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Critical Minerals and Renewable Energy Value Chains in Zimbabwe

A Study of Actors and Initiatives

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LIST OF ACRONYMS

AfDB	African Development Bank
COP	Conference of Parties
EPC	Engineering, procurement, and construction
ESAP	Economic structural adjustment programme
EU	European Union
FDI	Foreign direct investment
GDP	Gross domestic product
GHG	Greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
IMF	International Monetary Fund
IPP	Independent power producer
IRENA	International Renewable Energy Agency
MW	Megawatt
NDC	Nationally determined contribution
PGM	Platinum group metal
PPP	Public-private partnership
PPPP	Public-private-philanthropic partnership
PV	Photovoltaic
REE	Rare earth element
REN	Renewable energy
SADC	Southern Africa Development Community
SARW	Southern Africa Resource Watch
UK	United Kingdom
UN	United Nations
UNESCO	UN Educational, Scientific and Cultural Organisation
UNCTAD	UN Conference on Trade and Development
ZERA	Zimbabwe Energy Regulatory Authority
ZMDC	Zimbabwe Mining Development Corporation

EXECUTIVE SUMMARY

***Critical Minerals and Renewable Energy Value Chains in Zimbabwe: A Study of Actors and Initiatives in Zimbabwe* is part of a regional action research agenda on *Strategic Minerals and the Energy Transition in Southern Africa* under the Southern Africa Resources Watch (SARW). The report examines Zimbabwe's mining sector and how it responds to the global energy transition, which has created an unprecedented demand for the exploration, extraction, processing and trade of critical minerals. The minerals include lithium, copper, and rare earth elements (REEs), used to manufacture renewable energy technologies such as electric vehicles, wind turbines, solar panels, and mobile phones.**

Zimbabwe's mining industry is a cornerstone of the national economy. In 2023, it breached the US$12 billion target set in the country's 2030 Vision. The sector contributes over 60% of Zimbabwe's export receipts and attracts more than 50% of foreign direct investment. Over the years, the growth experienced in the mining sector has been from gold, platinum group metals (PGMs), ferrochrome, steel, nickel, diamonds, lithium, and coal.

The country has substantial lithium reserves. Ranked fifth in the world, Zimbabwe has gained global attention and has become a significant global supplier of lithium, drawing foreign direct investments, particularly from Chinese companies. In 2023, Zimbabwe banned the export of raw lithium, seeking to drive downstream infrastructure development. This is because the country has ambitions to become a regional processing hub for lithium-ion batteries. However, little or no evidence shows progress towards local electric vehicle battery manufacturing in Zimbabwe.

Zimbabwe has manganese, chromium (with the Great Dyke belt estimated to host 10 billion tons of chromium, while about 608 million tons are estimated to occur elsewhere), nickel, and there are efforts to revive copper production. Together with rare earth elements (REE) exploration projects, Zimbabwe's potential as a supplier of critical minerals is promising. To turn this potential into wealth, Zimbabwe must go more steps up the value chain, beneficiate its raw ore, and attract foreign direct investment into green technologies industrial projects. Domestic refining will bring more jobs, better infrastructure and a rise in fiscal benefits. This will drive Zimbabwe's development, particularly trade and industrialisation.

Zimbabwe must develop a Critical Minerals Strategy to optimise its benefits. This will provide a national framework for identifying a list of critical minerals and strategies for sector growth. The increased demand makes it essential for public policy to guide the exploitation of the minerals to benefit communities. As mining operations ramp up production to meet the global demand, environmental and social costs are expected to rise. For this reason, the study calls for the mining sector to follow responsible and sustainable mining practices to achieve the imperative for a just energy transition (JET). This includes adherence to environmental, social, and governance (ESG) standards such as putting in place grievance redress mechanisms, respect for human rights and observing the rule of law in all mining activities and related supply and value chains.

1. INTRODUCTION

Zimbabwe, endowed with a wealth of critical minerals such as lithium, platinum, and rare earth elements, stands at a pivotal juncture in its economic development and energy transition. These minerals, essential for the global transition to renewable energy, position Zimbabwe as a potentially key player in the burgeoning green economy. The confluence of rich mineral reserves and increasing global demand for sustainable energy solutions underscores the strategic importance of examining Zimbabwe's role in the renewable energy value chains. Understanding the dynamics of these value chains is crucial not only for policymakers and industry leaders within Zimbabwe but also for international stakeholders invested in the global transition to renewable energy. Through a detailed analysis of the initiatives and collaborations, this report aspires to contribute to a more informed dialogue on how Zimbabwe can optimise its resources for economic growth and environmental sustainability.

The study delves into the intricate network of actors and initiatives shaping the landscape of Zimbabwe's critical minerals and renewable energy.

2. METHODOLOGY

The report is based on a desktop review. Apart from critical analysis of the status quo, primary sources of information were heavily relied upon. Since transitioning to low-carbon pathways in the energy sector is regarded as urgent to honour obligations under the Paris Agreement, this report also considers the nationally determined contributions (NDCs) and statutory instruments enacted to guide the production and sale of these minerals. Information from government agencies, local non-governmental organisations, and international development partners was solicited to understand better the renewable energy (REN) sector's initiatives, especially when such information could not be obtained from official sources such as institutional websites. By mapping the connections between mineral extraction, processing, and integration into renewable energy technologies, this study seeks to elucidate Zimbabwe's opportunities and challenges in leveraging its mineral wealth for sustainable development.

3.OVERVIEW OF ZIMBABWE'S MINERALS ECONOMY

3.1. MINING SECTOR

Zimbabwe's mineral economy is a cornerstone of its economic development, playing a significant role in historical and contemporary contexts (Government of Zimbabwe 2022). The mining sector, rich with diverse mineral deposits, has been a key driver of the country's GDP and export revenues. The mining sector in Zimbabwe has a long and complex history, deeply intertwined with the country's colonial past and subsequent economic policies. Mining contributes about 5 per cent to the GDP and 23 per cent in total exports, earning the country 60 per cent of annual foreign currency, translating into 13 per cent of GDP. Traditionally, the main commodities mined in Zimbabwe are gold, platinum, coal, and diamonds.

During the colonial era, the mining industry was dominated by British and South African companies, notably Anglo-American and Lonrho. These corporations established a strong presence in Zimbabwe, exploiting the country's rich mineral resources, including gold, platinum, and chrome. The Great Dyke, a geological formation rich in minerals, became a focal point for mining activities, with its vast deposits of platinum group metals (PGMs), nickel, and chromium. Anglo-American, one of the world's largest mining companies, played a pivotal role in developing Zimbabwe's mining industry. Alongside Lonrho, these corporations extracted valuable minerals and controlled significant parts of the value chains, from extraction to export. This dominance continued after independence, although the landscape began to shift with changing economic and political dynamics.

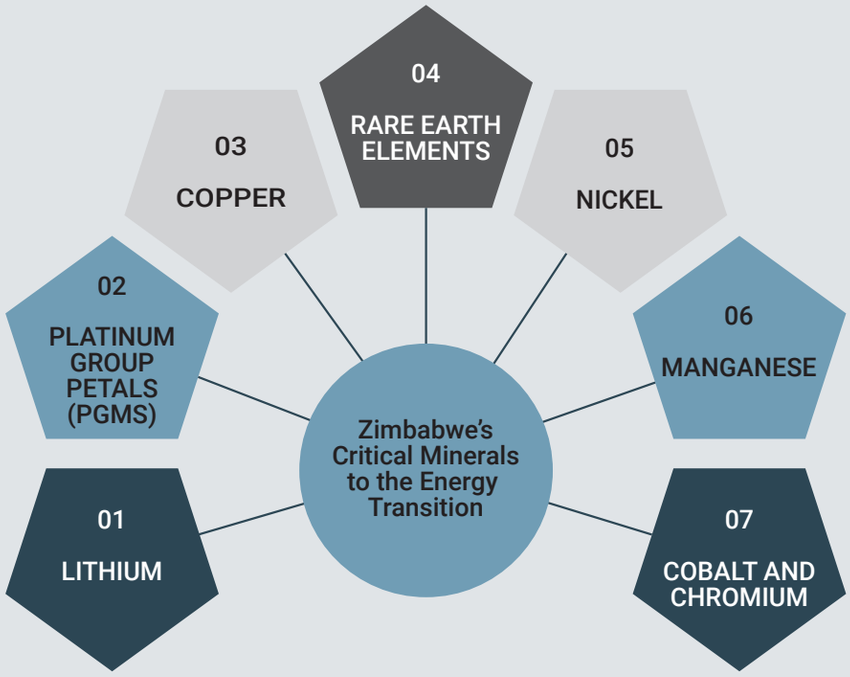
In the 1990s, Zimbabwe underwent significant economic reforms under the economic structural adjustment programme (ESAP), introduced at the behest of the International Monetary Fund (IMF) and the World Bank. Using a neoliberal agenda, ESAP aimed to liberalise the economy, reduce government intervention, and promote private sector growth. However, the programme produced negative outcomes: deindustrialisation, loss of jobs, and poor public service delivery in water, health, and education. While remaining a critical component of the economy, the mining sector faced numerous difficulties during this period. Several industries were closed, and a decline in manufacturing output followed. This deindustrialisation affected the broader economy, exacerbating unemployment and reducing the country's industrial capacity. The mining sector, however, continued to attract foreign investment, albeit with varying degrees of success.

