



Botswana's Critical Minerals Opportunity: Evaluating Policies and Value Chain Development Prospects

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ABSTRACT

Botswana, with its rich deposits of critical energy transition minerals such as copper, manganese, nickel, and cobalt, stands at a crossroads between becoming a global leader in green technology manufacturing or continuing to export raw minerals. These minerals are essential for developing renewable energy technologies, including solar panels, wind turbines, and battery storage systems for electric vehicles (EVs). As the demand for these resources surges due to the global energy transition, Botswana should decide whether to pursue beneficiation strategies to create green jobs and locally-manufactured technologies or remain reliant on imports for its energy transition. This brief explores Botswana's existing policies on critical energy transition minerals, identifies gaps, and provides recommendations to ensure alignment with the country's climate goals, including its Nationally Determined Contributions (NDCs) and Just Energy Transition (JET) plan.

EXECUTIVE SUMMARY

The Government of Botswana is sensitised of the potential that critical raw materials have for digital and green transition. As a mineral-led economy, the mineral exploration and mining landscape is already shifting to include critical energy transition minerals (CETMs; hereinafter critical minerals) value chain development at which the government of Botswana's second Transitional National Development of 2022 (TNDP) for the period April 2023 to March 2025 (National Planning Office Government of Botswana, 2022) has invested billions of Pula to take advantage of all the country's strategic and critical mineral development and value addition within the economy. The government acknowledges that making a mineral-led growth sustainable is a lofty, if not elusive, goal with pressing challenges arising in the form of impact, challenges, mitigation and adaptation. Therefore, value chains could potentially be developed on local raw materials as well as opportunities for participation in the regional frameworks such as the Southern Africa Customs Union (SACU), Africa Continental Free Trade Area (AfCFTA) and global value chains (National Planning Office Government of Botswana, 2022). The TNDP was a two-year national project for 2023 and 2024, earmarked for considerable research and development and with a budget of BWP156,20 million (approximately USD\$12m). Its intended purpose was to provide data that will facilitate project identification, assessment and exploitation of minerals and other commodities to inventories and develop mineral resources for sustained growth. These projects include, but are not limited to, National Integrated Geoscience Information System (NIGIS), recapitalisation and commercialisation of Botswana Geoscience Institute (BGI) laboratories, development of a 10-year Mineral Resource Development, Exploitation and Value Chain (Beneficiation) Strategy to resuscitate the Botswana mining value chain and further interpretation of Aeromagnetic Geoscience Data, (National Planning Office Government of Botswana, 2022). Furthermore, the Mineral Policy of 2022 has considered a more attractive business climate and investment that considers several objectives of mining diversification from the diamond-led economy and to aggressively promote Botswana's mining sector and promote beneficiation and value-added activities where viable. The intention is to explore shared synergies, resource pooling and have integrated planning.

The country has limited rail network constrained only to the East but through the TNDP, the government invested BWP199 million (approximately USD\$15m) to provide infrastructure for trade and investment promotion. The government also invested BWP8,5 billion (approximately USD\$640m) on the identification,

acquisition, development, operation and maintenance of complementary water resources to support development in the mining and other sectors (National Planning Office Government of Botswana, 2022).

It is evident that Botswana has still not fully explored the green technology manufacturing opportunities. However, it is on the right path to explore its potential through strategies aimed at defining mineral occurrences, opportunities in the region and facilitating the required supporting infrastructure.

In this policy brief, a comprehensive review of the mining sector, existing policies, strategies and plans related to critical minerals, renewable energy technologies and the global energy transition as combined with the urgency of cutting carbon gas emissions is discussed. The alignment of these policies with Botswana's Just Energy Transition (JET) plans is reviewed to identify gaps, challenges and barriers in the current policy framework. Finally, policy recommendations and roadmap suggestions for implementing recommendations on the critical minerals strategy and green technology development in Botswana are made.

