FINAL REPORT

The Energy Transition and Critical Minerals in Ghana: Diversification Opportunities and Governance Challenges

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List of Acronyms and Abbreviations

AfCFTA	African Continental Free Trade Area
AMV	African Mining Vision
DRC	Democratic Republic of Congo
DTCTP	Deepwater Tano-Cape Three Points
EIA	Environmental Impact Assessment
EITI	Extractive Industries Transparency Initiative
EMD	Electrolytic manganese dioxide
ESG	Environmental, social and governance
ESIA	Environmental and Social Impact Assessment
EV	Electric vehicle
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GHEITI	Ghana Extractive Industries Transparency Initiative
GIADEC	Ghana Integrated Aluminium Development Corporation
GIISDEC	Ghana Integrated Iron and Steel Development Corporation
GNPC	Ghana National Petroleum Corporation
ISI	Import Substitution Industrialisation
ISSP	Industrial Sector Support Programme
MDA	Mineral Development Act
MDF	Mineral Development Fund
MIIF	Minerals Income Investment Fund
MSG	Multistakeholder Group
NDC	Nationally Determined Contribution
PDPEA	Problem-Driven Political Economy Analysis
SDWT	South Deepwater Tano
SEA	Strategic Environmental Assessment
SSA	Sub-Saharan Africa
VRP	Volta River Project

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Executive Summary

Objective of the Study

This report maps the critical (transition) minerals in Ghana and the associated socio-economic opportunities and governance challenges. The objective of the report is to assist policymakers and stakeholders in understanding the risks and opportunities associated with the energy transition and access the information required to navigate them.

The report focuses on four areas, namely:

1. **Global and local framing of the energy transition**, its impact on the extractives industry, and the role of critical minerals. This constitutes an assessment of fossil fuel-based revenue expectations and implications of the transition in the petroleum sector and the broader economy.

2. **Scope of proven critical minerals in Ghana.** This includes the volumes (quantities) of proven critical minerals and spatial dimensions (where they are located in the country).

3. **Review of the existing legal and regulatory regime guiding the mining sub-sector, emphasising critical minerals.** This includes a discussion of how emerging fiscal and legal regimes reflect recent and future developments in the mining sector in other jurisdictions in light of the energy transition.

4. **Potential fiscal, social and environmental risks and opportunities based on the resource mapping assessment.** This includes proposing transparency parameters that future GHEITI MSG reports could cover to inform the public debate on the energy transition.

The methodology used in producing this report encompassed qualitative, quantitative and political economy analysis. Firstly, we conducted an extensive literature review and stakeholder mapping covering relevant documents across Ghana's mining sector, emphasising critical minerals. This was followed by quantitative analysis and synthesis of resource data collected from relevant stakeholder institutions, including the Minerals Commission. Finally, the findings from the qualitative and quantitative analyses were further analysed using light touch problem-driven political economy analysis to identify the range of possible intervention areas. This all-encompassing approach allows for harnessing the underlying data and the perspectives of multiple stakeholders on leveraging the opportunities within the critical minerals value chain for Ghana.

Key Findings

Below are the report's key findings, organised around the four areas.

Global and local framing of the energy transition

1. **The energy transition, a pathway toward transforming the global energy sector to net-zero by 2050 and beyond, has commenced.** The transition represents one of the most viable ways to mitigate the impacts of human-induced climate change. To put this into context, while it took 75 years for coal to be dethroned by oil as the main primary global energy source from 1900 to 1975, global governments are seeking to halve this time to 35 years for renewables share in the primary energy mix to catch up with oil at its peak in 1975.
2. **The energy transition is already having profound impacts on the global oil and gas market.** While oil and gas prices have currently risen to near-decade highs primarily due to the ongoing Russia-Ukraine war, in the longer term, the energy transition is anticipated to lead to lower oil demand and benefit lower-cost producers.
3. **Moving from the current fossil-based energy system to a cleaner one to meet global net-zero goals requires deploying new energy technologies**, which rely on critical minerals such as copper, lithium, nickel, manganese, graphite, cobalt and other rare earth elements. Critical minerals are broadly understood to mean those minerals fundamental to the fourth industrial revolution (4IR) and the global decarbonisation agenda — essential to producing high-tech, renewable energy and defence applications. For example, IEA estimates indicate that about four times more minerals from the current estimated 7 million tonnes (Mt) to 28 Mt are needed if the 2040 sustainable development scenarios are to be met. These new critical minerals will be used in electric vehicles, battery storage, electricity networks, and other low-carbon power generation.

Scope of proven critical minerals in Ghana, including the volumes

4. **Ghana has several critical (transitional) minerals needed for the energy transition in known and unknown commercial quantities** – these include manganese, bauxite/aluminium, iron ore, silica, and lithium. For example, Ghana has the second-largest reserves of bauxite deposits in Africa, next to Guinea and recently discovered lithium in commercial quantities. Ghana also has significant manganese reserves in the Western Region at Nsuta, which it has exploited since 1916. There are also significant occurrences in the Dixcove area, South Bole District in Northern Ghana, Axim Salman area and Wa. However, these ore bodies require further studies to delineate them to attract much-needed exploration and development investment. Manganese is a key ingredient for producing cathode materials for electrical conduction: lithium-ion, alkaline and zinc-manganese batteries. The medium-grade Nsuta deposit is one of the high-quality blends suitable for electrolytic manganese metals used in stainless steel and manganese dioxide battery raw materials. Ghana could capture more of the value chain by building an Electrolytic manganese dioxide facility in-country to reduce the global reliance of this material on South Africa and China. Europe's fast-growing battery market could be a potential market, and the government should consider commissioning a feasibility study.
5. **Ghana currently has iron ore deposits in Shieni in the Northern Region, Opon Mansi in the Western Region, and deposits in Oti and Pudo in the Upper West Region.** Renewable energy technologies such as wind turbines require significant iron ore (steel), copper and aluminium. The iron ore can be mixed with other raw materials like manganese, silica, limestone, and charcoal/coking coal to produce steel. A study conducted by BloombergNEF shows that *"to build enough wind turbines to reach net zero by 2050, 1.7 billion tons of steel will be needed"*. This is enough to make over 20,000 replicas of the iconic Golden Gate Bridge in San Francisco, United States of America. Ghana's iron ore deposits need significant infrastructure, especially railways, to evacuate them to steel production centres down the coast in the industrial Port City of Tema and Takoradi or for exports. Furthermore, Ghana could become a cost-competitive steel manufacturer to meet some of Africa's domestic demand. However, this requires cheaper and more reliable electricity and improved environmental governance standards to curb or mitigate production life cycle emissions (reducing the carbon footprint). Iron ore and steel production is a highly energy-intensive and polluting process.
6. **Regarding silica, some recent reports indicate that Ghana has potentially good quality silica sands/quartz sand from which silicon (silicon dioxide) can be manufactured.** Silicon dioxide is used in manufacturing silicon chips and solar cells due to its excellent semiconductor properties. However, there is a lack of well-defined geological data and investment drive to attract capital to develop this resource in Ghana. Therefore, there is a need for a geological study that includes a market scope and the feasibility of developing the deposits.
7. **Furthermore, the lithium resource estimate of the flagship high-purity, low contaminants Ewoyaa discovery in the Central Region has been increased by Atlantic Lithium Limited by nearly 50%.** In addition, it is reported that the company has signed an offtake agreement for 50% of the spodumene concentrate produced from the Ewoyaa mine during its operational life with global electric vehicle company Tesla. **Electric vehicles represent a US$7 trillion market opportunity between today and 2030 and US$46 trillion between today and 2050. Ghana should give serious consideration to how they can create economic value-add and domestic jobs from this growth.** South Africa, Egypt, Morocco and Ghana have all implemented automotive policies to attract investments into their auto sectors. Ghana is an emerging automotive destination. As a new entrant, Ghana can work with automakers to build forward-facing assembly lines which prioritise new technologies such as electric vehicles. Leveraging the country's lithium and resources from other African countries, the government can formulate policies that attract and retain downstream manufacturing capacity in-country.
8. **Overall, Ghana can leverage its industrial raw materials base and the African Continental Free Trade Area (AfCFTA) to become a major hub for Africa and Europe in the new low-carbon era.** This strategic action will require a detailed understanding of Ghana's resource potential and harnessing clear value chain opportunities.

Review of the existing legal and regulatory regime guiding the mining sub-sector with particular emphasis on critical minerals

9. **The prevailing legal and regulatory regime for mining in Ghana is, in our view, reasonably adequate to address the current issues in the industry; the challenge in Ghana is not one of the laws but rather enforcement, including environmental governance, especially with artisanal mining.** The prevailing legal and regulatory instruments underpinning Ghana's mining industry are premised on Article 257(6) of the 1992 Fourth Republican Constitution. The preceding constitutional

provision makes it imperative that all minerals, including critical minerals such as lithium and silica sand, are vested in the President in trust for the citizens of Ghana.

10. **Ghana's Minerals Commission is primarily responsible for developing and coordinating mineral sector policies and monitoring their implementation.** In 2018 and 2019, the government created two new vehicles to give a dedicated focus back to two other minerals: bauxite and iron ore. In this regard, the government passed the following laws to create two new vehicles — Ghana Integrated Iron and Steel Development Corporation (GIISDEC) and Ghana Integrated Aluminium Development Corporation (GIADEC) —similar to what pertained in the 1970s and early 1980s. While there are attempts to capture more of the value chain opportunities by creating dedicated state companies such as GIADEC and GIISDEC, there is a need to align this with the country's broader industrial policy and implementing vehicle of the Industrial Sector Support Programme (ISSP).
11. **Most of Ghana's mineral policies do not specifically mention critical minerals; however, they reference the components needed to develop a viable critical minerals value chain and employment generating opportunities**. Some of the principal objectives of the country's minerals and mining policy relevant for the development of the critical mineral include the need to (1) diversify the country's mineral production base to promote a more sustainable support base for the economy; (2) promote linkages (backward, forward and horizontal) to minerals produced locally to the maximum extent possible; (3) optimize tax revenue generation and ensure transparent and equitable distribution of mineral wealth; (4) assist in the development of skilled human resource and develop local industrial capacity for the mineral industry; and (5) use mining as a catalyst for wider investment in the economy Attaining these objectives, ultimately requires a delicate balance between safeguarding the interests of the State and investor community.
12. **While the intended objectives of the national minerals and mining policy are noble, there is a lack of synergy between it and other major climate policy initiatives, such as Ghana's nationally determined contribution (NDC).** Therefore, Ghana must align its critical mineral policies and plans with a well-defined broader industrial development strategy and commitments to meeting climate targets as per the NDCs. There is also the need for more institutional collaboration to address information asymmetry gaps in critical minerals resource assessments and planning.
13. A closer analysis of the NDCs and the 2020 National Climate Change Report shows several potential projects. However, **these are not linked systematically to the country's industrial policy and long term aspirations. In essence, there is a lack of synergy between the aspirations of the NDCs, "how" they will be financed/attained and importantly, how a country like Ghana can leverage the opportunities** therein to develop a new industrial base including in the critical minerals supply chain.