3.2. ZIMBABWE'S MINERALS CRITICAL TO THE ENERGY TRANSITION

IRENA (2022) states that critical materials are the resources needed to produce key technologies for the energy transition, including wind turbines, solar panels, batteries for electric vehicles (EVs), and electrolysers.[1] Availability and affordability, and especially the security of supply of these critical minerals, remain crucial for the energy transition. The criticality of the minerals underscores the vital importance of these minerals to different countries according to their energy and industrial needs. For this reason, the US, Canada, EU, and Australia have developed a formal Critical Minerals List, and in this regard the sourcing of minerals has become a major issue in geoeconomics and geopolitics. Hence, IRENA (2022) has noted that factors for determining criticality remain subjective and location-specific. However, for this paper, critical minerals refer to those important for the clean energy transition, termed green minerals by the African Union.

[1] IRENA, "Critical materials" (IRENA, n.d.) <https://www.irena.org/Energy-Transition/Technology/Critical-materials> accessed 3 March 2024

Figure 1: Zimbabwe's Minerals Critical to the Energy Transition.



3.2.1. Lithium

Lithium is essential in lithium-ion batteries, making it crucial for electric vehicles and energy storage (Scott and Ireland, 2020). According to the African Mining Market, Zimbabwe's lithium deposits are the largest in Africa and the sixth largest globally. The government claims that the country will meet 20 per cent of the world's total demand for lithium when it fully exploits its known lithium resources, and four major lithium projects are currently under development.[2] The sector has drawn investors in battery minerals from Canada, the UK, and Australia, with China emerging as the dominant player.[3] The Bikita Mine, a lithium company, was acquired by the Chinese company Sinomine Resource Group in 2022 through a transaction valued at $180 million.[4] Following the acquisition, significant investments have been made to expand the mine's operations, including constructing two lithium processing plants (Ross, 2023). The Bikita mine can now produce up to 300 000 metric tons of spodumene concentrate and 480 000 tons of petalite annually (Energy Capital Power 2023). Beyond Bikita Mine, several significant lithium projects are operating in Zimbabwe. Arcadia Lithium Project, located near Harare, was operated by Prospect Resources from 2016 to 2022 when the mine was acquired in April 2022 by China's Zhejiang Huayou Cobalt for an 87 per cent interest (for $422 million), and is rated as one of the world's biggest hard rock lithium resources. Zulu Lithium Project, managed by Premier African Minerals, is located at Fort Rixon, about 80km from Bulawayo. It has a significant resource base estimated at 20.1 million tonnes, with plans to explore further and develop the site. Kamativi Lithium Project is being redeveloped into a lithium operation and a joint venture between the Zimbabwe Mining Development Corporation (ZMDC) and Canada's Jimbata, with significant lithium deposits identified within the tailings from previous mining activities (Mining Index, 2024). Mirrorplex Exploration, acquired by an Australian company, Six Sigma Mirrorplex, is exploring lithium in the Shamva area, and preliminary findings suggest extensive lithium mineralisation across the project area (Mining Index 2024). Eagle Canyon Group Holding Limited backed the US$13 billion value addition and beneficiation park approved by the Zimbabwean government. China Natural Resources Inc. entered into a sale and purchase agreement with Feishang Group Limited and Top Pacific (China) Limited to acquire Williams Minerals (Pvt) Ltd, which owns a mining permit for a Zimbabwean lithium mine. Chinese companies have acquired the biggest portfolio of lithium mining projects in Zimbabwe.

[2] International Trade Administration, "Zimbabwe - Country Commercial Guide" (ITA, 29 February 2024) <https://www.trade.gov/country-commercial-guides/zimbabwe-mining-and-minerals> accessed 6 April 2024.
[3] Ibid
[4] Alex Donaldson, "Sinomine completes upgrades at Zimbabwe lithium mine" (Mining Technology, July 10) 2023) <https://www.mining-technology.com/news/sinomine-bikita-lithium/> accessed 4 April 2024.

3.2.2. Platinum Group Metals (PGMs)

Zimbabwe is a significant player in the global market for platinum group metals, which include platinum, palladium, rhodium, ruthenium, iridium, and osmium (SFA (Oxford) 2024). These metals are crucial due to their extensive use in automotive catalytic converters, jewellery, electronics, and various industrial applications. Zimbabwe possesses the second-largest reserves of PGMs in the world, primarily concentrated in the Great Dyke region.

Table 1: Manganese, Cobalt, and Chromium

No.	Mineral	Description
1	**Manganese**	Manganese is vital for steel production and battery technology, with Zimbabwe being a potential supplier for the growing battery industry. In 2022, Zimbabwe exported $114k in manganese ore, making it the world's 61st largest exporter of manganese ore (OEC World 2024).
2	**Chromium**	Chromium, primarily used in stainless steel production, is another valuable resource in Zimbabwe's mineral portfolio. Chinese companies like Afrochine Smelting, Jinan Corporation, Sinosteel Corporation are involved in the mining and processing of this mineral in Zimbabwe. This critical resource is found along the Great Dyke region and Darwendale.
3	**Cobalt**	Cobalt, essential in lithium-ion batteries, is also available in Zimbabwe and it is poised to contribute significantly to Zimbabwe's potential role in the electric vehicle revolution. Zimbabwe is set to import 47 800 kilograms of cobalt by 2026, a five per cent annual growth rate from 2021. This figure is a 117 per cent increase from 2008 (Report Linker Research 2024).

Zimbabwe's mineral belt, the Great Dyke, is estimated to host 10 billion tons of chromium, while about 608 million tons are estimated to occur elsewhere (Mlambo 2018). The country also has the world's largest reserve of metallurgical quality chromite.

3.2.3. Copper

In May 2021, Goldman Sachs described copper as "the new oil". By 2030, copper demand from the green transition will rise an estimated 600 per cent to 5.4 million metric tons (Mt) in the base case, and up to 900 per cent to 8.7 million metric tons on the back of the adoption of green technologies. The rush for critical minerals has not only been from Chinese investors. Western countries have joined this race. Marula Mining, a UK mining company, has been searching for copper and lithium mining opportunities. Through its Zimbabwe-domiciled local subsidiary, Muchai Mining (Marula holds 80 per cent of Muchai's shares, and Gondo Mineral Resources, holds 20 per cent) is among the UK companies that have entered mining in Zimbabwe. Other UK companies, Premier African Minerals and Red Rock, are invested in Zimbabwe's lithium prospects. Copper is in demand globally, and Zimbabwe's copper mining is experiencing a revival after Mhangura, the last major copper mining company in Zimbabwe, was forced to shut down in 2000 due to a sharp decline in international copper prices. Zimbabwe launched the Greater Chinhoyi Copper Development Programme to revive six copper assets of ZMDC. In 2021, the ZMDC signed an agreement with China's Zhi Jui Mining Resource to start processing mining dumps at Mhangura. In addition to Mhangura, ZMDC has copper operations in Alaska and Sanyati. It is important to realise that these copper assets are non-operational due to lack of investment – about $500 million is required to revive ZMDC's copper assets.