BOTSWANA'S MINING SECTOR OVERVIEW AND CRITICAL ENERGY TRANSITION MINERALS DEVELOPMENTS IN SADC AND BOTSWANA

There is no clear strategy that profiles critical minerals development in Botswana. Historically, Botswana has been a diamond-led country with a successful model coupled with a strong macroeconomic policy framework that managed to transform it from a poor to middle income economy. At independence in 1966, beef was the country's main export and largest sector which contributed 39% of annual Gross Domestic Product (GDP). The diamond mining sector in Botswana took-off in the 1970s when international aid dominated the government budget as the main source of foreign exchange (Lewin, 2011). On average the sector contributed 49% in 1986, 34% in 1996, and 35% in 2006 (Ministry of Finance and Economic Development, 2017). Diamond revenues were channelled to the revenue stabilisation fund which later became the government's stable source of revenue. Another part of fiscal savings was channelled to other forms of capital invested in infrastructure, health and education, contributing to growth without crowding out private sector investment and development. This was a successful measure of sustainability (Hamilton, Ruta, & Tajibaeva, 2005).

In some respects, Botswana succeeded by using appropriate and robust macroeconomic, exchange rate and fiscal policies (Jefferis, 2016). In 2011, Debswana, the predominant diamond mining company, saw its shareholders, De Beers and the Botswana Government conclude a diamond sales agreement that gave Botswana direct access to the global diamond market. Under the 10-year agreement, the Diamond Trading Company International (DTCI) was to relocate its sights and operations, which included professional, skills, equipment and technology, from London (United Kingdom) to Gaborone by 2013. The agreement stated, among others, that from the sales base in Gaborone, DTCI would aggregate production from De Beers' operations worldwide and sell to international sight-holders. Further, the DTCI was to continue supporting the local diamond cutting and polishing industry in Botswana and increase the



commitment by making more diamonds available for manufacturing in Botswana, from US\$500 million (approximately BWP3.5 billion) to US\$800 million (approximately BWP5.6 billion) per annum in 2014 (unpublished reports).

Generally, the contribution of mining to GDP has been declining, notably in the period between 2017 and 2023 where the mining GDP to total GDP was just below 20%. In 2020, due to the COVID-19 global health pandemic, diamond contribution to GDP recorded lows of 9% percent and recovered to about 17% in 2023 (Statistics Botswana, 2024). Notably, the percentage share of mining had dropped due to the country's efforts to diversify the economy away from minerals and hence recorded successful growth of non-mining sector to total GDP, showing positive effects of intended economic diversification (Sefemo & Segobai, 2019).

The other mined mineral resources in Botswana include copper, nickel, silver and cobalt as a by-product, soda-ash and salt, gold and industrial minerals. There are also some occurrences of platinum group metals (PGMs) and rare earth minerals such as platinum, palladium, rhodium, ruthenium, lithium, tantalum, tin, caesium, zinc and manganese, whose development are at the feasibility stage in most operations (The S&P Capital IQ Pro platform, 2024).

Critical energy transition minerals are scarce, and their production and processing is dominated by a few countries. The German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (2023), describes the Southern African Development Community's (SADC) selected critical minerals as chromium, cobalt, graphite, lithium, manganese, nickel, rare earth elements (REEs), tantalum, titanium and zinc. These are found in the thirty-four (34) defined European Union (EU) raw critical minerals: (aluminum/bauxite, antimony, arsenic, baryte, beryllium, bismuth, boron/borate, cobalt, coking coal, feldspar, fluor spar, gallium, germanium, hafnium, helium, heavy rare earth elements (HREEs), lithium, light rare earth elements (LREEs), magnesium, manganese, natural graphite, niobium, platinum group metals (PGM), phosphate rock, copper, phosphorus, scandium, silicon metal, strontium, tantalum, titanium, tungsten, vanadium, and nickel) and SADC relevant minerals (chromium, coal, diamonds, gold, tantalum, tungsten, uranium, vanadium, zinc).

Whilst there is no clear definition of the category of critical minerals, the demand for these specific minerals, used for clean energy technologies, renewable energy compatible grid infrastructure and e-mobility, solar photovoltaic panels, onshore and offshore wind parks, and production of electric vehicles (EVs), assigns unique value to these resources. Mobility REEs are critical for the production of permanent magnets that are vital for wind turbines, while nickel is crucial for building nacelles for these turbines. Silicon is essential for PV solar cells and electricity networks need huge amounts of copper and aluminium. Copper is the cornerstone for all electricity related technologies, whereas EV batteries and grid storage batteries use a large amount of these minerals especially cobalt, graphite, lithium, manganese, nickel and phosphorus (German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection, 2023).