Potential fiscal, social and environmental risks and opportunities based on the resource mapping assessment

14. **Most of the core stakeholder views on the energy transition from the mining and oil and gas sectors are disparate.** There is a lot of silo thinking happening on the energy transition from the respective angles of where these various institutions sit. Some within the oil and gas industry, such as the Petroleum Commission, GNPC and Ministry of Energy, are acutely aware of the energy transition and its potential implications for exploiting upstream oil and gas. CSOs also share this view in Ghana and have held various dialogues on the energy transition over the past few years. Key CSOs active in championing broader public debate on the energy transition in the upstream oil and gas industry include NRGI and Africa Centre for Energy Policy (ACEP). For example, NRGI and ACEP have held at least three public programmes and sustained advocacy on the transition in the past two years. **On the other hand, there is not that much knowledge, and awareness of the energy transition within the mining industry and its potential implications for developing critical minerals supply chains in Ghana**. Various stakeholders consulted, including the Minerals Commission and Ministry of Lands and Natural Resources, indicate that some work is being done to develop an integrated minerals supply chain in Ghana, such as for Iron Ore and Bauxite. However, these are not necessarily implemented with an energy transition mindset that seeks to position Ghana to increasingly play a key role in the global value chains for critical minerals.

15. **One of the key lessons from Ghana's past resource-based industrialisation effort is ensuring synergies between energy and industrial policies — the need for integrated mining planning.** The Volta River Project (VRP) of the 1960s is one such example of the deep-rooted fundamental thinking required if Ghana fully takes advantage of the opportunities that the energy transition presents with

soaring demand for critical minerals. For Ghana to benefit from leveraging the critical minerals supply chain as one of its growth anchors, it needs to systematically address the constraints to growth, namely: (1) provision of relatively cheaper and reliable electricity (especially for aluminium refining and smelting), (2) development of rail, road and port infrastructure to evacuate products to market, and (3) addressing environmental governance/ reducing the emissions output of mines and processing facilities.

16. In the context of the critical minerals needed for the energy transition, most of the five minerals available in Ghana — namely: manganese, bauxite/aluminium, iron ore, silica and lithium — are highly likely to be mined and processed by the private sector miners together with State partners such as GIISDEC, GIADEC and MIIF. **Nonetheless, significant concerns have been raised about land compensation issues and the possible negative externalities (environmental impacts) of some extraction forms, particularly for bauxite and, to an extent, lithium**. For example, **most of Ghana's bauxite deposits lie within protected forest reserves, which raises environmental issues.**
17. **Corruption risks could become elevated in Ghana with the potential increase in demand for critical minerals to power the energy transition.** While most of the critical minerals in Ghana are likely to be mined and extracted at an industrial scale to benefit from economies of scale, it could nonetheless drive a new boom or rush for licenses by miners who may not be qualified to hold such licenses. Ghana has sought to mitigate some of the corruption risks within the mining sector by introducing a beneficial ownership regime for company registration and launching a national mining repository/cadastre and contracts portal, among others. However, we encourage the Minerals Commission and other State institutions to broaden such disclosures, especially the lease agreements, for new contracts involving critical minerals.
18. **Several elements of Ghana's underlying mineral fiscal regime are inflexible and do not allow capture of enough value to the state, especially for an emerging critical minerals industry.** Ghana does not have a dedicated fiscal regime for the critical minerals sector; instead, what pertains is the prevailing royalty-tax (concession) system under the existing development and investment agreements signed between Ghana and the various mining companies.
19. **One of the key issues cited for Ghana signing flawed or one-sided extractive contracts hitherto with international investors has been the lack of good geological data to underpin or strengthen the State's hand in negotiations.** To support good quality data gathering, we strongly advocate allocating a portion of the Mineral Development Fund (MDF) to fund extensive joint geological campaigns by the Minerals Commission, Geological Survey Authority, GIISDEC and GIADEC to improve the data quality and availability, particularly for certain critical base metals. We note further that the MDF may not be adequate to provide enough resources for all these institutions. Thus, there is a need for complementary financial resources to adequately fund these organisations to play their role of providing data to support the sector.

Way forward and recommendations (policy implications)

1. **GHEITI, together with other stakeholders, must advocate for the preparation of a national energy transition strategy that recognises the role of critical minerals mining in Ghana and costed action-based plans to allow the country to participate in capturing more of the global value chains fully.** Lessons from gold mining and other minerals over the past decade should Ghana: it is no longer enough to just mine and export minerals in their raw form when far bigger values and more sustainable jobs can be created even at the intermediate processing stage. There is a need to synergise the country's energy transition plans with its medium to long-term industrial policy for this to happen. GHEITI MSG could champion and lead in preparing such an extractive cross-sector strategy to ensure synergy of policies and action plans that consider the views of both the private and public sectors and demand-side actors.
2. **The Minerals and Mines Act, which is currently under review, offers opportunities to ensure alignment with the country's energy and climate goals.** GHEITI is uniquely positioned to advocate for the alignment of Ghana's energy and climate strategic goals vis-à-vis the opportunities that the transition presents for broader low-carbon industrialisation, including in the critical minerals supply chain.
3. **The central government, EPA, Minerals Commission, GHEITI and other stakeholders must ensure that the environmental governance risks with new mines and refineries are fully considered** in the project planning and implementation.
4. **There is a need for the central government to consider upgrading the Minerals Commission to a Minerals Authority to give it a bigger operational mandate.** Such a revised mandate and a more strategic focus on critical minerals will add value to the country. Also, If the Minerals Commission is given

a bigger mandate, then the governance structure has to be strengthened to perform as an independent body.

5. **There is a strong imperative for more institutional collaboration, especially between GIISDEC, GIADEC, Minerals Commission, GSA and MIIF in critical minerals and alignment of industrial policy and industrial sector support programme (ISSP) to developing and optimising value chains — synergies between mining and industrial policies.** These would, of course, need to be supported by the respective Ministries of Trade and Industry, Ministry of Finance, Ministry of Lands and Natural Resources, and Ministry of Energy. In addition, high-level political support from Ghana's Presidency would also be key, given how the country's political settlements work.
6. **Ghana must review the underlying fiscal regime for critical minerals as several elements of the prevailing mineral fiscal regime are inflexible and could hinder capturing enough value for the state.** In this regard, Ghana could consider the following:
    a. **Consider whether the level of government equity at 10% is adequate in capturing potential value in the sector and balancing this with attracting investment**. The government could, after careful consideration, get MIIF to own extra participating (paid) interest in proven critical minerals deposits (as is done with petroleum via GNPC Explorco).
    b. Review role of MIIF in the mining value chain: MIIF could be a vehicle to own processing infrastructure and retain more of the value chain. This could be done on a joint-venture basis to reduce the project risks. Companies that set up processing infrastructure could be offered additional tax incentives. **In reforming MIIF to play a more strategic interventionist role in Ghana's critical minerals supply chain, strong corporate governance is required to minimise agency costs and pecuniary interests to reduce insider dealings and corruption.** Valuable lessons on value creation from Zambia's ZCCM-IH, Chile's CODELCO and Norway's SDFI (for oil and gas) can be learned. **More state participation would need to be accompanied by strong anti-corruption safeguards.**
    c. **Consider whether tax and other incentives would be appropriate to attract investment:** There is a need to implement the ring-fence regime to curtail gold-plating (deliberate cost reductions). This is a lesson from the gold mining and oil and gas industries that need to be learned. Strong cost control is fundamental to the ability to collect taxes on income, such as corporate income tax and windfall taxes. The State could also consider introducing a windfall tax at the mine level. However, these need to be tied to mine profitability and could be calculated on a pre- or post-tax basis.
7. **GHEITI and other stakeholders must advocate for adequate financial resources to fund and revamp the country's geological potential, especially concerning critical minerals.** It is no longer enough to have minor stakes in projects for lack of data that Ghana can use as a bargaining chip to its advantage. Instead, Ghana must come to the negotiating table with an improved knowledge of the country's resource potential. To operationalise, **we strongly advocate allocating a portion of the Mineral Development Fund to fund extensive geological campaigns** by the Minerals Commission, Geological Survey Authority, GIISDEC and GIADEC to improve the data quality and availability, particularly for certain critical base metals.
8. **GHEITI could own the gap in the policy brokerage space on energy transition and critical minerals in Ghana and provide the thought leadership required on these issues**. Most of the conversations on the energy transition in the country are skewed towards oil and gas and the broader energy industry, less so on the mining side of the equation, where there are ample opportunities for Ghana to diversify its economic base.
9. **The Minerals Commission and other State institutions should consider broadening their transparency and accountability efforts, including disclosing contracts, beneficial ownership, and resource-backed loans for new contracts involving critical minerals.** This would allow stakeholders to review and assess company efforts to meet contract provisions, given that corruption and other governance risks could become elevated in Ghana with the soaring demand for critical minerals to power the energy transition. While Ghana has sought to mitigate some of the corruption risks within the mining sector by introducing a beneficial ownership regime for company registration and launching a national mining repository/cadastre and contracts portal, more could be done.

No.	Activity	Lead Agencies	Suggested timeline
1.	Develop a critical minerals strategy and action plan taking into account the key identified risks: licensing, fiscal regime, geological data gaps, environmental governance, and financing. NB: This can dovetail into ongoing national energy transition discussions being led by the Ministry of Energy	Ministry of Mines and Natural Resources, Ministry of Energy, Ministry of Finance, Ministry of Trade and Industry, Ghana Minerals Commission, GHEITI, MIIF, MDF	6 months – 1 year
2.	Upgrading the Minerals Commission to a Minerals Authority subject to legal review/advice on the constitutional processes and Cabinet Approval	Presidency/Cabinet, Ministry of Mines and Natural Resources, Minerals Commission, GHEITI	> 1 Year
3.	Institutional collaboration in the area of critical minerals and alignment of industrial policy and industrial sector support programme (ISSP) to develop and optimise value chains	GIISDEC, GIADEC, Minerals Commission, GSA and MIIF	3 – 6 months
4.	Provide the thought leadership required on energy transition and critical minerals space	GHEITI	2 months – 1 year

1 Introduction

This section covers the following themes:

- Background and introduction to the report.
- Specific objectives and scope of the work.
- The methodology used, limitations and structure of the report.