3.2.4. Nickel

Nickel has become one of the most critical minerals recognised by Japan, the US, and Canada, all of which have classified it as a critical mineral for their industrial interests. Zimbabwe, a nickel producer, is home to the Trojan Nickel mine, the country's only nickel mine. The mine, which began nickel production in 1964 under the Anglo-American group, can produce approximately 5500 metric tons of nickel concentrate annually. However, on 3 May 2024, the government placed Zimbabwe's sole nickel mine under administration.[5] The company halted production due to equipment failure, high electricity costs, and low global prices. Nickel production has sharply declined from a record level of $100 000 per ton in 2022 to about $19 000 per ton. Due to oversupply, the nickel market is saturated. Trojan Mine's nickel concentrate output dropped to 1314 metric tons in its last financial year, which ended in March 2024, down from 3180 metric tons the year before. The case of Trojan Mine highlights the risk of dependence on primary commodity exports as global markets experience cyclical price shocks. Price shocks make a strong case for value addition and the production of finished products.

3.2.5. Rare Earth Elements (REEs)

The global shift towards renewable energy and reducing carbon emissions underscores the importance of REEs. REEs are fundamental in manufacturing wind turbine generators and photovoltaic (PV) cells (Farina, and Anctil, 2022). According to the Zimbabwe Geological Survey (2020), REEs are a group of seventeen metals with unique properties that make them critical to manufacturing high-technology gadgets that people use daily. These 17 REEs are cerium (Ce), dysprosium (W), eribium (Er) europium (Eu), gadolinium (Od), holmium (Ho) lanthanum (La), lutetium (Lu), neodymium (Nd), praseodymium (Pr), promethium (Pm), samarium (Sm), scandium (Sc), terbium (Tb), thulium (Tm), ytterbium (Yb), and yttrium (Y) (Zimbabwe Geological Survey (2020). China controls 70 per cent of the rare earth market and has used its dominance of the minerals in its ongoing trade war with the US (newZWire 2019). In Zimbabwe, REEs are available in areas like Katete in Binga, Gungwa in Rushinga, Nanuta in Mt Darwin, and Dorowa minerals in Buhera, among others (Zimbabwe Geological Survey 2020). MRG Metals, an Australia-based mineral exploration company, has signed a binding memorandum of understanding (MoU) with Wickbury Investments to form a joint venture (JV) for a REEs project in Zimbabwe (Mining Technology 2024). A UK-based company called Rainbow Rare Earths, listed on the London Stock Exchange, has acquired land covering 12.6km² in Northern Zimbabwe to explore REEs.

Zimbabwe can support the global transition to renewable energy sources by developing its REE sector. The transition from internal combustion engines to electric vehicles relies heavily on REEs to produce powerful and efficient electric motors. Zimbabwe's REE resources can thus contribute to the global EV market, supporting efforts to reduce greenhouse gas emissions.

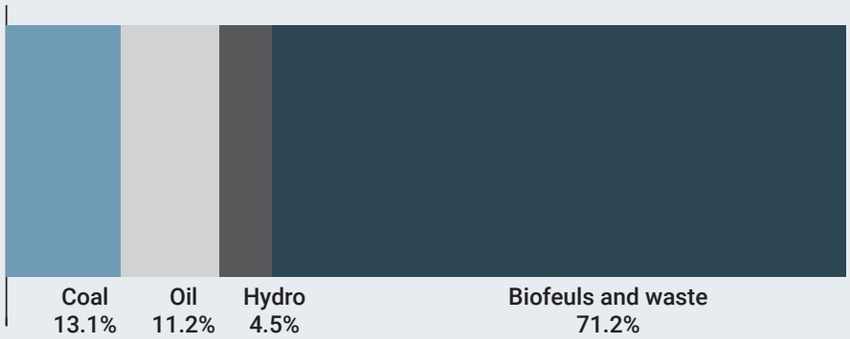
[5] Nyasha Chingono, "Zimbabwe's sole nickel mine placed under administration" (Reuters, 3 May 2024) <https://www.cnbcafrica.com/2024/zimbabwes-sole-nickel-mine-placed-under-administration/> accessed 12 May 2024.

4. ZIMBABWE'S ENERGY MIX

4.1. ENERGY GENERATION AND SUPPLY MIX

Zimbabwe's energy mix includes various sources, including hydroelectric power, thermal power, solar energy, oil, gas, biodiesel, biomass, and other renewable sources.

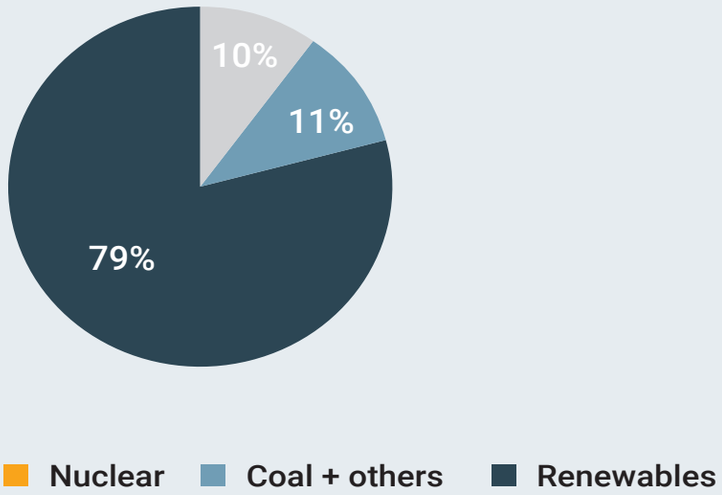
Figure 2: Total Energy Supply



Source: IEA (2023)[6]

Zimbabwe's energy generation is dominated by coal (thermal) and hydropower (Figures 2 and 3). In 2023, Zimbabwe's installed electricity generation capacity was approximately 2 540 MW from hydro and thermal power supply. However, due to climate change, aging infrastructure, and equipment breakdowns, electricity generation is often much lower than this capacity, resulting in power cuts and load shedding. The country has suffered from significant power deficits with a peak demand of 1 900 MW, forcing power outages of 12–14 hours a day (World Bank 2023). This has also been the situation in South Africa and Zambia, which has made the SADC region power insecure.

Figure 3: Total Energy Supply in 2020



Source: IRENA 2023

While the government commissioned an additional 600MW at the Hwange power station in 2023 due to Chinese loans and technical support, the installed capacity is still insufficient to meet demand. The effect has been felt more acutely in productive sectors. This has created the necessity for renewable energy supply and independent power producers (IPPs).

[6] IEA, "Energy system of Zimbabwe" (IEA, n.d.) <https://www.iea.org/countries/zimbabwe accessed> accessed 5 May 2024

4.2. ZIMBABWE'S HYDROCARBON ECONOMY

4.2.1. Coal: Still Central to National Grid Stabilisation

Hydrocarbons are a significant part of Zimbabwe's energy mix, dominated by substantial coal-driven power generation. The nation possesses vast coal deposits primarily located in the Hwange, Lupane, Lubimbi, and Sengwa regions, estimated at 11 billion tonnes (with 2.5 billion tonnes open castable). Coal-bed methane in Lupane alone is conservatively estimated at 500 billion tons at 95 per cent purity (Mlambo, 2018). These reserves are utilised extensively for thermal power generation, providing a substantial portion of Zimbabwe's electricity. The Hwange Thermal Power Station, Zimbabwe's largest coal-fired power plant, is a critical facility in this sector, contributing significantly to the national grid. Despite the global shift towards renewable energy, coal remains a central component of Zimbabwe's energy strategy, ensuring energy security and supporting industrial activities.

4.2.2. Transport Sector: Petrol and Ethanol Blending

Zimbabwe also focuses on enhancing its energy mix and reducing dependence on imported fuels, particularly by blending ethanol with conventional fuels like petrol. According to Zimbabwe's Biofuels Policy (2020), the country's energy demand is rising, with a current national requirement of three million three hundred thousand (3 300 000) and four million three hundred thousand (4 300 000) litres of petrol and diesel per day respectively. The Biofuels Policy recognises that the widespread adoption of biofuels could reduce the country's dependence on imported petroleum products, stabilise fuel prices, ensure energy security, promote rural development and investment, reduce poverty, and create employment. Key players in biofuels include Green Fuel, which operates the significant ethanol plant in Chisumbanje (Green Fuel 2023), and regulatory bodies like the Zimbabwe Energy Regulatory Authority (ZERA) that mandate ethanol blending to reduce fuel imports and promote renewable energy. Supported by significant sugar producers such as Triangle Limited and Hippo Valley Estates, these initiatives contribute to environmental sustainability by lowering carbon emissions. This integrated approach aims to create a more resilient and diversified hydrocarbon economy, fostering sustainable development and energy independence for Zimbabwe.