In June 2021, Khoemacau completed construction of its low-cost c.60ktpa copper and c.1.6Mozpa silver metal concentrate with the company's annual production anticipated to rise to between 40,000 and 50,000 tonnes of copper in copper concentrate (MMG, 2024). The Chinese investor, MMG Ltd., is reported to have invested US\$700 million to double production on this mine and secure the copper critical minerals which are on high demand for the green energy transition. This investment will increase copper output to at least 130,000

Botswana has the following critical minerals and per the work definition. In their demands for renewable energy technologies and global energy transitions.

- Copper
- Nickel
- Cobalt
- Manganese
- Potential REE

There is a notable boom in the development of copper, nickel, silver and cobalt deposits in Botswana. These currently fall under the base metal category within the Botswana Mineral Policy. These minerals, particularly copper-silver, are concentrated in the prospective regions of the Kalahari Copper belt that has similar setting to the Central Africa.

tonnes, with silver output rising from five (5) million ounces per annum to 1.6 million ounces, as reported by the Managing Director, Johan Ferreira at a mining conference (Mining.com, 2024). The life of the mine is projected to 20+ years of operation (MMG, 2024).

Sandfire/Tshukudu Metals Mining, on the other hand, has a significant landholding that extends over most of the central and western portions of the Kalahari Copper Belt in Botswana. The primary commodities at Sandfire/Tshukudu Metals property are copper, silver, palladium, and platinum. The company completed a definitive feasibility study for the Motheo expansion project in August 2022. The Motheo low-cost rapid expansion will see processing capacity increase sustainability from the initial rate of 3.2Mtpa to 5.2Mtpa by the end of 2023, with the projects' design and procurement activities significantly advanced (Sandfire, n.d.).

Botswana used to operate BCL Limited (BCL) copper-nickel and cobalt producing mine which was second-best performing after diamond mining until 2016 when it was liquidated. Currently there are several exploration companies such as the Canadian Premium Nickel Resources (PNR) in the area of the liquidated mine sites in the eastern Botswana. The company purchased some of the old BCL operations focused on the discovery and advancement of high-quality Ni-Cu-Co-PGM resources. Currently, they are exploring nickel as a primary commodity with associated Copper, Cobalt, Platinum, Palladium, and Gold (The S&P Capital IQ Pro platform, 2024).

In the same geographic area, Phoenix Mine owned by Public Joint Stock Co Mining & Botswana, holds Nickel, Copper, Palladium, Platinum, Gold, Silver, Cobalt mineralisation reported at 241,500 tonnes of the primary nickel ore. SI6 Metals Ltd and Bamangwato Concessions Ltd. have also commenced the feasibility of the Nickel, Copper, Cobalt, Gold, Platinum, Palladium, Rhodium, Ruthenium, Silver, Lithium, Tantalum, Tin, Caesium ore associated minerals estimated at 17,136 tonnes as of 2015.

As reported by S&P Global (The S&P Capital IQ Pro platform, 2024), Giyani Metals Corp., Everbroad Investments (Pty), Marcelle Holdings (Pty) Ltd. and Bezant Resources Plc. have completed their feasibility studies for their manganese deposits in Kanye, southern Botswana. Mount Burgess Mining N.L. is also scoping the zinc development property currently at pre-feasibility, hosting zinc, lead, silver, copper, gallium, germanium, vanadium and cobalt, with an estimated 385,000 tonnes of zinc primary mineral.