1.1 Background

The energy transition, which is a pathway toward transforming the global energy sector to net-zero by 2050 and beyond, is no more a fringe idea. The transition represents one of the most viable ways to mitigate the impacts of human-induced climate change. In 2015, global governments signed the Paris Agreement at the United Nations Conference of the Parties (COP 21) to limit global warming to well below 2 degrees Celsius (°C) — preferably to 1.5°C — compared to pre-industrial levels. Maintaining global temperature at 1.5°C and meeting net-zero goals calls for a drastic reduction in greenhouse gas (GHG) emissions emanating from its massive dependence on conventional (fossil) fuels. This calls for switching to low and net-zero energy sources such as renewables and new mobility solutions – for example, electric cars.

Besides climate change concerns, the transition is driven by (1) advances in technology, (2) new energy policies being promoted by global governments, especially in a post-COVID-19 pandemic context, and lastly, (3) evolving consumer preferences, especially with environmental, social and governance (ESG) pressures. For example, at COP26 held in November 2021, several global governments announced new investments in clean energy technologies, including making commitments to phasing down coal power in the next few decades.[1] Additionally, more than 130 countries, including major equatorial ones such as Brazil, the Democratic Republic of the Congo and Indonesia, pledged to halt and reverse forest loss and land degradation over the next decade.[2]

Moving from the current fossil-based energy system to a cleaner one to meet global net-zero goals requires deploying new energy technologies, many of which rely on critical minerals — such as copper, lithium, nickel, manganese, graphite, cobalt and rare earth elements. These minerals are vital to the transition for sustaining battery longevity, performance, and energy density of all-electric vehicles (EV) motors, solar panels, and wind turbines. For example, copper and silicon are critical to the effective functioning of solar photovoltaics (PV) modules. In contrast, copper and aluminium are critical to effectively transferring electrons through electricity networks. To put things into further context, the International Energy Agency (IEA) and other studies indicate that a typical EV requires 200 kilograms (kg) of seven different metals[3], compared with about 40kg for a conventional car and from only two metals (copper and manganese).[4] In other words, a typical EV requires six times (6x) the mineral inputs of a conventional car. Furthermore, an offshore wind plant requires thirteen times (13x) more mineral resources than a similarly sized gas-fired power plant.[5] As such, certain minerals are 'critical' for the energy transition and the attainment of net-zero goals, as Figure 1 demonstrates.

[1] See https://www.gov.uk/government/news/world-leaders-join-uks-glasgow-breakthroughs-to-speed-up-affordable-clean-tech-worldwide

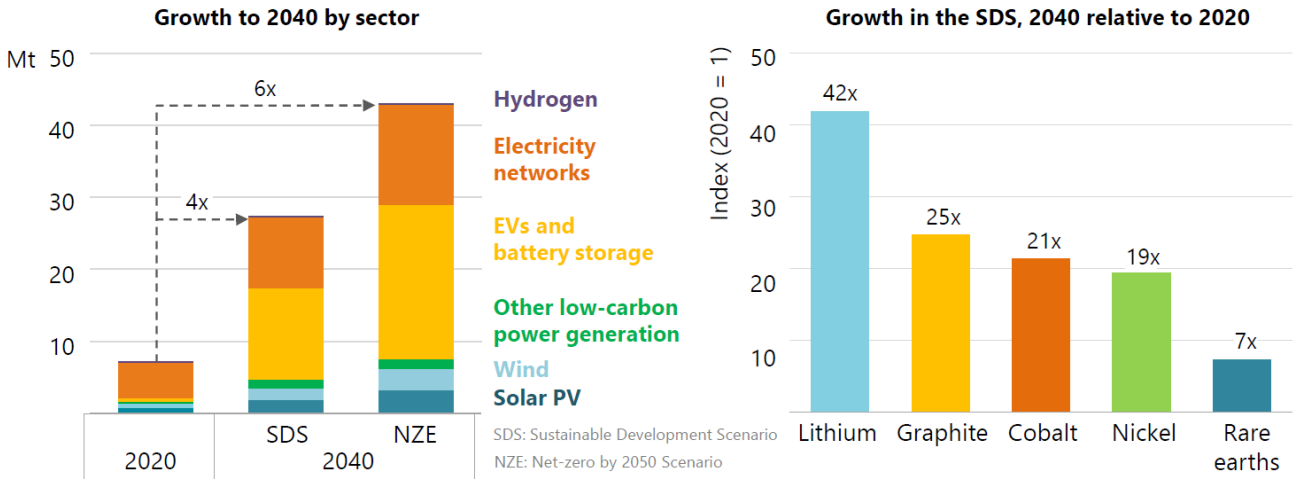
[2] See https://www.nature.com/articles/d41586-021-03034-z

[3] These are copper, lithium, nickel, manganese, cobalt, graphite and other rare earths.

[4] IEA (2021). The Role of Critical Minerals in Clean Energy Transitions. Available at: https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions, at p.26

[5] IEA (2021). The Role of Critical Minerals in Clean Energy Transitions – Launch Presentation. Paris, 5 May 2021, at p.3

Figure 1 Mineral demand for clean energy technologies by scenario



Source: IEA 2021

The energy transition presents opportunities for countries with these critical mineral resources to capture a significant part of the global value chain, such as by producing electric vehicles (EVs) battery components and other components for low-carbon electricity networks, among others. In many countries, especially those with significant fossil fuel revenues, such as in Sub-Saharan Africa, the debate is often skewed towards the risks – such as undeveloped fields, untapped revenues, and stranded assets[6] – rather than the opportunities it presents for developing other aspects of their economies and value chains. For example, many of these fossil fuel producing countries also have availability of minerals which are critical for the transition. In the African context, Ghana remains one of the leading mineral producing countries on the African continent. It is currently the largest gold producer in Africa and the ninth-largest producer of diamonds globally.[7] The extractives industry (and specifically mining) is a fundamental component of Ghana's industrial strategy and transition to an upper-middle-income nation, acting as a lever to provide revenues and jobs. Industrial mining has existed in Ghana since the 1900s. **These mineral resources have and continue to provide critical revenues to the Ghanaian Treasury, accounting for about 43% share of mineral receipts[8] in total exports in 2019 and about 6% of gross domestic product (GDP)**, according to World Bank, Ghana Statistical Service and Ghana Chamber of Mines statistics.

Ghana also has several critical minerals needed for the energy transition in varying abundance – these include manganese, bauxite/aluminium, iron ore, silica, graphite, and lithium. For example, Ghana has the second-largest reserves of bauxite deposits in Africa besides Guinea, and together, these account for 32% of the world's proven reserves. It has sought to develop an integrated bauxite and aluminium industry since the 1960s commencing with the Volta River Project. Since the early twentieth century (the 1910s), the country has also produced and exported manganese. Ghana has also found significant commercial quantities of iron ore and lithium resources in recent times. It is looking forward to leveraging these resources to anchor a new resource-based industrialisation drive. While the country seeks[9] to lure global giants such as Tesla and other car manufacturers into setting up a base in the country, **translating these old and newfound mineral resources into inclusive growth and development requires addressing important governance and value chain risks.**

[6] See https://www.bloomberg.com/news/articles/2021-08-02/ghana-seeks-to-borrow-1-7-billion-to-help-acquire-energy-assets
[7] See https://eiti.org/ghana.
[8] See http://ghanachamberofmines.org/wp-content/uploads/2020/07/2019-Mining-Industry-Statistics-and-Data-for-Ghana.pdf.
[9] See https://news.bloomberglaw.com/environment-and-energy/ghana-hopes-lithium-load-will-lure-automakers-3

A recent Chatham House paper[10] acknowledges that the Extractive Industries Transparency Initiative (EITI) could help ensure that implementing countries, such as Ghana, gain better insights into the risks and opportunities associated with the transition to a green energy sector and access to the information required to navigate them. There is an opportunity for the Ghana EITI to leverage its multi-stakeholder platform and implementation framework to provide reliable information to inform dialogue on the implications of the energy transition, especially concerning critical minerals and opportunities for value-enhancing industrialisation.

Several stakeholders have demonstrated interest in understanding not only the risks but also the opportunities that a transition to a lower-carbon future brings.[11] EITI and the Ghana Multistakeholder Group (MSG) have an excellent opportunity to leverage their platform to advocate for a strong national partnership to support further implementation and engagement on energy transition issues. Given the aforementioned, there is the prospect of supporting the Ghana EITI MSG to provide reliable information to credibly inform ongoing public debate and emerging government policy on the energy transition.