Box 1: Biofuels: Ethanol Production and Petrol Blending

Zimbabwe has a mandatory petrol-ethanol blending policy. Ethanol from sugar cane has been used as a fuel extender (blend) for over 40 years. Since 2011, Green Fuel (Pvt) Ltd, a wholly owned Zimbabwean joint venture company, has produced ethanol. The three shareholders are Green Fuel, Macdom, and ARDA (who represents the government of Zimbabwe). The processing plant has been installed with expertise from Brazil, with 60% manufacturing support from local engineers. Ethanol is a clean-burning, high-octane motor fuel produced by the fermentation of plant sugars. Zimbabwe's fuel has contained 10-25% ethanol blends from the 1970s until the late 1990s. Ethanol blending has been part of the country's energy security, and it was introduced to alleviate fuel shortages and high petrol prices. All cars in the county during these 20 years ran on an ethanol blend of up to 25% with no compatibility issues. According to the company, its anhydrous ethanol is in line with the 'fuel grade' approved for use in Europe and the US (to EU standards, specifications EN 15376 and CWA (EN) 15293).

Hydrocarbons still dominate Zimbabwe's energy mix. Most vehicles on Zimbabwe's roads are second-hand vehicles imported from Japan, which are petrol and diesel-powered. The transition to electric mobility is conceivably far-fetched. The Harare City Council, for example, has introduced some electric vehicles as part of its smart-city plans. This is still in a pilot phase, and nothing much along the scale that is required for the impactful decarbonisation of the transport system.

4.2.3. Oil and Gas Exploration

Recent geological surveys and exploration activities in Zimbabwe have indicated the presence of hydrocarbon deposits in regions such as the Muzarabani Basin (Invictus Energy Limited 2024). The Cahora Bassa Project encompasses one of the last underexplored frontiers for African Rift basins (Invictus Energy Limited 2024). This area, situated in the northern part of the country, has garnered attention from government and private investors due to its promising geological formations that suggest significant oil and gas potential. Invictus Energy, an Australian company, is exploring oil and gas and has been actively conducting seismic surveys and exploratory drilling in the Muzarabani Basin. Their Cabora Bassa Project aims to assess the commercial viability of the hydrocarbon deposits in this region (Invictus Energy Limited 2024).

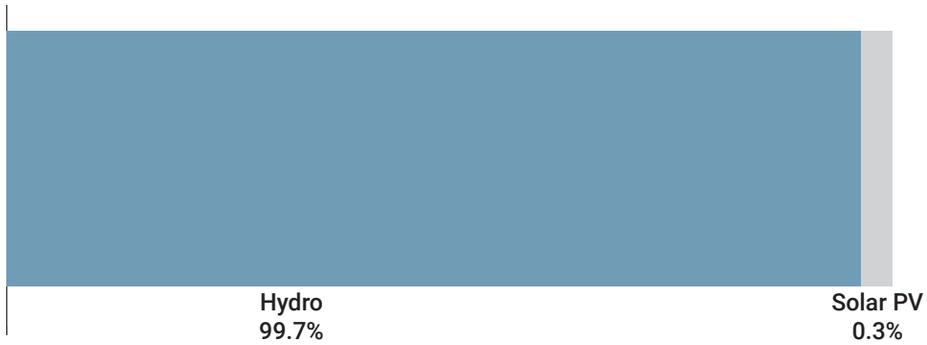
5.RENEWABLE ENERGY ACTORS AND INITIATIVES IN ZIMBABWE

Zimbabwe's renewable energy sector is gaining momentum as it seeks to diversify its energy sources and address energy deficits. Various actors, including the government, private sector, non-governmental organisations (NGOs), and international partners, have promoted renewable energy access using solar, wind, hydropower, and biomass. Zimbabwe has a Renewable Energy Policy guided by the country's NDCs, aligned to the demand-supply scenario, grid absorption capacity, and utilities' ability to pay for renewable energy electricity. Targets in the policy seek to achieve an installed capacity of 1100MW or 17 per cent of the total electricity supply to meet electricity demand, whichever is higher, from RE sources by 2025, and 2100MW or 27 per cent of of overall generation to meet electricity demand, whichever is higher, from RE sources by 2030.[7] Zimbabwe has set a target to install more than 250 000 solar geysers in old (as retrofits) and new buildings by 2030.[8] This section highlights key renewable energy actors and initiatives.

5.1. HYDROELECTRICITY

Zimbabwe's hydropower is significant. But the share of hydropower generation in the total energy mix is on the decline and increasingly unreliable due to low water levels on account of climate change induced droughts.[9] However, hydropower remains close to 100 per cent of the renewable energy share. This has resulted in power shortage in Zimbabwe characterised by load shedding of up to 8 or more hours. The shortage gap has also been closed through the import of hydro power from Mozambique's Cahora Basa through the Southern Africa Power Pool (SAPP).[10]

Figure 4: Zimbabwe's Renewable Electricity Generation by Source (non-combustible)



Source: IEA (2022)

In new developments, there is hydropower potential in the Batoka Gorge Hydroelectric Power Station project, a joint initiative between Zimbabwe and Zambia. This 2400MW hydroelectric power is estimated to cost US$4.5 billion. It is important to note that the project is close to the Victoria Falls, a UNESCO World Heritage site,[11] and faces significant opposition from communities and environmentalists, with threats to ecosystem services.

Solar energy production is on the rise, especially for domestic consumption but is still negligible in the electricity generation mix.

5.2. SOLAR ENERGY PROJECTS

Ironically, Zimbabwe hosted the UN Solar Summit in 1991. However, the country failed to use the event to increase investment in solar technologies. It took an electricity shortage for solar energy to receive prominence, and Zimbabwe has invested heavily in solar energy deployment in the past decade.

[7] Zimbabwe Ministry of Energy and Power Development "National Renewable Energy Policy" (Government Publications, 2019) <https://www.zera.co.zw/National_Renewable_Energy_Policy_Final.pdf> accessed 5 April 2024
[8] Ibid
[9] FurtherAfrica, "Kariba dam water loses 99% water amid heightening climate change" (FurtherAfrica.com, 4 January 2023) <https://furtherafrica.com/2023/01/04/kariba-dam-water-loses-99-water-amid-heightening-climate-change/#:~:text=Water%20levels%20at%20Kariba%20North%20Bank%20and%20Kariba,power%20generation%20as%20the%20climatic%20change%20crisis%20continues> accessed 5 April 2024.
[10] SAPP is a cooperation of the national electricity companies in Southern Africa under the auspices of the SADC. The companies have created a common power grid between their countries and a common market for electricity in the SADC region.
[11] Sneha Abraham, "UN Greenlights 2,400MW Batoka Gorge Project" (ConstructAfrica.com, 18 October 2023) <https://constructafrica.com/news/un-greenlights-2400mw-batoka-gorge-project> accessed 5 April 2024

5.3. INDEPENDENT POWER PRODUCERS (IPPS) AND RENEWABLE ENERGY

Several independent power producers have been granted licenses by the Zimbabwe Energy Regulatory Authority (ZERA) on account of Zimbabwe's 2019 National Renewable Energy Policy. The policy seeks to increase the share of renewables in the energy mix by creating incentives from supply to distribution and demand, in both urban and rural settings.[12]