Property	Owner(s)	Development Stage	Activity Status	Commodity(s)	Primary Commodity	Primary Reserves & Resources	Unit	Total In-Situ Value (US\$ million)	Resources Date
Khoemacau	MMG Ltd.; Pagoda Tree Investment Co.	Operating	Active	Copper, Silver	Copper	10,923,203	Tonnes	103,396.9	30 Apr 2023
Tshukudu	Sandfire Resources Ltd.; Strata Investment Holdings Plc	Operating	Active	Copper, Silver, Palladium, Platinum	Copper	772,780	Tonnes	7,500.8	30 Jun 2024
Selkirk	Premium Nickel Resources Ltd.; Botswana	Feasibility	Active	Nickel, Copper, Cobalt, Platinum, Palladium, Gold	Nickel	224,600	Tonnes	6,586.6	31 Dec 2016
Phoenix	Public Joint Stock Co Mining & Botswana	Operating	Active	Nickel, Copper, Palladium, Platinum, Gold, Silver, Cobalt	Nickel	241,500	Tonnes	5,644.4	31 Dec 2014
Kubabe	Mount Burgess Mining N.L.	Pre-feasibility / Scoping	Active	Zinc, Lead, Silver, Copper, Gallium, Germanium, Vanadium, Cobalt	Zinc	385,000	Tonnes	1,683.2	03 Nov 2022
Magogophate	S16 Metals Ltd.; Bamangwato Concessions Ltd.	Feasibility Started	Active	Nickel, Copper, Cobalt, Gold, Platinum, Palladium, Rhodium, Ruthenium, Silver, Lithium, Tantalum, Tin, Caesium	Nickel	17,136	Tonnes	390.4	28 Apr 2015
K. Hill	Giyani Metals Corp.; Evergreen Investments (Pty); Marcelle Holdings (Pty) Ltd.	Feasibility Complete	Active	Manganese	Manganese	14,700,000	Tonnes	39.8	13 Jul 2023
Matsitama	Eastport Ventures Inc.; African Copper Plc	Advanced Exploration	Active	Copper, Silver, Platinum, Gold, Zinc, Palladium, Rhodium	Copper	N/A	N/A	N/A	N/A
Ngami	Cobre Ltd.	Pre-feasibility / Scoping	Active	Copper, Silver	Copper	N/A	N/A	N/A	N/A

Table 1: Critical Minerals Profiling in Botswana (The S&P Capital IQ Pro platform, 2024)

Commodity: Cobalt, Copper, Gallium, Manganese, Nickel, Palladium, Platinum, Platinum Group Metals, Rare Earth Elements, Rhodium, Silver, Titanium, Zinc
Property Type All Properties
Development Stage Late Stage, Mine Stage
Activity Status: Active, On Hold Awaiting Higher Prices, On Hold Awaiting Financing
Reserves & Resources as-of Date All Available

Note: Results are based on the primary commodity. In-situ values are the combined value of all commodities in reserves and resources at S&P Global Market Intelligence nominal prices for the current year. The Reserves & Resources as-of Date refers to the most recent date the Reserves & Resources were calculated for this property.

A summary of properties containing critical minerals in Botswana at operating, prefeasibility, and reserves developed are summarised in table 1 below.

In the past, the Botswana government commissioned a study through the Botswana Geological Institute (BGI) to assess mineral potential of Molopo Farms in 2006, and identified twenty-nine (29) potential sites for precious and base metals (Cu (copper)), PGE (platinum group elements), Au (Gold), Ni (Nickel), Fe (Iron) and rare earth metals in Mabutsane area (Botswana Geoscience Institute).

It is evident that copper-nickel cobalt is actively been explored with other minerals still under development.

EXISTING POLICIES FOR CRITICAL MINERALS DEVELOPMENT

Botswana Minerals Policy

The Botswana Minerals Policy is a statutory legal document that governs the different acts and institutional frameworks to provide direction on the management of, and development of Botswana’s Mineral Resources. This document was reviewed in 2022 with a clear objective to outline the government’s role in mineral resource development and fostering effective partnerships with private sector while at the same time strengthening the associated institutional frameworks. In this document the government provides clear direction and intentions for developing coal, base metals and precious metals, diamonds, small-scale mining and industrial minerals. The government further outlines its intentions and ambitions to facilitate downstream activities. For instance, Botswana identifies an opportunity in developing its abundant coal resources by supporting its local consumption to drive economic

growth through increasing the contribution of clean coal to Botswana’s energy mix. The government objectives are to also utilise the appropriate and environmentally friendly technologies for coal beneficiation (e.g. coal to liquids, coal to gas and coal to chemicals).