1.2 Objective

This report aims to map out the critical minerals in Ghana and their associated governance challenges. This will help stakeholders better understand the risks and opportunities of the transition to a green energy sector and access the information required to navigate them. The study results will be shared with government institutions, MSG and other key stakeholders

1.3 Scope of work

The study encompassed the following scope (Figure 2):

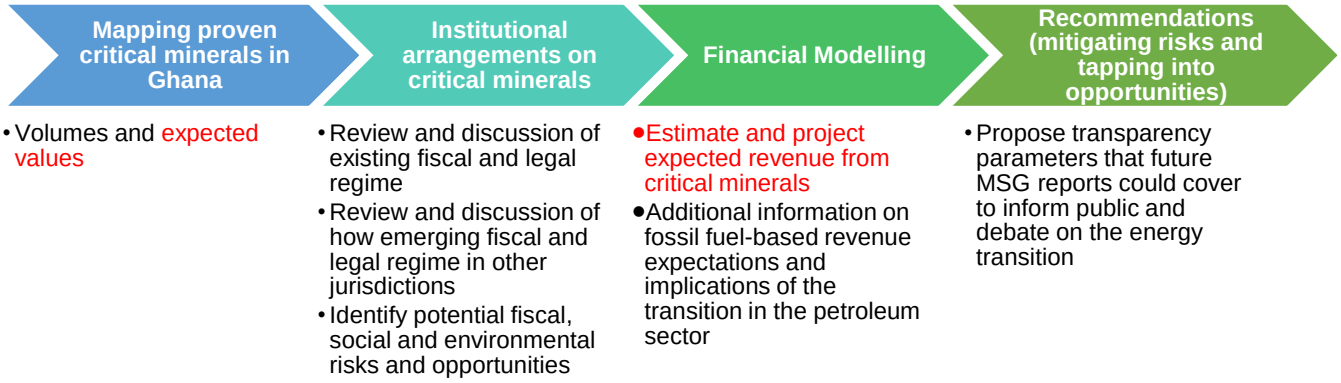
1. A mapping of the scope of proven critical minerals in Ghana, including the volumes and expected values
2. Review and discussion of existing fiscal and legal regime guiding the mining sub-sector with particular emphasis on critical minerals
3. Review and discussion of how emerging fiscal and legal regime reflect recent and future developments in the mining sector in other jurisdictions in the light of the energy transition
4. Undertake financial modelling to estimate and project expected revenue from critical minerals
5. Identify potential fiscal, social and environmental risks and opportunities based on the mapping and revenue projection
6. Highlight recommendations, including practical guidance for mitigating risks and tapping into opportunities
7. Where relevant, propose transparency parameters that future MSG reports could cover to inform public and debate on the energy transition.[12]
8. To the extent possible, provide additional information on fossil fuel-based revenue expectations and implications of the transition in the petroleum sector

[10] *Transparency in Transition: Climate Change, Energy Transition and the EITI* (2020). Available at: https://www.chathamhouse.org/sites/default/files/2020-06-17-transparency-in-transition-eiti-bradley.pdf

[11] See https://resourcegovernance.org/blog/five-steps-authorities-ghana-can-take-prepare-energy-transition-and-better-govern-oil-gas-mining

[12] A couple of implementing countries (notably Burkina Faso and Trinidad and Tobago) have made efforts to collect emissions data through EITI Reports.

Figure 2 Broad scope of the assignment



Source: Authors' construct. NB: Areas highlighted in red were not assessed in the study due to data limitations.

1.4 Methodology

The methodology used in producing this report encompassed qualitative, quantitative and political economy analysis (Figure 3). These are explained in more detail below.

Qualitative analysis

- **Desk literature review:** We conducted an extensive literature review covering relevant documents across Ghana's mining sector. The literature review aimed to understand the main stakeholders and their responsibilities or mandate concerning minerals management and industrial policy implementation in Ghana.

- **Stakeholder mapping and analysis:** This involved a deep dive mapping and analysis of the different stakeholders involved in the minerals management in Ghana to understand stakeholder interests and needs and how that has evolved, especially in the context of the energy transition. This was done through some selected stakeholder interviews with persons and organisations engaged in the national policy debate on the energy transition. This exercise also helped identify possible misalignment in stakeholder interests and motivations vis-à-vis critical minerals and the energy transition.

Quantitative analysis

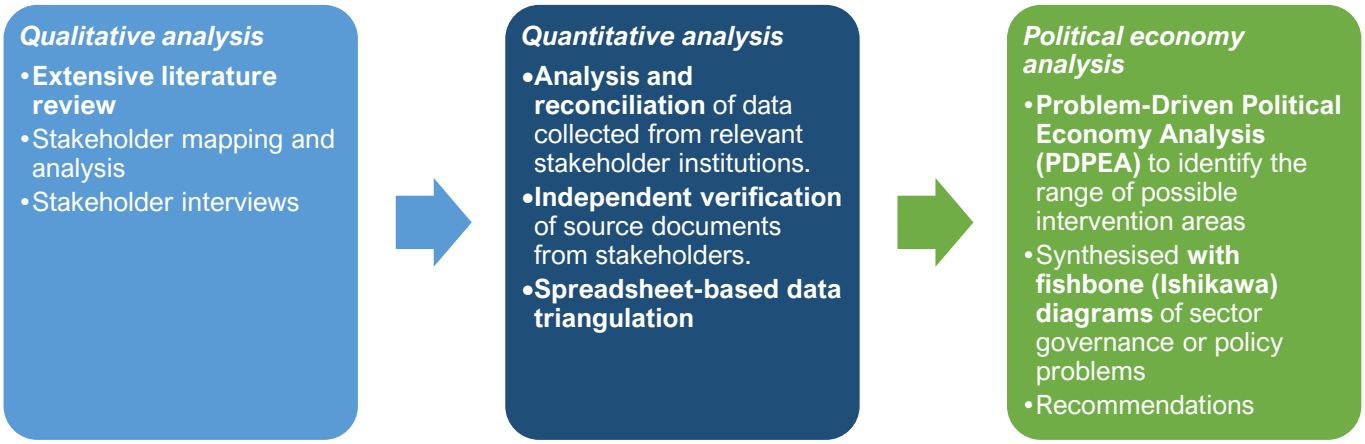
- **Analysis and reconciliation of resource data** collected from relevant stakeholder institutions, including the Minerals Commission.
- **Independent verification** of source documents from stakeholders.
- **Spreadsheet-based data triangulation and some modelling** were then undertaken to establish the potential revenues from Ghana's interests.

Political economy analysis

- The findings from the qualitative and quantitative analyses are further analysed using a **Problem-Driven Political Economy Analysis (PDPEA)** to identify the range of possible intervention areas.
- These are then **synthesised with fishbone (Ishikawa) diagrams** of sector governance or policy problems in the context of critical minerals and the energy transition. Ishikawa diagrams are used to identify the root causes of each problem and entry points for each issue in terms of intervention or output areas.

This all-encompassing approach allows for harnessing the underlying data and the views of multiple stakeholders on leveraging the opportunities within the critical minerals value chain for Ghana.

Figure 3 Outline of research methodology



Source: Author's construct

1.5 Limitations of the report

Despite the consultant's best attempts to comprehensively address all the issues outlined in the scope of work, we note a few challenges:

- The consultant could not complete the scope item on "estimate of projected revenues from critical minerals". This is because too many significant uncertainties surrounding costs and volume estimates mitigated against the completion of such modelling effectively, as illustrated below.
    - **Costs:** The Consultant reviewed several bespoke databases; however, they did not contain Ghana's relevant mine-level cost projection data. An accurate financial model cannot be developed in the absence of country-specific mine-level project costs.
    - **Volume estimates:** The volumetric estimates of manganese and bauxite have not been updated since the late 1980s. With Lithium, we have some production numbers from Atlantic Lithium's recent regulatory filings on the Ewoyaa prospect in the Central Region, but again there are significant uncertainties on the upside. Iron ore is at infant stages with no known volumetric estimates or commercially recoverable volumes, so we could accurately model the expected revenues.

Despite the foregoing, the work done so far highlights some of the critical operational and governance gaps that need to be addressed [and which GHEITI/EITI can champion] if the transition benefits Ghana.

1.6 Structure of the report

The remainder of the report is structured as follows:

- Section 2 lays the conceptual foundations of the energy transition and its impact on the extractives industry.
- Section 3 assesses the critical minerals available in Ghana, including volumetric estimates.
- Section 4 assesses the legal and regulatory regime for critical minerals in Ghana and undertakes a diagnostic benchmarking of this to other mineral resource-rich countries such as Chile.

- **Section 5** analyses the emerging socio-economic and governance issues, including environmental risks associated with critical minerals mining in Ghana. This includes how previous GHEITI disclosures can inform forward-looking decisions on critical minerals in Ghana.
- **Section 6** concludes and provides recommendations on strengthening the value chain linkages between critical minerals mining and industrial policy in Ghana.

2 The energy transition and critical minerals

This section covers the following themes:

- Defining and contextualising the energy transition.
- Impact of the energy transition on the extractives industry with emphasis on sub-Saharan Africa, including fossil fuel-based revenue expectations and implications of the transition in the petroleum sector
- The role critical minerals play in the energy transition.

2.1 What is the energy transition?

The energy transition is fundamentally a complete reframing of how energy is produced and consumed in the 21st century and beyond. Nonetheless, it is essential to note that global energy systems have constantly been evolving, or as some say, "progressive"[13] in form and substance. That is, any transition of global energy systems from one dominant form to another generally happens gradually and in different stages, influenced by various factors — economic, social and technological development.[14] **In the current context of the climate debate, the energy transition is a pathway toward transforming the global energy sector to net-zero by 2050 and beyond, is no more a fringe idea.**

The transition represents one of the most viable ways to mitigate the impacts of human-induced climate change. In 2015, global governments signed the Paris Agreement at the United Nations Conference of the Parties (COP 21) to limit global warming to well below 2 degrees Celsius (°C) — preferably to 1.5°C — compared to pre-industrial levels. Maintaining global temperature at 1.5°C and meeting net-zero goals calls for a drastic reduction in greenhouse gas (GHG) emissions emanating from massive dependence on conventional (fossil) fuels. This calls for switching to low and net-zero energy sources such as renewables and new mobility solutions. In other words, there is a need for a rapid transition and fundamental shift in the global energy system driven by low-carbon technologies. To put this into context, while it took **75 years for coal to be dethroned by oil as the main primary energy source from 1900 to 1975, global governments are seeking to halve this time to 35 years for renewables to catch up (share of RE in the primary energy mix) with oil at its peak in 1975 — that is, about 50% of the global primary energy mix by 2050** (Figure 4)**.**

Besides climate change concerns, the transition is driven by (1) advances in technology, (2) new energy policies being promoted by global governments, especially in a post-COVID-19 pandemic context, and lastly, (3) evolving consumer preferences, especially with environmental, social and governance (ESG) pressures.[15] For example, at the November 2021 COP26 conference, several global governments announced new investments in clean energy technologies, including making commitments to phasing down coal power in the next few decades.[16] Furthermore, more than 130 countries, including major equatorial ones such as Brazil, the Democratic Republic of the Congo and Indonesia, pledged to halt and reverse forest loss and land degradation over the next decade.[17]

[13] Nalule, V. R. (2021). How to Respond to Energy Transitions in Africa: Introducing the Energy Progression Dialogue. In *Energy Transitions and the Future of the African Energy Sector* (pp. 3-35). Palgrave Macmillan, Cham.