Table 2: State of Licensed IPPs and State-Owned Projects

Licensee	Power Station	Capacity MW	Technology	Location	Offtaker
Padenga, Holdings Limited	Nuanvana South Solar Plant	1.2	Solar PV	Kariba	Own consumption
Econet Wireless	Econet Willowvale solar Plant	0.45	Solar PV	Harare	Own consumption
Standards Association of Zimbabwe	SAZ Solar Plant	0.19	Solar PV	Harare Province	Own consumption
Schweppes Limited	Schweppes Harare Solar Plant	1	Solar PV	Harare Province	Own consumption
Old Mutual Life Assurance Company Zimbabwe	Mutual Gardens Solar Plant	0.648	Solar PV	Harare Province	Own consumption
Econet Wireless Zimbabwe Ltd	Econet Msasa Solar Plant	0.105	Solar PV	Harare	Own consumption
Econet Wireless Zimbabwe Ltd	Econet Graniteside Solar Plant	0.10176	Solar PV	Harare	Own consumption
Econet Wireless Zimbabwe Ltd	Econet Mutare Solar Plant	0.1089	Solar PV	Mutare	Own consumption
Luxaflor Roses P/L	Luxaflor Roses Solar Plant	0.1184	Solar PV		Own consumption
MD De Chassart & Son P/L t/a/ Surrey Abattoir	Surrey Abattoir Solar Plant	0.117	Solar PV	Marondera	Own consumption
Schweppes Zimbabwe Limited	Schweppes BBj Factory Solar Plant	0.564	Solar PV		Own consumption
Tanganda Tea Company Limited	Tanganda Ratelshoek Solar Plant	1.8	Solar PV	Manicaland Province	Own consumption
Dromervale (Pvt) Ltd	Dromervale Farm Solar Plant	0.382	Solar PV	Marondera	Own consumption
Nottingham Estates (Pvt) Ltd	Nottingham Estates Solar/ Diesel Power Plant	2.25	Solar PV	Beitoridge	Own consumption
Infrastucture Fund Zimbabwe	First Mutual Part Borrowdale Solar Plant	0.15	Solar PV	Harare	Own consumption
Tanganda Tea Company Limited	Jesey Estates Solar Plant	1.4	Solar PV	Manicaland	Own consumption
Tanganda Tea Company Limited	Tingamira Estate	1.2	Solar PV	Manicaland Province	Own consumption
Rift Valley Properties (Pvt) Ltd	Bay 11 Solar Plant	0.5	Solar PV	Harare	Own consumption
Guruve Solar Park (Pvt) Ltd	Guruve Solar Park	1.2	Solar PV	Mashonaland Central Province	ZETDC
Caledonia Mining Services (Pvt) Ltd	Blanket Mine Solar Plant	17.5	Solar PV	Matebeleland South	Own consumption
SolGas (Pvt) Ltd	Cross Mabale Power Plant	5	Solar PV	Cross Mabela, Hwange	ZETDC
Centragrid (Pvt) Ltd	Centragrid Power Station	2	Solar PV	Cross Mabela, Hwange	ZETDC
Riverside Power Station (Pvt) Ltd	Riverside Power Station	2.5	Solar PV	Mutoko Mashonaland East	ZETDC

Source: Zimbabwe Energy Regulatory Authority (2024)

[12] DLA Piper Africa, "Africa Energy Futures: Zimbabwe" (DLA Piper Africa, 3 November 2022) <https://www.dlapiper.com/en/insights/publications/2022/11/africa-energy-futures/africa-energy-futures-zimbabwe> accessed 12 April 2024.

By 2023, about 23 IPPs were licensed under the solar PV technology, and 18 projects involved installation for own use. The power generated is used to supply electricity to mining (Blanket Mine), agro-industrial (Tanganda estates), and telecommunications (like Econet) companies. The megawatts range from a high of 17MW to as low as 0.1MW. However, it has been reported that licensed IPPs have failed to operate for several reasons, including foreign currency shortages and funding challenges.

There are solar farm projects in the pipeline that promise to boost Zimbabwe's renewable energy potential. These include an innovative plan supported by the European Union to float solar panels on top of the Kariba Dam water surface.

KARIBA DAM SOLAR FLOATING PROJECT

China Global South Project (2023) pointed out that a Chinese Energy Engineering Corp aims to construct a 1000-megawatt (MW) floating solar plant on the Kariba dam along the Zambezi River. This project will be worth nearly $1 billion. This innovative project aims to supplement the existing hydropower generation, which is increasingly affected by climate-induced water level fluctuations

Litigation related to procurement disputes has cast doubts on the transparency of renewable energy licenses. In a matter in which the Zimbabwe Power Company (ZPC) floated a tender for the engineering, procurement, and construction (EPC) of a 1000MW Gwanda Solar Power Station Project, a legal dispute with the contractor, Intratek Zimbabwe in partnership with China's ZTE, has resulted in project delays. In January 2023, the High Court declared the EPC contract valid and binding between the parties with an order for ZPC to pay Intratek an amount of US$1 191 374 and an outstanding balance of US$693 000. The matter was heard before the High Court and on appeal by the Supreme Court of Zimbabwe [See Zimbabwe Power Company v Intratrek Zimbabwe (127 of 2023) [2023] ZWSC 56 (1 December 2023)]. As the dispute rages, it is reported that ZPC has awarded a new power purchase agreement, signed between ZPC's ZETDC and Matshela Energy Limited, a South African IPP.

The project delays underscore the need for more robust procurement regulations and integrity of process to ensure the effective implementation of renewable energy initiatives in Zimbabwe. As pledged by state parties to the Paris Agreement at COP 28, the UAE Consensus commits countries to triple renewable energy capacity by 2030, meaning that energy policies and regulations must be enabling to ensure rapid expansion of wind power, solar power, hydropower and geothermal power. Increased accountability in renewable energy value chains will attract foreign capital and donors to close the energy financing gap currently stalling project development in developing countries such as Zimbabwe. Donor efforts such as those by the Zimbabwe Multi-Donor Trust Fund (ZimFund), administered by the African Development Bank (AfDB), supports solar power initiatives in rural areas (AFDB 2017). The AfDB-managed Sustainable Energy Fund for Africa (SEFA) approved a US$965 000 grant to Oxygen Energy Private Limited to develop a 20MW off-grid solar PV rooftop project on buildings owned and managed by Old Mutual Property Group Zimbabwe countrywide (AFDB 2017).

5.4. WIND ENERGY PROJECTS

Zimbabwe intends to generate 100 MW from wind power by 2025.[13] However, the country still needs to understand its full wind potential through scientific studies. In 2017, the Zimbabwe Energy Regulatory Authority (ZERA) invited bids from contractors to undertake a feasibility study on potential sites where wind power stations could be established, but these stalled due to high-cost prices. In one of the major initiatives, Power Technology (2024) states that Optate Africa plans to build a 200MW wind power plant near the town of Plumtree in the country's southwest. In a notice given in terms of Section 71 of Rural District Council Act (Chapter 29:13), the Mangwe Rural District Council indicated that Optate Africa has sought a 25-year lease from the council for 100ha of land to set up its plant. In Guruve, another wind-power project is an early-stage 100MW project jointly developed by Enerfin Sociedad de Energia, SLU (Tatanga Energy 2024). Enerfin is a subsidiary of Elecnor Group, one of the leading Spanish companies in developing and operating infrastructure projects, and Tatanga Energy. This project is being developed in the Mashonaland Central Province, along the Guruve and Mazowe Rural District Councils border in northern Zimbabwe (Tatanga Energy 2024).

5.5. BATTERY STORAGE SYSTEM AND ELECTRIC VEHICLES (EVS)

In the global energy transition context, lithium-ion (li-ion) batteries have been incorporated into electric vehicle value chains due to their superior power density, central to moving vehicles over long distances. With the market share for EVs currently accounting for 18 per cent of all cars sold globally and growing rapidly, predictions suggest that they will reach more than 30 per cent of vehicle sales by 2025. Most of these batteries will be powered by nickel-containing li-ion batteries.

Zimbabwe is making strides in integrating battery storage systems and EV projects to enhance its renewable energy landscape. Notable initiatives include ZERA's renewable energy projects and a proposed lithium battery manufacturing plant. GreenFuel (Pvt) Ltd is expanding its ethanol operations to include battery storage, while the ZIM-EV project aims to introduce EVs and develop local manufacturing capabilities. The Harare Institute of Technology is experimenting with the development of locally sourced lithium-ion batteries, in collaboration with international institutions.

5.5.1. Lithium-ion Battery Manufacturing

In Zimbabwe, there is a pressing need to develop the production capacity for lithium-ion batteries as part of the country's vision for industrial growth. This includes envisioning the manufacturing of various components such as lithium carbonate, electrodes, electrolytes, lithium-ion batteries, and the assembly of electric vehicles. Due to its substantial lithium reserves, EV battery manufacturing in Zimbabwe offers significant economic growth potential. However, this sector's development is closely linked to geopolitical dynamics, with Zimbabwe's strategic position in the global lithium market exposing it to international political and economic pressures. Foreign investments, particularly from China, introduce external influences that can shape local policies and priorities, potentially leading to dependency if not managed well. As global demand for EV batteries rises, Zimbabwe must balance attracting foreign investment with safeguarding national interests through robust local content policies.