Currently, the Minerals Policy does not have any confirmative status for critical minerals development in Botswana. The majority of the identified critical minerals being copper, nickel, manganese and cobalt are categorised under the base and precious metals within the most-recently amended Minerals Policy of 2022 (Ministry of Mineral Resources ,Green Technolgy and Energy Security, 2022). The Botswana government’s strategic intentions are: (i) to provide comprehensive geological information on these deposits; (ii) promote the use of new technologies for base metals mining, processing, trading and beneficiation; (iii) facilitate the development of necessary support infrastructure; and (iv) encourage domestic supply of concentrates for meeting the local demand as a matter of priority without negatively impacting the commercial viability of projects. All these are expected to transform Botswana into a competitive jurisdiction for private sector investment in the development of base and precious metals.

Government Investment In Providing Pre-Competitive Data To Unlock Mineral Potential In The Country

Since Botswana’s independence in 1966, the government embarked on aggressive nationwide geological and geophysical mapping exercises, resulting in high-resolution aeromagnetic and gravity data in the northern part, central and Molopo farms where the potential REE mineralisation has been found. Currently, 45% of the country is covered by 37% at 1:125,000 scale, and 8% of 1:1250,000 scale geological maps. The government furthermore undertook the soil geochemistry sampling of the North-West, Ngamiland and Molopo Farms (Botswana Geoscience Institute) While most of the east-northern side have been explored, the western part that hosts majority of the sedimentary hosted copper, silver and cobalt mineralisation was not developed due to the thick Kalahari sands. Completion of the north-western aeromagnetic survey enabled major mining players in the country and has prompted the now active copper mines (Khoemacau/MMG and Sandfire Motheo mines) in the Kalahari copper belt. The provision of geo data is one of the strategies that worked for mineral development in Botswana. The exercise is still ongoing, aimed at unlocking more mineral wealth. Additionally, Botswana launched the online platform, National Integrated Geoscience Information System (NIGIS)_ from the financial year 2018/19, which allows investors to manage mineral rights online and was financed through the previous National Development Plan 11 (Botswana Geoscience Institute , n.d.).

Institutional Framework In The Mining Sector

The Ministry of Minerals and Energy (MME) formulates, directs and coordinates the development and implementation of national policies and programmes for the minerals and energy resources sectors. They are implemented through government departments, parastatals, government companies and national committees such as the following:

Botswana Geoscience Institute: A government parastatal founded to promote research and provide baseline information for mineral prospects in the country. The BGI, which was formerly the Geological Survey, acts as an advisory body, managing and disseminating geoscience information.

Mineral Development Company Botswana (MDCB): They manage the government of Botswana’s interests and in seeking new investment opportunities in mining within and outside



Botswana.

Department of Mines (DOM): DOM is the mining operations and licensing regulator enabling compliance to the set standards and operational procedures. They maintain company performance and operational status on mining rights across the country.

Mineral Investment Promotion

The government collaborates with stakeholders such as Botswana Investment and Trade Centre (BITC), MDCB, BTO and Business Botswana to promote mineral investment through conferences and publications.

The BITC provides investment guides to investors. For example, the EU-Botswana forum held in 2023, (Botswana Investment and Trade Centre, 2023) identified mineral beneficiation investment opportunities. It indicated that Botswana being the most attractive destination for doing business in Africa, holds potential for economic diversification and beneficiation where it has implemented various tax incentives and other measures to promote beneficiation of mineral resources (reduced tax rates for companies engaged on the sector, favourable import duty for equipment and machinery used in beneficiation processes).

As an example, the copper mining value chain thus provides opportunities in: capital goods — suppliers of machinery and equipment in exploration and mining; consumables — explosives, fuel and lubricants, chemicals/reagents and services such as drilling, logistics and copper smelting.

Industrial Development Policy (Idp)

The Industrial Development Policy (IDP) was established in 2014 to promote development of diversified and viable industries as well as commercial sectors. The IDP recognised need to adapt its content to the rapidly changing landscape taking into account developments at regional and multilateral level that benefit the country.

National Export Strategy (Nes)

The major aim of Botswana's export strategy is to make Botswana competitive with a view of expanding current levels of exports and placing new ones in the international markets, thereby diversifying the country's export base.

Economic Diversification Drive (Edd) Policy

The EDD policy focuses on the establishment of medium-to-long term strategies leading to a globally competitive private sector which will no longer need government support and intervention.