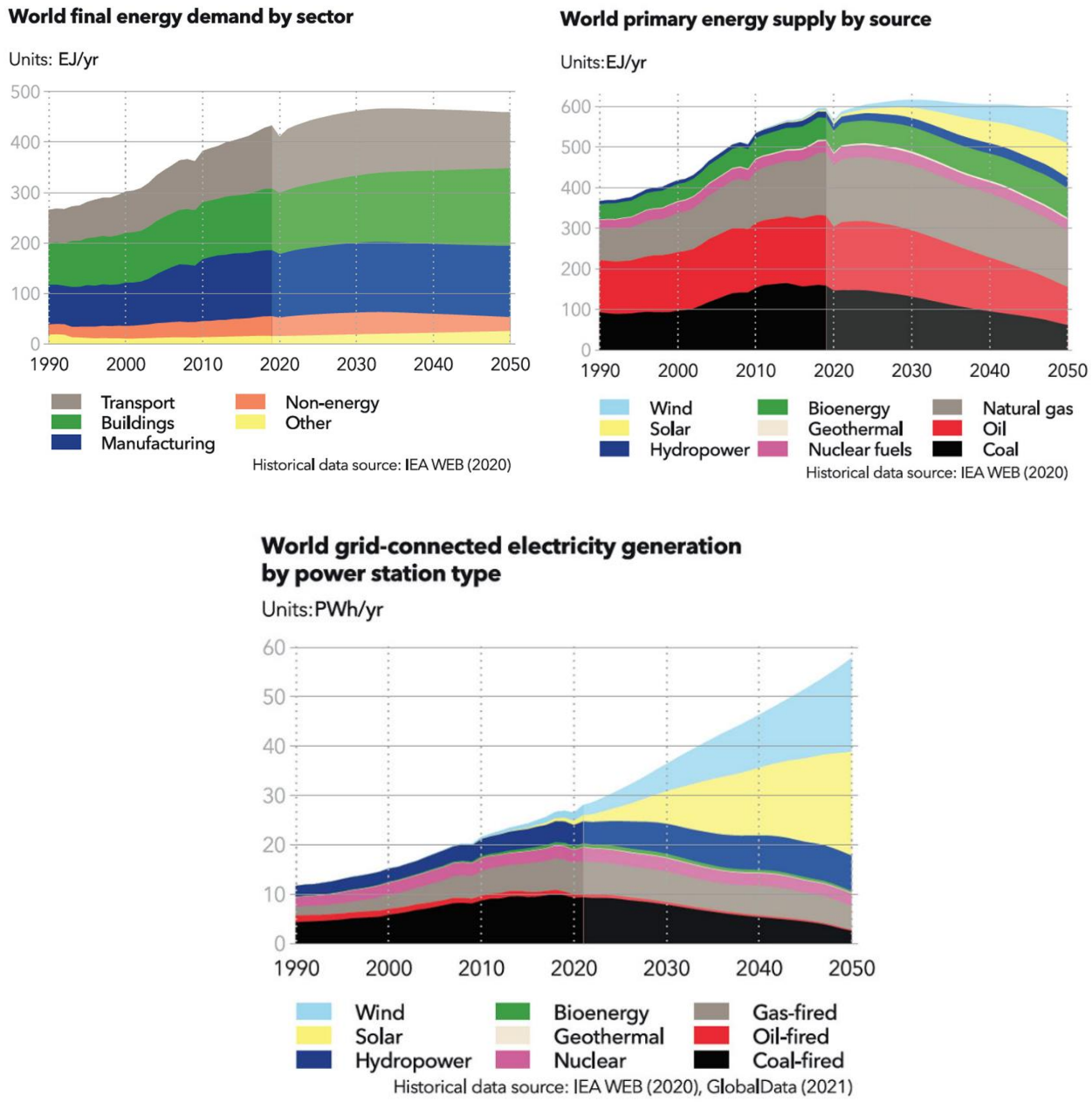
[14] Nalule, V., & Acheampong, T. (2021). Energy Transition Indicators in African Countries: Managing the Possible Decline of Fossil Fuels and Tackling Energy Access Challenges. *Journal of Sustainable Development Law and Policy (The)*, *12*(1), 1-48.

[15] Nalule, V.R., Anaman, P., Acheampong, T. (2022). Energy Transition and Africa's Oil and Gas Resources: Challenges and Opportunities. In: Acheampong, T., Kojo Stephens, T. (eds) Petroleum Resource Management in Africa. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-83051-9_16

[16] See https://www.gov.uk/government/news/world-leaders-join-uks-glasgow-breakthroughs-to-speed-up-affordable-clean-tech-worldwide

[17] See https://www.nature.com/articles/d41586-021-03034-z

Figure 4 Pathways for the global energy system



Source: DNV 2021[18]

2.2 Impact of the energy transition on the extractives industry with emphasis on Africa

For many African countries, energy transition planning has not begun. Fundamentally, a rapid transition means giving up significant oil and gas resources and revenues that have powered the economies of many of these countries, such as Nigeria and Angola, and new emerging producers such as Ghana, Tanzania, Uganda, Senegal, Mauritania, and Mozambique. In a sense, several African countries face being forced to choose between

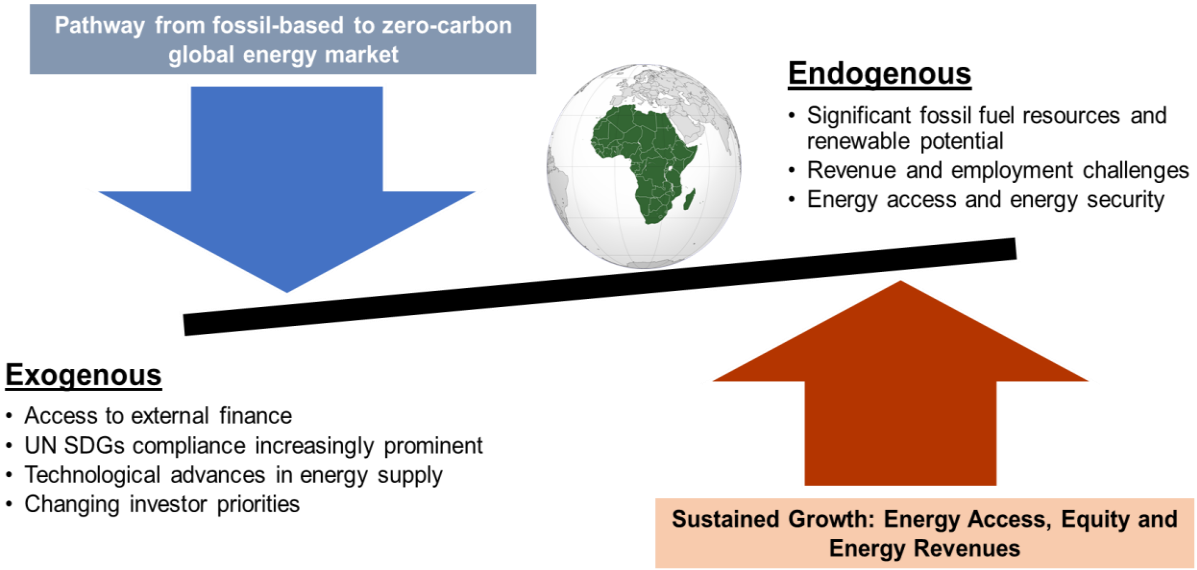
[18] *Energy Transition Outlook 2021*. Available at: https://eto.dnv.com/2021/highlights/energy-transition-outlook

sustained economic growth or growing sustainably (Figure 5).[19] These sentiments are also driven by the fact that Africa's historical contribution to global greenhouse emissions (GHGs) is less than 4%. Yemi Osibanjo, Vice President of Nigeria, poignantly captures[20] the dilemma facing especially oil-producing African countries as follows:

> *"Curbing natural gas investments in Africa will do little to limit carbon emissions globally but much to hurt the continent's economic prospects…Africa's progress could be undone by the rich world's efforts to curb investments in all fossil fuels. Across sub-Saharan Africa, natural gas projects are increasingly imperilled by a lack of development finance…Efforts to restrict fossil fuel investments in Africa are even harder to stomach because many of the wealthy countries behind them—including Japan, the United Kingdom, and the United States—include natural gas in their own multidecade plans to transition to clean energy."*

We detail below how the transition is impacting the oil and gas and mining sectors in Africa.

Figure 5 Balancing sustained economic growth and growing sustainably for African countries



Source: Author's construct based on Berkove et al. (2021)[21]

2.2.1 Oil and gas

The energy transition is already profoundly impacting the global oil and gas market. The landscape for oil and gas companies has profoundly shifted as countries, and international organisations step up climate change commitments.[22] Some studies have suggested that "60% of oil and fossil methane gas, and 90% of coal must

[19] Acheampong, T., & Menyeh, B. O. (2021). COVID-19 and the 'Great Reset': Responding to Energy Transition and Sustainable Development Challenges in Sub-Saharan Africa. *Oil, Gas & Energy Law*, *19*(5).
[20] The Divestment Delusion: Why Banning Fossil Fuel Investments Would Crush Africa. https://www.foreignaffairs.com/print/node/1127817
[21] IHS Markit (2021). Sub-Saharan Africa's energy transition: A choice between growing sustainably and sustained growth? https://ihsmarkit.com/Info/0521/africaet.html
[22] Bouckaert, S., Pales, A. F., McGlade, C., Remme, U., Wanner, B., Varro, L., ... & Spencer, T. (2021). Net Zero by 2050: A Roadmap for the Global Energy Sector.

remain unextracted to keep within a 1.5°C carbon budget".[23] The International Energy Agency (IEA) in its 'Net Zero by 2050' report[24] , profoundly remarked that achieving the 1.5°C target necessitates *"[that] there are no new oil and gas fields approved for development … and no new coal mines or mine extensions are required" beyond projects already committed as of 2021".* Specifically for sub-Saharan Africa, another estimate indicates that **51% of Africa's oil reserves, 49% of its fossil methane gas, and 86% of the coal reserves will be unextractable if the 2050 1.5°C scenario is to be met**.[25]

Dwindling oil demand in the future due to the transition will push future prices towards the marginal cost of oil production. Thus, countries sitting at the lower end of the oil supply cost curve are likely to be the ones that will benefit as their barrels are likely to be produced and come to the market (that is, advantaged barrels) as compared to those at the mid to higher end of the cost curve (Figure 6). There is a significant risk of asset stranding due to the refocus of capital investments by international oil companies and financiers (and longer-term concerns about oil demand) and the lack of operating capacity of some national oil companies (NOCs) to take over some of these assets. For gas prices, they are likely to remain relatively more resilient due to regional trading dynamics. Natural gas is traded in several markets on a bilateral basis.

