolkit for Zambia: A Comprehensive Guide. Lusaka: IAPRI.

Yila,O, (2021a). Climate Finance Mapping for NDC Implementation in Zambia.

Yila. O, (2021b). Monitoring, Reporting and Verification (MRV) of Climate Finance for Zambia.

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