National Plans And Policies

3.7.1 VISION 2036: Vision 2036 is Botswana's transformative blueprint that provides frameworks for achieving prosperity for all by the year 2036. The vision aligns with global agenda for sustainable development and principles of African Union (AU) Agenda 2063 to ensure that it pursues its national aspirations aligned to meet regional and global goals.

Transitional National Development Plan:

Botswana's development process has been guided by successive National Development Plans (NDPs) and these have provided a medium-term planning and budgeting framework (typically 5-6 years) for capital and recurrent

expenditure and have been a key feature of Botswana's system of development management. The most recent plan, the National Development Plan 11, ended on 31st March 2023. The preparation of the National Development Plan 12 was to follow but was deferred in order to ensure that the development planning process is coherent and well-aligned to the country's aspirations of achieving high-income status by 2036. It is expected to take effect from the 2025/2026 financial year.

Special Economic Zones Authority (Seza) Act:

The government of Botswana, through the Ministry of Trade and Investment (MTI) established Special Economic Zones Authority (SEZA) in 2018 as a state-owned enterprise to execute the establishment of the special economic zones around the country. Establishment of the SEZs is geared towards spurring industrial growth and economic diversification. Botswana would energise promotion of world-class industries with backward and forward linked industries with other benefits being realised such as technology transfer, entrepreneurship development and skills focusing on strategic economic areas across the country.

NATIONALLY DETERMINED CONTRIBUTIONS TOWARDS CLIMATE CHANGE — INTERGRATED RESOURCE PLAN AND NATIONALLY DETERMINED CONTRIBUTIONS

Regional And International Integration

Botswana aspires to be part of the regional integration in developing its mineral resources. The country, through the revised Mineral Policy, has committed to the joint exploration and development of mineral resources with neighbouring countries, and facilitate the transit of goods and services for effective mining operations. The country has also committed to harmonising its mineral policies with regional standards by subscribing to frameworks such as:

- SADC Treaty: Encouraging economic cooperation and shared development initiatives.

Aligned to the pillars of 2036, the National Energy Policy seeks to contribute towards sustainable economic development by ensuring optimal usage of local resources to facilitate growth to a high-income country by 2036 (Ministry of Mineral Resources, Green Technology, and Energy Security, 2021).

The National Development Plan 11 focused on increasing self-reliance on the country's energy resources. At the moment, Botswana positions itself in the right geographical position, interconnections (existing and planned) to offer opportunity for electricity export and imports to/from the region using mostly coal resource energy.

- SADC Protocol on Mining: Establishing regional standards for mining operations, resource management, and environmental sustainability.
- Africa Mining Vision 2050; Promoting sustainable development and industrialisation in Africa through mineral resource governance and value addition.



(Ministry of Mineral Resources ,Green Technolgy and Energy Security, 2022).

National Determined Contributions

- Botswana submitted its Nationally Determined Contributions to the United Nations Framework Convention on Climate Change (UNFCCC) in 2016, in support to the country's efforts to realise its development goals and resilience towards climate change.
- Additionally, Botswana adopted the Paris Agreement 2015, where it made its NDC commitments to reduce total greenhouse gas (GHG) emissions by 15% in 2030, with reference to 2010 emissions.
- The government also has intentions of providing affordable clean energy in alignment with the United Nations (UN) 2030 agenda for sustainable development goals (SDGs), especially SDG 7.

(Ministry of Mineral Resources, Green Technology, and Energy Security 2021)

Currently, coal is the main source of electricity with generation capacity of 732MW (600 from Morupule A, 132 from Morupule B), followed by diesel powered peaking plants (160 MW) (Ministry of Mineral Resources ,Green Technology, and Energy Security, 2021) .