Furthermore, in sub-Saharan Africa, studies show that natural gas will be a vital part of the sub-region's energy mix for the foreseeable future, especially in West, East and Southern Africa, where largescale gas reserves and resources exist. For example, Nigeria is estimated to have 203 trillion cubic feet (Tcf) of gas reserves. In contrast, new regional players like Mozambique have about 99 Tcf of discovered gas resources and plan to export these to South Africa.[26] Lastly, significant shifts in global oil and gas markets due to the Russian-Ukraine war, mainly forcing Western countries (Europe and America) to divest away from Russian hydrocarbons, could make Africa a competitive alternative supply region. For example, Italian major Eni indicated in April 2022 that it could source extra gas supplies from Algeria, Egypt, Nigeria, Angola and Congo-Brazzaville to meet European shortfalls.[27] In that same month, Italy and Algeria signed a new gas supply deal to increase gas imports from the latter by about 40%.[28]

Deutch, J. (2020). Is net zero carbon 2050 possible?. *Joule*, *4*(11), 2237-2240.
Nalule, V., & Acheampong, T. (2021). Energy Transition Indicators in African Countries: Managing the Possible Decline of Fossil Fuels and Tackling Energy Access Challenges. *Journal of Sustainable Development Law and Policy (The)*, *12*(1), 1-48.

[23] Welsby, D., Price, J., Pye, S., & Ekins, P. (2021). Unextractable fossil fuels in a 1.5 C world. *Nature*, *597*(7875), 230-234.; Arora, N. K., & Mishra, I. (2021). COP26: more challenges than achievements. *Environmental Sustainability*, 1-4.; McGlade, C., & Ekins, P. (2015). The geographical distribution of fossil fuels unused when limiting global warming to 2 C. *Nature*, *517*(7533), 187-190.

[24] IEA (2021). Net Zero by 2050, IEA, Paris. https://www.iea.org/reports/net-zero-by-2050

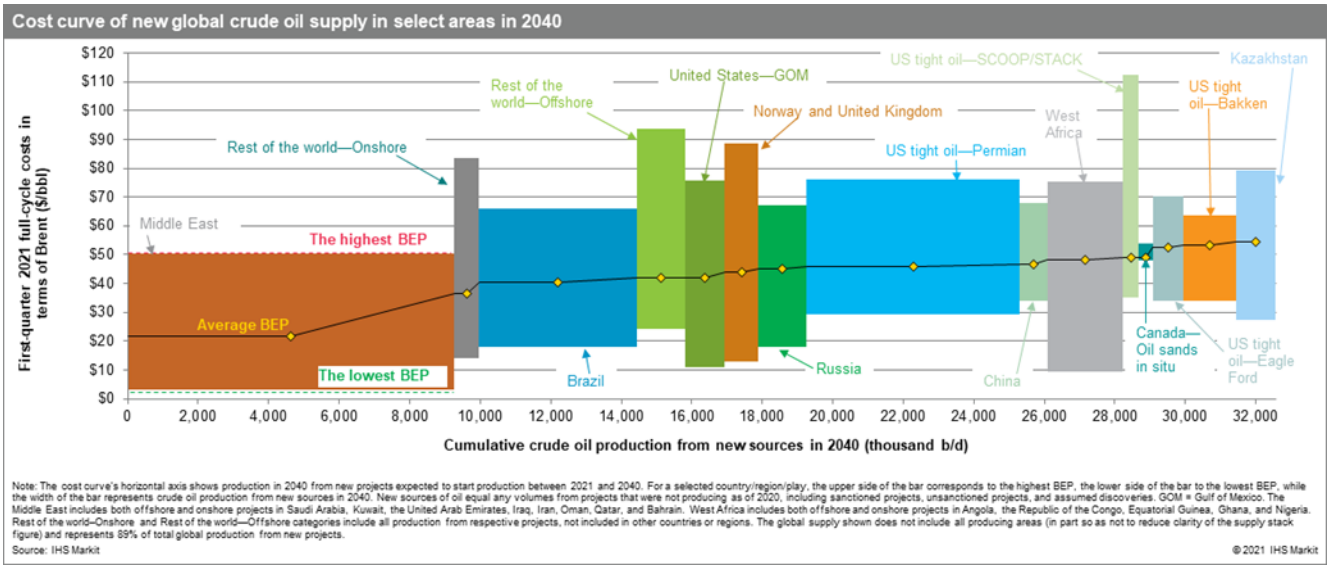
[25] Welsby, D., Price, J., Pye, S., & Ekins, P. (2021). Unextractable fossil fuels in a 1.5 C world. *Nature*, *597*(7875), 230-234.

[26] Africa Energy Chamber (2022). The State of African Energy 2022. https://africa-energy-portal.org/sites/default/files/2022-01/AEC-Outlook-2022_b.pdf, at p.99

[27] *Gas starved Europe looks to Africa for new supplies as E&Ps reconsider shelved projects* (2022). Available at: https://www.rystadenergy.com/newsevents/news/press-releases/gas-starved-europe-looks-to-africa-for-new-supplies *Africa is imperfect solution to Europe's gas woes* (2022). Available at: https://www.reuters.com/breakingviews/africa-is-imperfect-solution-europes-gas-woes-2022-04-28

[28] *Ukraine crisis: Can Africa replace Russian gas supplies to Europe?* (2022). Available at: https://www.bbc.co.uk/news/world-africa-61334470

Figure 6 Crude oil supply cost curve



In essence, Sub-Saharan African countries will be affected by IOC's shifting priorities. Nevertheless, **planned regional divestments may create entry opportunities for willing investors.** There are E&P opportunities **for well-capitalised, risk-tolerant buyers** less strategically constrained by shareholder and policy pressures. Some of those well-positioned to make forays into the Sub-Saharan African market include **international NOCs, private equity-backed (PE) firms, commodity trading firms and well-resourced local (indigenous) E&P firms.** The focus of these areas for new entrants could include:

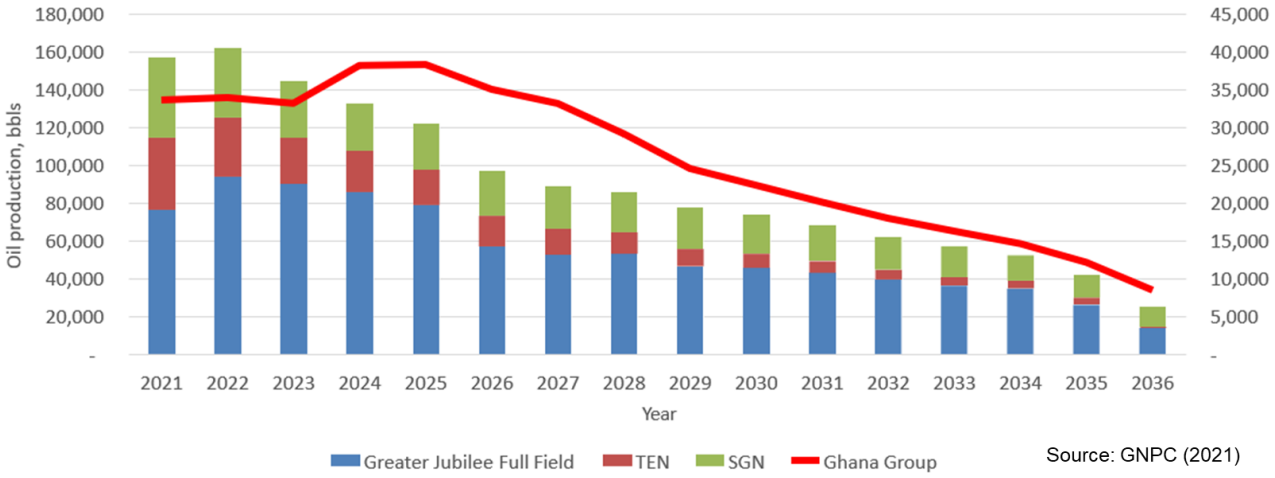
- Competitive returns on capital to shareholders.
- Refocusing on short-cycle, high-margin developments.
- Infrastructure-led exploration.

In the context of potential asset stranding due to the energy transition, GNPC has sought to accelerate its drive towards more active participation in Ghana's upstream oil and gas industry via operatorship. This is also driven by the fact that Ghana, since the early 2000s, has signed 17 petroleum agreements with various IOCs, out of which there are only three (3) producing fields while eleven (11) have limited or no activity. Further compounding this is that the three producing fields have plateaued and will continuously decline without new in-fill developments or new fields coming on stream (Figure 7).[29] Given the preceding, GNPC seeks to maintain a sole focus on this commercial mandate by forming joint ventures and other forms of cooperation with international or local partners.[30] An example of this is GNPC's proposed USD1.65-billion farm-out deal to acquire extra equity in the Deepwater Tano-Cape Three Points (DTCTP), and South Deepwater Tano (SDWT) blocks offshore Ghana and operated by Norwegian-based Aker Energy and sister company AGM Petroleum.

[29] Public Interest and Accountability Committee (2022). *'Assessment of the Management and Use of Ghana's Petroleum Revenues for the Past 10 Years'.* Accra, Ghana., at p.xv

[30] ibid

Figure 7 Ghana crude oil production forecast (2021-2036) without new interventions



Source: GNPC (2021)

Reasons given by Ghana's energy ministry and the NOC for supporting the transaction include, among others, that *"Ghana faces the risk of stranded assets and dwindling proven reserves if GNPC is unable to undertake exploration, development and production alone. A declining industry undermines growth, diminishes revenue expectations for Ghana, and makes redundant the stock of skilled labour in the industry, which Ghana has rapidly built over the decade… This partnership has the potential to add more than 200,000 barrels of crude oil to Ghana's current production within the next 4 to 5 years."* [31]

However, the deal has been criticised by a section of Ghana's civil society[32], raising fundamental governance issues around the proposed sale. These include:

- **The lack of independent valuation of the reserves and contingent resources** of the DWT/CTP and SDWT blocks
- **Commerciality of the Nyankom-1X discovery (a contingent resource) –** currently, there is no technical and economical solution at the extreme water depths to commercially exploit the Nyankom discovery
- **Over optimistic oil price forecasts** in the valuation reports; this has a major impact on the underlying net asset value
- **Historical costs and tax claims**
- **Other public policy issues**
    - Ghana's government acquiesced to Aker's interests by amending the petroleum laws and agreement to favour the latter - reducing Explorco's 24% paid interest in SDWT to zero. This was the first-ever amendment of a petroleum agreement in Ghana
    - **Proceeds from the farm-down are likely to be used to fund the sellers' portion of the now reduced or minimal stakes**