5.5.2. Nickel Feedstock for Battery Manufacturing

In addition to lithium, Zimbabwe has nickel, which is also critical to manufacturing batteries. Its main advantage over other metals is its lower cost to deliver higher energy density and greater storage capacity. Further advances in nickel-containing battery technology mean that it is set for an increasing role in energy storage systems, helping make the cost of each kWh of battery storage more competitive. It makes energy production from intermittent renewable energy sources such as wind and solar more viable. With this increasing market share, battery technology is also advancing, another reason why the proportion of nickel-containing li-ion batteries in use is set to grow. Two of the most used types of batteries, nickel cobalt aluminium (NCA) and nickel manganese cobalt (NMC), use 80 per cent and 33 per cent nickel, respectively; newer formulations of NMC are approaching 90 per cent nickel.[14]

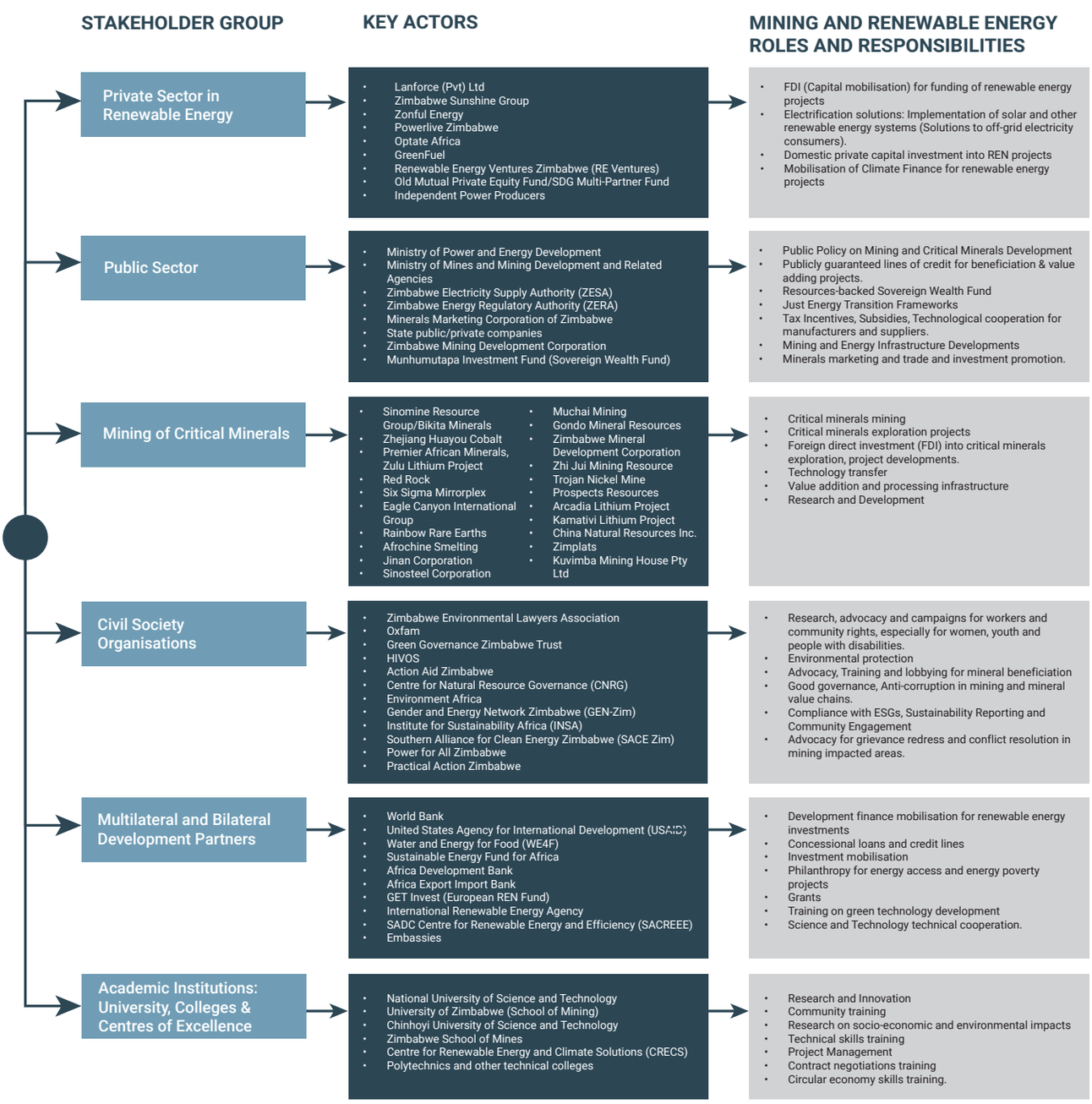
[13] REVE (Wind Energy and Electric Vehicle Magazine), "Zimbabwe plans to produce 100 MW from wind energy" (REVE, April 18, 2021) < https://www.evwind.es/2021/04/18/zimbabwe-plans-to-produce-100-mw-from-wind/80409> accessed 4 May 2024

[14] Reuters, "Exclusive: Tesla taps Asian partners to address 4680 battery concerns" <https://www.reuters.com/business/autos-transportation/tesla-taps-asian-partners-address-4680-battery-concerns-2023-03-10/> accessed 13 April 2024.

Today, most li-ion batteries, known for their reliability and effectiveness, rely on nickel. This reliance on nickel is a testament to its role in enhancing the performance and potential of these batteries.

Geopolitical tensions like trade wars can impact supply chains and market dynamics, making localisation or regionalisation of value chains crucial. A strategic approach involving strong local content policies, diverse investment sources, and proactive international engagement is therefore essential for Zimbabwe to effectively leverage its EV battery manufacturing potential. Strategies to localise value chains are unclear, aside from the government banning raw lithium exports. Lithium processing can be basic, like any mineral, and the country continues to export bulk, un-beneficiated concentrates. The following demonstrate key actors and initiatives in the context of critical minerals and renewable energy transition in Zimbabwe.

Figure 5: Stakeholder Mapping



6.HIGHLIGHTING ZIMBABWE'S CRITICAL POLICY GAPS

6.1. POLICY DISCONTINUITY AND TECHNICAL CAPACITY

The key gap in Zimbabwe's approach to critical minerals and renewable energy value chains lies in the discontinuity and lack of technical expertise in policy development. Efforts to create a comprehensive national minerals development policy and a lithium-specific strategy were abandoned due to the departure of key personnel, leaving the Ministry of Mines and Mining Development without the necessary capacity to formulate effective policies. This absence of an overarching policy framework leads to fragmented initiatives and undermines transparency, coordination, and strategic planning, which is crucial for harnessing the full potential of Zimbabwe's mineral resources.

In the SADC region, only Zambia has developed a draft National Critical Minerals Strategy. This follows the example of countries such as Australia, Canada, the US and members of the European Union. China, which has exercised export bans on graphite exports, follows a strategic approach to its critical minerals and imports from all over the world. There is a clear industrial logic in the dealings of the powerful countries regarding critical minerals and participation in global renewable energy value chains.

6.2. LACK OF LOCAL CONTENT POLICIES AND GUIDELINES ON CRITICAL MINERALS

Zimbabwe's pursuit of sustainable mineral development faces challenges stemming from inadequacies in local content policies. The Zimbabwe National Industrial Development Policy ((2024-30), while acknowledging local content as a strategic thrust, lacks detailed implementation guidelines, hindering effective monitoring and implementation. Moreover, ambiguity persists regarding the definition of local content, especially concerning upstream supply to lithium mines and the differentiation between domestically produced and imported materials, impacting local procurement and supplier development efforts. The Local Content Strategy also fails to address direct employment opportunities in primary lithium production, overlooking a crucial aspect of local economic empowerment. Furthermore, insufficient consideration is given to the potential impact of local ownership on enhancing local content, and social sustainability issues such as the participation of marginalised groups and gender equality. Delegating local content thresholds to industry bodies like the Chamber of Mines risks prioritising corporate interests over broader socio-economic development. Moreover, policy instruments like Statutory Instrument 5 of 2023 lack clarity, raising concerns about accountability and potential abuse of authority. Addressing these gaps is imperative for formulating comprehensive local content policies that promote sustainable mineral development and inclusive growth in Zimbabwe.

7.JUST ENERGY TRANSITION

People and nature are at the centre of the global energy transition. In essence, there are two transitions that are in motion: a transition to a low-carbon society and a just energy transition for people and the environment. There is a need to build resilience in these two transitions.