Despite having large coal resources, Botswana has ample renewable energy sources to augment clean energy production particularly from solar energy. The country has annual direct normal radiation of 3,000 kWh/m²/a in most parts of the country with an average insolation on a horizontal surface 21MJ/ m² (International Trade Administration, 2024). Reasonable wind speeds exist in the country with the highest wind resources potential located in the southwest, central, and eastern parts of the country, with average wind speeds above 7 m/s, wind power density above 200W/ m² and annual energy production above 4.5GWh/year. The country's integrated resource plan (IRP) is centred on the potential demand supply scenarios. The main supply side is based on: (i) diversification of electricity generation; (ii) self-sufficiency in electricity generation and becoming a net electricity exporter; and (iii) mitigation of low environmental impact using low carbon technologies in coal. The introduction of the new renewable technologies, being photovoltaic, was planned to start from 2022 with exception of other sources emitting Co2 and an anticipated exponential growth and emission plateaus of 6500Kt of Co2 from 2027 (Government of Botswana, 2020).

The model for electricity supply was chosen as it satisfied the supply side strategy for Botswana. This model includes approximately 20% of renewables from 2021, at least until around 2034, and a slight reduction of coal usage to 60% in 2040 with the introduction of gas.

According to the International Trade Organisation (ITO), Botswana launched a rooftop solar (RTS) program in 2020 with the assistance of USAID's initiative, Power Africa Energy Programme (SAEP). This five-year project intended to enable domestic consumers to install their own solar systems to generate electricity and sell back to Botswana Power corporation (BPC). Despite the introduction of Botswana Energy Regulatory Authority in 2017, which sparked interest in renewable energy development within the private sector, the monopolised transmission and distribution of electricity from BPC has hindered previous independent power producers (IPPs). The International Trade Organisation further reveals that BPC poses regulatory framework challenges, power purchase agreements (PPA) pricing terms, and the cost of commercially

financed capital

In order to ensure security of supply, in 2020, the Botswana government committed to building;

- 100MW Solar Photovoltaic and
- A total of 35 MV grid tied Solar Photovoltaic by 2022, 10 - 100MW CBM by the year 2025,
- 200MW Concentrated Solar Plant (CSP) by the year 2026,
- A 300MW Coal by the year 2026,
- A 50MW Wind by the year 2027,

(International Trade Administration, 2024). The 2007 Amendment to the Electricity Supply Act now allows private companies to participate in power generation and sign PPAs to sell electricity to BPC. However, within the National Energy Policy, use of the grid is effectively limited to IPPs with PPA agreements with BPC.

Carbondioxide (Co2) Emissions From Current Coal Energy Resource

Botswana's energy sector remains largely dependent on coal, with fossil fuels accounting for a significant share of the country's energy mix. According to the Energy Accounts Reports, the country's CO2 emissions have been steadily increasing, particularly in the industrial and energy production sectors. This reliance on coal-fired power plants has not only contributed to rising emissions but has also slowed progress toward a low-carbon economy.

The Energy Accounts Reports (unpublished) highlight that Botswana's total CO2 emissions have grown from 7.4 million tons in 2010 to over 10 million tons in recent years. Industrial activities, including mining and mineral processing, are major contributors to these emissions.

Botswana's reliance on coal underscores the need for an urgent energy transition to reduce reliance on carbon-intensive energy sources and to harness renewable energy technologies.

“Despite having large coal resources, Botswana has ample renewable energy sources to augment clean energy production particularly from solar energy.”



CONCLUSIONS

The following conclusions have been drawn from this policy brief:

- Botswana has made significant strides in mineral governance, with a focus on diamond beneficiation. However, there is limited evidence of a comprehensive strategy for critical minerals such as copper, cobalt, nickel, and manganese. Key policy documents, such as the Botswana Minerals Policy and the National Energy Policy, outline the government’s approach to resource extraction and energy generation, but they do not provide sufficient detail on the beneficiation of critical minerals in the context of renewable technologies.
- There are limited downstream industries despite aspirations to include them in the mining value chain. The country needs to strengthen efforts to create an enabling environment for beneficiation opportunities.
- Sustainability of minerals development remains key to Botswana’s economy.
- Botswana mining policy has strong institutional frameworks that if implemented will advance the mining value chain.
- Botswana has intensified efforts and collaborations to map the critical minerals endowment for investor attraction by providing pre-competitive geoscience knowledge. However, there is no defined strategy for critical mineral value chain development.
- Coal-fired plants remain the foundation of Botswana’s energy framework and government needs to intensify efforts to reduce or

Analysis Of Existing Policies And Plans For Critical Minerals:

5. 1 OPPORTUNITIES

Consideration for the development of a critical minerals beneficiation strategy offers a pathway to reduce these emissions.