[31] *GNPC seeks Parliament approval to purchase 37% stake in Aker Energy's oil block - MyJoyOnline.com* (2021). Available at: https://www.myjoyonline.com/gnpc-seeks-parliament-approval-to-purchase-37-stake-in-aker-energys-oil-block

[32] *Parliament Must Investigate the GNPC Transaction with Aker Energy Ghana – Africa Centre for Energy Policy* (2021). Available at: https://acep.africa/works/parliament-must-investigate-the-gnpc-transaction-with-aker-energy-ghana

GHANA : Why GNPC is intent on taking control of Aker and AGM's oil assets - 24/08/2021 - Africa Intelligence (2021). Available at: https://www.africaintelligence.com/oil--gas_state-strategy/2021/08/24/why-gnpc-is-intent-on-taking-control-of-aker-and-agm-s-oil-assets,109686671-art

$1.65bn Aker Energy/AGM–GNPC farm-out deal overpriced - Theo Acheampong - MyJoyOnline.com (2021). Available at: https://www.myjoyonline.com/1-65bn-aker-energy-agm-gnpc-farm-out-deal-overpriced-theo-acheampong

- Transaction narrowed down to a GNPC-Ministry of Energy-Aker/AGM debate when The Petroleum Commission, the upstream regulator, has a more fundamental role to play
- **GNPC is saddling itself with more debt given it already has challenging financial commitments** – for example, take-or-pay gas contract obligations, power and LNG project guarantees, Tema LNG project

Fundamentally, the transition and attendant decline in the use of crude and gas in the global energy mix means that producing countries like Ghana will have to temper their expectations of significant petroleum revenues. The significant volatility associated with commodities in general, particularly oil and gas, should serve as a warning. Indeed, the dashed heightened expectations of bumper oil and gas revenues following the discovery of oil and gas in commercial quantities in Ghana in 2007 should be a warning. Ghana became a victim of the 'presource curse'[33] with high unstainable borrowings (debt) and worsening poverty and inequality.

2.2.2 Minerals

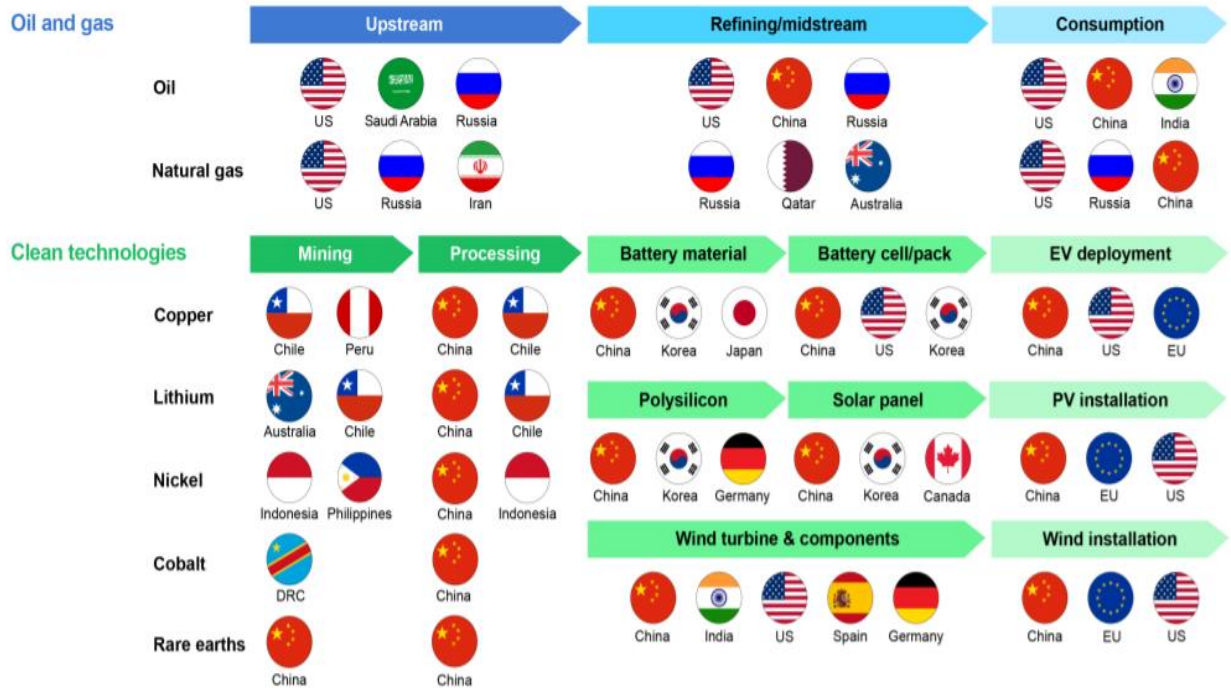
The energy transition has already pushed mineral markets into a bullish cycle for several critical minerals. This is expected to last for several years as demand for these metals and supply chain vulnerabilities drive up prices, albeit with some correction along the way.[34] The rise in prices means that new projects, hitherto classified as marginal, are now likely to become feasible. This will lead to a more geographically diverse supply market. It must be noted that the supply chain for critical minerals and clean energy technologies, while heavily titled to G20 countries, is relatively more diversified than oil and gas (Figure 8).

The need to secure these critical minerals is also driving up a chain of mergers and acquisitions (M&A) activity on the African continent. Last year, Ganfeng Lithium Co, one of the world's biggest lithium producers, paid US$130 million for a stake in the Goulamina hard-rock mine in Mali in exchange for at least half of its first-phase output. Australia's AVZ Minerals made a US$17.9 million (A$25m) investment to support early works and exploration drilling at the Manono Lithium Project in the Democratic Republic of the Congo (DRC). In early 2022, Chinese company Zhejiang Huayou acquired controlling rights to Zimbabwe's Arcadia Lithium Mine in a US$422 million deal.

[33] Frynas, J. G., & Buur, L. (2020). The presource curse in Africa: Economic and political effects of anticipating natural resource revenues. *The Extractive Industries and Society*, *7*(4), 1257-1270.
Mihalyi, D., & Scurfield, T. (2021). How Africa's prospective petroleum producers fell victim to the presource curse. *The Extractive Industries and Society*, *8*(1), 220-232.
Ruzzante, M., & Sobrinho, N. (2022). *The'Fiscal Presource Curse': Giant Discoveries and Debt Sustainability*. International Monetary Fund.

[34] IMF Blog (2021). Soaring Metal Prices May Delay Energy Transition. https://blogs.imf.org/2021/11/10/soaring-metal-prices-may-delay-energy-transition

Figure 8 Indicative supply chains of clean energy technologies vis-à-vis oil and gas



Source: IEA (2021, p.29 &30)

2.3 What role would critical minerals play in the energy transition?

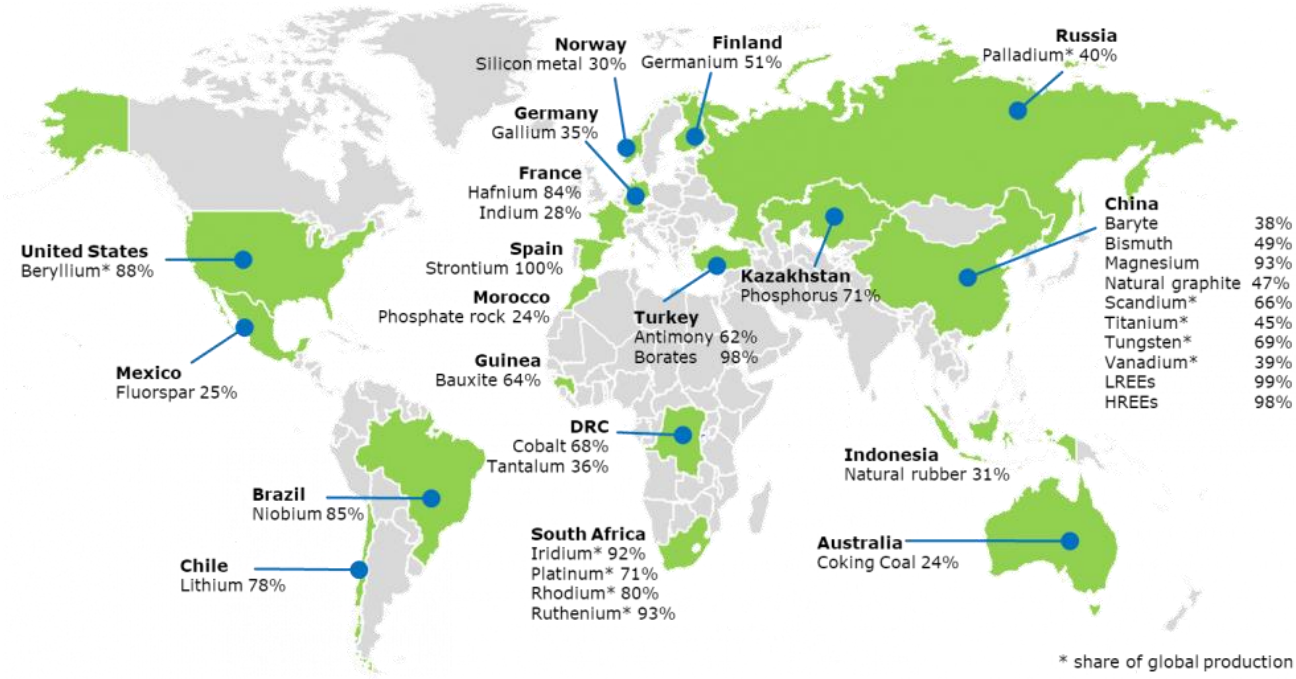
Critical minerals are broadly understood to mean those minerals fundamental to the fourth industrial revolution (4IR) and the global decarbonisation agenda — essential to the production of high-tech, renewable energy and defence applications.[35] However, these minerals can also be subject to significant supply chain disruption, especially because they are concentrated in a few geographic locations; this is in addition to price risks.[36] **The United States government defines a critical mineral as mined material essential to the country's economic and national security; the supply chain is vulnerable to disruption and serves an essential function in the manufacturing of products, and its absence will have consequences on economic or national security[37].** The U.S. maintains a critical minerals list that is periodically updated, with the