7.1. ENERGY POVERTY AND AFFORDABLE ENERGY ACCESS

Zimbabwe experiences frequent load shedding due to inadequate power generation capacity, aging infrastructure, and maintenance issues, significantly impacting both urban and rural areas and leading to unreliable electricity supply (Mhaka, Runganga, Nyagweta, Kaseke, and Mishi, 2020). Much of the population lacks access to reliable and affordable energy, affecting economic activities, health services, education, and overall quality of life (Mhaka et al. 2020). Much of Zimbabwe's power infrastructure is outdated and requires substantial modernisation investment, with key facilities like the Hwange Thermal Power Station often operating below capacity (AfDB 2024). The country relies on electricity imports from South Africa and Mozambique to supplement domestic generation, making it vulnerable to regional supply constraints (AfDB 2024). The Kariba Dam, a major source of hydroelectric power, faces reduced capacity due to recurring droughts, exacerbating power shortages and increasing dependence on imports (World Economic Forum 2016, Dube and Nhamo, 2023). While rural electrification remains a priority, with the Rural Electrification Agency working to extend the grid and promote off-grid renewable energy solutions (Rural Electrification Fund 2024), significant investments, policy support, and community engagement are still needed.

Communities play a vital role in decision-making processes concerning the utilisation of their resources, as enshrined in constitutional provisions and principles of devolution. However, without transparency and accountability in the sector, achieving mitigation, resilience, and sustainable development (particularly regarding critical minerals such as lithium) becomes unattainable. A crucial omission in the nationally determined contributions (NDCs) is the need for more focus on expanding the exploration and mining of hydrocarbons, which contradicts the goal of transitioning towards greener energy sources. Addressing this requires a just transition approach, considering equitable resource distribution, long-term market outlook, and competent contract negotiation to ensure win-win outcomes. Moreover, energy access remains challenging in many mining communities, highlighting the need for comprehensive solutions prioritising intragenerational and intergenerational equity, and ultimately fostering sustainable development.

7.2. NAVIGATING THE RISKS OF A JUST ENERGY TRANSITION

Zimbabwe's rich deposits of critical minerals, such as lithium, platinum group metals, and rare earth elements, are pivotal for the global shift towards renewable energy. However, this transition poses several risks that must be addressed to ensure the transition is just and sustainable. The extraction of critical minerals in Zimbabwe has significant environmental and economic implications. For instance, mining activities in the Great Dyke, which is rich in platinum group metals, nickel, and chromium, threaten local biodiversity by disturbing habitats and displacing wildlife. Unki Mine, operated by Anglo American Platinum, has faced criticism for its ecological impact, prompting the implementation of environmental management strategies such as buffer zones and reforestation. in addition, artisanal and small-scale gold mining poses environmental hazards, notably mercury pollution in water bodies like the Mazowe River, impacting human health and ecosystems.

7.3. EFFORTS TO DECARBONISE THE MINING SECTOR IN ZIMBABWE

Zimbabwe's mining sector, which includes over 60 exploited minerals contributes significantly to the economy, making up 8.6 per cent of GDP and over 60 per cent of exports. Efforts to decarbonise this sector are crucial for achieving the country's economic and environmental goals, including commitments under the NDCs for greenhouse gas (GHG) emissions reduction. The principal regulatory framework, the Mines and Minerals Act of 1961, lacks direct provisions for climate change but allows for incorporating climate considerations through mining rights negotiations. The Environmental Management Act (EMA) [Chapter 20:27] addresses environmental impacts, requiring environmental impact assessments (EIAs) and regulating air quality and emissions. Key statutory instruments, such as SI 72 of 2009 and SI 131 of 2016, target atmospheric pollution and ozone-depleting substances, respectively. Reporting standards like the Global Reporting Initiative (GRI) and environmental and social governance (ESG) disclosures are encouraged to measure and report carbon emissions. The GRI on mining provides greater scope for promoting a just energy transition and corporate accountability. These legislative frameworks and initiatives aim to align Zimbabwe's mining practices with global decarbonisation efforts, promoting sustainable development in the sector. More compliance systems are required to ensure greater scope for social and environmental justice.

7.4. DECARBONISATION OF STEEL PRODUCTION PROCESSES

The Manhize Iron and Steel Plant in Mvuma is owned by China's Dinson Iron and Steel Company. It is estimated to cost $1.5 billion on completion of its first phase and will have the capacity to produce 1.2 million tonnes a year. While this is critical to spur industrial growth and steel exports, the power used to produce steel will contribute to the country's GHG emissions. From the dedicated power supply, through a special grid supply between ZEDTCO and the steel company, the plant's furnaces will use Hwange coal-generated electricity and coke to remove the oxygen. This is a missed opportunity for Zimbabwe to produce 'green steel' produced using clean energy, significantly reducing GHG emissions and mitigating environmental impact and global warming. Given the abundance of solar potential in Zimbabwe, the use of renewable energy is a possibility that the country must incentivise investors to adopt if it is to meet its NDC commitments to cut emissions by 40 per cent by 2040.

In this sphere of green steel initiatives, Zimbabwe can draw lessons from international good practices in countries such as Sweden where the Hydrogen Breakthrough Ironmaking Technology (HYBRIT), a joint venture between SSAB, LKAB, and Vattenfall, aims to produce steel using hydrogen and electricity from renewable sources.[15] H2 Green Steel, a Swedish project, seeks to build a large-scale, fossil-free steel plant using hydrogen in 2024. ArcelorMittal's Smart Carbon and Innovative DRI has used multiple methods to produce green steel, including hydrogen and exploration of carbon capture and storage technologies. Hydrogen is not a major topic in Zimbabwe, but this should not be a limitation as Namibia and South Africa are developing an export-oriented green hydrogen economy. Zimbabwe can tap into this regional renewable energy supply chain as part of SADC co-operation and intra-Africa trade promoted by the AfCFTA to produce green steel. The decarbonisation of the steel industry and the production of green steel will create a ready market due to the high demand for sustainable products in this age of climate change and transformative industrialisation. Unlike in South Africa, where carbon capture, use, and storage (CCUS) is part of its Integrated Resource Plan (IRP) 2023,[16] this technology has not been considered an interim measure to justify the continued use of coal. In the steel sector, CCUS involves capturing CO2 emissions from plants to prevent the release of emissions into the atmosphere. The carbon can be stored underground or repurposed for other industrial processes.

[15] Vattenfall, "HYBRIT: The world's first fossil-free steel ready for delivery", (Vattenfall, 18 August 2021) <https://group.vattenfall.com/press-and-media/pressreleases/2021/hybrit-the-worlds-first-fossil-free-steel-ready-for-delivery#:~:text=The%20HYBRIT%20initiative%20was%20launched%20in%202016%20by,steel%2C%20with%20fossil-free%20pellets%2C%20fossil-free%20electricity%20and%20hydrogen.> accessed 2 May 2024

[16] Department of Mineral Resources and Energy (South Africa), (2024, January 4), "Integrated Resource Plan, 2023", (Notice No. 49974) Government Gazette , Vol 703, No. 10177) <https://www.dmre.gov.za/Portals/0/Energy_Website/IRP/2023/IRP%20Government%20Gazzette%202023.pdf> accessed 5 March 2024.

7.5. FINANCING THE GREEN TRANSITION

7.5.1. Domestic Resource Mobilisation

Zimbabwe has been plagued by decades of political and economic crisis. Access to international capital has, therefore, been a mammoth task. The country should strengthen the route of domestic resource mobilisation and forge collaborative partnerships with private or philanthropic sectors.

7.5.1.1. Progressive Taxation

A review of Zimbabwe's revenue policies is recommended. The government must develop a tax system to raise funds from critical mining companies for research and innovation, infrastructure development and budget support for social expenditure.

7.5.1.2. Private Sector Investment

Zimbabwe needs to establish clear and transparent public private partnership (PPP) frameworks to encourage private sector participation in green projects. This involves regulatory support, incentives, and risk-sharing mechanisms. This approach should extend to mobilising the necessary funding and expertise through public-private-philanthropic partnerships (PPPPs). These partnerships leverage the strengths of public institutions, private enterprises, and philanthropic organisations to drive green initiatives.

7.5.1.3. Zimbabwe's Sovereign Wealth Fund: The Mutapa Investment Fund

The Zimbabwe Sovereign Fund (now called Mutapa Sovereign Wealth Fund, which includes critical minerals mining companies) can also be used as a domestic financing mechanism.[17] Through domestic resource mobilisation, Zimbabwe can potentially restructure existing debt or secure new loans on more favourable terms. In its new currency reforms, Zimbabwe is using gold and critical minerals to back its latest currency Zimbabwe Gold (Zig).

7.5.1.4. Green Bonds

For Zimbabwe, Green bonds can offer a viable and innovative solution for financing the transition to a green economy. Green bonds can promote sustainable development and address climate change by attracting investment in renewable energy, sustainable agriculture, and other environmental projects.