By promoting local production of renewable energy technologies, such as solar panels and energy storage systems, Botswana can reduce its dependency on locally-produced and imported coal-fired electricity and decrease its overall carbon footprint.

Integrating green technologies into the national energy mix will not only contribute to economic diversification but will also help Botswana meet its emission reduction targets under the Paris Agreement.

Botswana’s strategy for regional and international integration reflects its ambitions to become a leader in critical minerals beneficiation and green technology development by aligning with frameworks like the SADC Protocol on Mining, Africa Mining Vision 2050, and global initiatives for sustainable mining and climate action.

Botswana can enhance its economic prospects, reduce its carbon footprint, and contribute meaningfully to the global energy transition.

Promoting Local Industrialisation

- Historically, Botswana has exported its mineral resources in raw form, particularly the bulk commodities like copper-nickel, silver and cobalt concentrate.

Opportunities, Gaps, And Challenges

Regional Value Chain Collaboration

- Botswana is well-positioned to collaborate with regional initiatives, such as the DRC-Zambia Battery Manufacturing Initiative. This could enhance the country's capacity to participate in regional value chains, benefiting from economies of scale and shared technological expertise.

Recommendations For Enhancing Critical Minerals Beneficiation And Green Technology Development

The following recommendations are meant for enhancing critical minerals beneficiation and green technology development in Botswana:

- 1. Developing a Comprehensive Critical Minerals Strategy**

Botswana should develop and implement a Critical Minerals Strategy that integrates mineral beneficiation with green industrialisation goals. The strategy should prioritise local value addition, focusing on the production of solar panels, battery storage systems, and electric vehicle batteries, thereby reducing the reliance on imported technologies.
- 2. Aligning Critical Minerals Policy with Climate Strategies**

The country’s critical minerals policy should be closely aligned with its NDCs and Just Energy Transition plan. A coherent policy framework would ensure that Botswana’s mineral wealth is fully leveraged to support its energy transition and low-carbon development agenda.

Advancing a strong coherence of some industrial policies such as SEZA, Industrial Development Policy and Economic Diversification Drive to align with mineral value chain beneficiation strategies and movement towards green technologies.

4. Investment in Infrastructure and Technological Capabilities

To effectively beneficiate its critical minerals, Botswana must invest in the necessary infrastructure, such as feasibility studies processing plants and technology transfer hubs. Collaboration with global and regional partners can help. Botswana build the required industrial capacity and technical expertise.

Some of the learnings can be drawn from Asian countries such as China and Japan, where their perspective of the policy debate on beneficiation was not only on deposits sizes, although China is a substantial producer, it was a larger part of the industrial policy.

Beneficiation was a part of a larger industrial policy assuring domestic supply, increasing employment and assuring a competitive global industry. In the African context, lessons can be taken from Namibia with the use of its industrial policy on the zinc production mineral beneficiation by Vedanta Resources PLC’s Skorpion mine and Namzinc refinery in south-west Namibia. Zinc occurs as the third valuable commodity after diamonds and uranium in Namibia. Botswana should draw lessons from its failed smelter operation from BCL Mine Limited that had cost overruns due to design issues not satisfying the intended purpose (Grynberg & Sekakela, 2016).

5. Fostering Regional Cooperation for Value Chains

Botswana should explore regional value chain opportunities through initiatives like the DRC-Zambia Battery Manufacturing Initiative.



By participating in these collaborations, Botswana can enhance its industrial base and gain access to regional markets for green technologies.

6. Strengthen Geopolitical Alliances and Market Access

In the context of rising global competition for critical minerals, Botswana should strengthen its alliances with key trading partners and regional bodies, such as SADC and the African Continental Free Trade Area (AfCFTA). These alliances can help the country secure markets for its beneficiated products and enhance its position in global supply chains.

7. Support Research and Development (R&D) in Green Technologies

Botswana should increase its investment in R&D for green technologies, including renewable energy systems, battery storage, and electric vehicle technology. This will enable the country to innovate and stay competitive in the rapidly evolving green technology sector.

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