7.5.2. Debt Distress and Public Debt Reforms

Public debt reforms offer a viable pathway for financing Zimbabwe's green transition: negotiating debt cancellation or rescheduling, which has the potential to unlock critical financial resources needed to invest in renewable energy, sustainable agriculture, and climate resilience. Zimbabwe has faced significant economic challenges over the past decades, resulting in a substantial public debt burden (Matandare and Tito, 2018). As of recent reports, Zimbabwe's public debt stands at approximately US$18 billion, comprising domestic and external debt (AFDB, 2023). According to the World Bank (2022), Zimbabwe is classified as 'in debt distress', with unsustainable public and publicly guaranteed (PPG) external and total debt and large external arrears.[18] These high public debt levels have, among other things, constrained the Zimbabwe government's ability to invest in critical infrastructure and development projects, including financing of climate change action and the green transition.

[17] While these can be used as domestic sources for climate finance in the implementation of the country's NDCs, it is also important to acknowledge the role that illicit financial flows and corruption have played in threatening the developmental aspirations of the country.
[18] World Bank, "Zimbabwe: Joint Bank-Fund Debt Sustainability Analysis" <https://documents1.worldbank.org/curated/en/342191656080358057/pdf/Zimbabwe-Joint-World-Bank-IMF-Debt-Sustainability-Analysis.pdf> accessed 28 April 2024.

7.5.3. Revenue Leakages: Illicit Trade in Critical Minerals and Illicit Financial Flows

The governance of minerals extraction and trade has been characterised by revenue leakages. This has resulted in smuggling, superficial government disclosures, limited capacity of regulatory authorities to enforce compliance in mines, and a lack of coordinated information dissemination in government institutions.[19] Skills limitations to evaluate mining data and lack of *verification and assaying* processes have provided sophisticated mining companies with loopholes to engage in illicit activities.[20] Taxation law and poor enforcement or legislative oversight of parliament resolutions regarding revenue leakages (including the inadequacy of weighbridges) have been inadequately implemented.[21] Can the government detect illicit trade in minerals and machinery to distinguish minerals such as silica from lithium exports? Border controls are important, but small aeroplanes may still be a menace. Zimbabwe reportedly loses about $100 million monthly in leakages through sophisticated syndicates.[22]

Critical minerals, such as lithium, nickel, and rare earth elements, are essential for green technologies, including electric vehicles and renewable energy systems. However, illicit financial flows (IFFs) often undermine financial benefits from these resources. The UNCTAD Economic Development in Africa Report (2020) states that illicit financial flows and corruption inhibit African development by draining foreign exchange, reducing domestic resources, stifling trade and macroeconomic stability, and worsening poverty and inequality.[23] Addressing IFFs is vital for financing the green transition in Zimbabwe by ensuring that revenues from critical minerals are used to support sustainable development and environmental goals. Several unmonitored airstrips have been used to smuggle minerals out of Zimbabwe. The technology is sometimes inadequate, and new radar control systems are needed to monitor aircraft entering and leaving the country's airspace.

Addressing IFFs is vital for financing the green transition in Zimbabwe by ensuring that revenues from critical minerals are used to support sustainable development and environmental goals.

[19] Pemberai Abide Tanda and Bekir Genc, "Zimbabwe's mining policy impact on revenue leakages" (Resources Policy, Volume 91, April 2024).
[20] Ibid
[21] Ibid
[22] Harmony Agere, "Unmonitored airstrips to be closed" Sunday Mail 21 November 2020.
[23] SUNCTAD, "Tackling Illicit Financial Flows for Sustainable Development in Africa" (Economic Development in Africa Report 2020) <https://unctad.org/system/files/official-document/aldcafrica2020_en.pdf> accessed 5 April 2024.

8.CONCLUSIONS AND RECOMMENDATIONS

Based on the comprehensive analysis of Zimbabwe's critical minerals and renewable energy value chains presented above, it can be concluded that Zimbabwe is intricately linked to global trends in energy transformation and critical mineral demand. Furthermore, the analysis has identified key conclusions and recommendations, which include the key areas addressed below.

8.1. GEOLOGICAL SURVEYS AND CLOSING THE DATA GAP

Zimbabwe's geological surveys have revealed a rich endowment of critical minerals, positioning the country as a significant player in the global energy transition. Comprehensive and updated geological surveys are crucial for accurately assessing the quantity and quality of these resources, facilitating informed decision-making, and attracting potential investors. Regular geological mapping and exploration initiatives are essential to maintain an up-to-date inventory of Zimbabwe's mineral wealth, ensuring that the country can effectively leverage its natural resources for sustainable development.

8.2. MINERAL VALUE CHAINS, STRATEGY AND CRITICAL MINERALS LIST

The country possesses abundant critical minerals essential for the energy transition, such as lithium, PGMs, manganese, cobalt, copper, chromium, and nickel are vital for various green technologies. However, the development of robust mineral value chains is hampered by challenges related to policy discontinuity, technical capacity gaps, and inadequate local content policies. Strengthening these value chains requires a holistic approach that includes the development of a national critical minerals strategy and a critical minerals list. This should spell out critical minerals value chains, capacity building, infrastructure development, and policy reforms to ensure that these minerals' extraction, processing, and export contribute maximally to the national economy.

8.3. GOOD AND TRANSPARENT RESOURCE GOVERNANCE

Efforts to promote renewable energy initiatives, including solar, hydropower, wind, and biomass projects, are underway, but issues such as corruption and mismanagement underscore the need for stronger oversight and accountability mechanisms. Good and transparent resource governance is paramount to achieving sustainable mineral development. This involves implementing and enforcing policies that ensure transparency in licensing, contracts, and beneficial ownership. Adopting stringent environmental, social, and governance (ESG) standards and climate disclosures can help build trust and attract responsible investments. Establishing a robust framework for negotiating terms and contracts is also critical to safeguard national interests and ensure fair revenue distribution.

8.4. HUMAN RESOURCES AND SKILLS DEVELOPMENT

The successful transition to a sustainable energy and mineral economy necessitates significant investment in human resource development. Building a skilled workforce capable of operating and managing advanced technologies in both the mining and the renewable energy sectors is essential. This includes enhancing educational and vocational training programmes, fostering research and development, and encouraging partnerships between academic institutions and industry players. By investing in human capital, Zimbabwe can create a knowledgeable and adaptable workforce that drives innovation and sustains growth in these critical sectors.

8.5. TECHNOLOGICAL COOPERATION

Technological cooperation with international partners is vital for overcoming the technical capacity gaps that currently hinder the effective exploitation of Zimbabwe's mineral resources and the development of renewable energy projects. Collaborative efforts in technology transfer, research, and innovation can help Zimbabwe adopt best practices and state-of-the-art technologies, boosting efficiency and sustainability. Engaging with global technology leaders and participating in international forums can give Zimbabwe the necessary expertise and tools to advance its energy transition goals.

8.6. REGIONAL INTEGRATION AND COLLABORATION

Regional integration and collaboration play a significant role in enhancing Zimbabwe's capacity to achieve a green transition. By participating in regional initiatives and trade agreements, Zimbabwe can benefit from shared resources, knowledge, and infrastructure. Collaboration with neighbouring countries can lead to developing cross-border renewable energy projects and harmonising regulatory frameworks, fostering a more integrated and resilient regional energy market. Regional partnerships also provide joint ventures and investment opportunities, strengthening economic ties and promoting sustainable development.

8.7. CAPITAL MOBILISATION

Mobilising capital is a critical component of financing Zimbabwe's green transition. Leveraging domestic and international funding sources, such as green bonds, climate finance mechanisms, and development aid, can provide the necessary financial support for large-scale renewable energy and sustainable mining projects. Establishing the Mutapa Sovereign Wealth Fund as a key domestic financing tool helps channel investments into priority areas, ensuring long-term economic stability and sustainability. Creating an enabling environment for private sector participation and fostering public-private partnerships can attract significant investments, driving the green transition forward.

8.8. ADDRESSING ENERGY POVERTY AND DECARBONISATION

Zimbabwe's energy mix still relies heavily on hydrocarbons, particularly coal, highlighting the imperative for a just energy transition to address energy poverty and reduce GHG emissions. Achieving a just transition involves ensuring that the shift towards renewable energy does not exacerbate social inequalities or leave vulnerable communities behind.

Zimbabwe should focus on inclusive growth, environmental sustainability, and energy security to successfully navigate the challenges of the energy transition and build a resilient, green economy for the future.

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