[35] Kalantzakos, S. (2020). The race for critical minerals in an era of geopolitical realignments. *The International Spectator*, *55*(3), 1-16.
Young, W. & Richardson, J. (2021). Critical minerals: Towards a British strategy. Council on Geostrategy Policy Paper. Available: https://www.geostrategy.org.uk/app/uploads/2021/11/ESPPP01-25112021.pdf
[36] Hayes, S. M., & McCullough, E. A. (2018). Critical minerals: A review of elemental trends in comprehensive criticality studies. *Resources Policy*, *59*, 192-199.
Galos, K., Lewicka, E., Burkowicz, A., Guzik, K., Kot-Niewiadomska, A., Kamyk, J., & Szlugaj, J. (2021). Approach to identification and classification of the key, strategic and critical minerals important for the mineral security of Poland. *Resources Policy*, *70*, 101900.
Vakulchuk, R., & Overland, I. (2021). Central Asia is a missing link in analyses of critical materials for the global clean energy transition. *One Earth*, *4*(12), 1678-1692.
[37] US Government (2017). A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals https://www.govinfo.gov/content/pkg/FR-2017-12-26/pdf/2017-27899.pdf

most recent update in 2022.[38] The list currently has about 50 minerals ranging from nickel, cobalt and aluminium, among others.[39]

In the European Union, critical raw materials (CRMs) are defined as being crucial to the European economy, **which forms a strong industrial base and enables the production of a broad range of goods and applications used in everyday life and modern technologies[40]**. The latest list update occurred in 2020, with 30 minerals considered critical.[41] These minerals range from lithium to silicon metal, bauxite, lithium, cobalt and vanadium, among others (Figure 9).[42]

Figure 9: Countries accounting for the largest share of EU supply of critical raw materials (EU)



Source: European Union

Figure 10 illustrates the criticality of certain minerals vis-à-vis the associated energy transition technologies. Metals such as copper, lithium, nickel, cobalt, manganese, and graphite are vital to the transition for sustaining battery longevity, performance, and energy density of all-electric vehicles (EV) motors, solar panels, and wind turbines. To illustrate, a typical EV requires about 200 kg of seven different metals, compared with about 35-40kg for a conventional one (internal combustion engine: ICE) which comes from only two metals (Figure 11).

According to Bloomberg, solar panels with 1 gigawatt (GW) power capacity need about 18.5 tons of silver, 3,380 tons of polysilicon and 10,252 tons of aluminium. The number of materials required for a wind turbine and its associated infrastructure for a power capacity of one gigawatt will be 387 tons of aluminium, 2,866 tons of copper and 154,352 tons of steel. Lithium-ion battery with a storage capacity of 1 gigawatt-hour (GWh) of energy will require 729 tons of lithium, 1,202 tons of aluminium and 1,731 tons of copper. A public electric vehicle charging

[38] US Federal Register (2022). 2022 Final List of Critical Minerals. https://www.federalregister.gov/documents/2022/02/24/2022-04027/2022-final-list-of-critical-minerals

[39] USGS (2022). U.S. Geological Survey Releases 2022 List. https://www.usgs.gov/news/national-news-release/us-geological-survey-releases-2022-list-critical-minerals

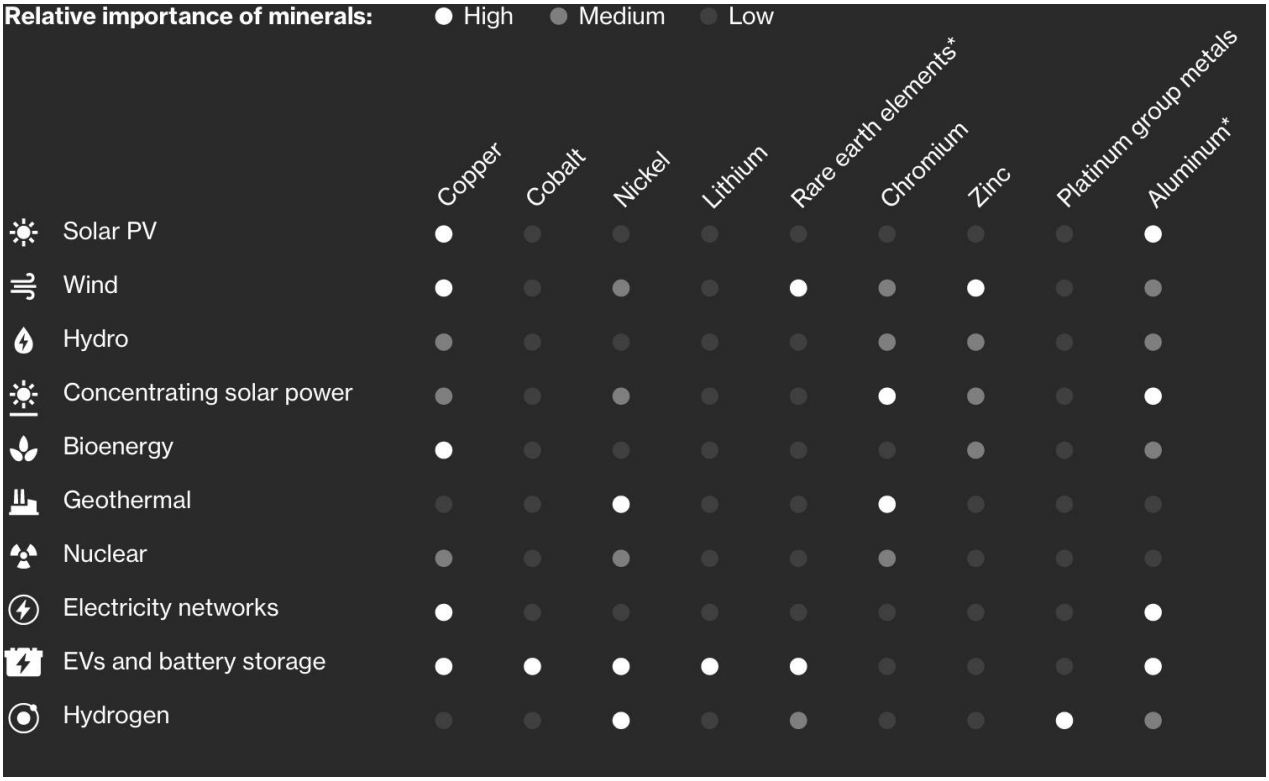
[40] European Commission (n.d.). Critical raw materials. https://ec.europa.eu/growth/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en

[41] EU Science Hub (2022). Raw Materials Information System (RIMS). https://rmis.jrc.ec.europa.eu/?page=crm-list-2020-e294f6

[42] European Commission (2020). Critical Raw Materials Resilience: Charting a Path towards greater Security and Sustainability. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0474&from=EN, at p.4

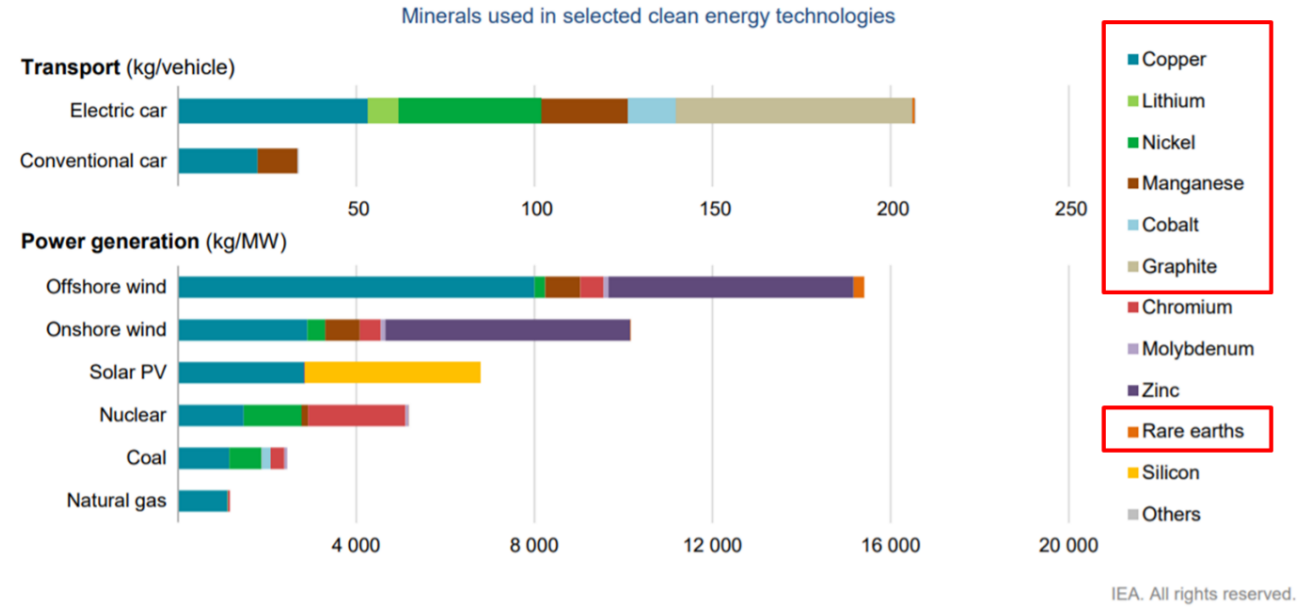
infrastructure will require about 25 kg of copper, whereas a nimble one for home charging will require about 2 kg of copper[43]. **Cumulatively, these technologies will require millions of tons of materials annually to manufacture.**

Figure 10: Energy transition technologies and the metals required



Source: IEA

Figure 11 Minerals used in selected clean energy technologies



Source: IEA (2021, p.26)

[43] https://www.bloomberg.com/graphics/2021-materials-silver-to-lithium-worth-big-money-in-clean-energy/?sref=ZrxB1zXa

Countries around the world have announced targets to electrify their mobility. According to McKinsey&Co, to achieve these targets, incumbent automotive suppliers need to shift production from ICE to electric vehicle components. Europe will have to build an estimated 24 new battery giga-factories to supply local passenger electric vehicle battery demand. With more than 70 million electric vehicles on the road by 2030, the industry will need to install large numbers of public chargers and provide maintenance operations for them. Renewable electricity production needs to increase by 5% to meet EV charging demand. Finally, battery electric vehicle (BEV) production emissions must decline since BEVs currently have 80% higher emissions in production than ICE vehicles[44]. The automobile transition is assessed to create about US$100 billion in new value chain opportunities through the introduction of new supply chain parts such as batteries. **This new shift to battery-powered vehicles from internal combustion will create significant demand for battery metals and a decline in fossil fuels.** For batteries only, overall metals demand will grow from 2 million metric tons in 2019 to 14 million metric tons in 2030. Aluminium demand will grow about 14 times this decade; iron will grow by about 13 times, and manganese demand from batteries will grow about three times.[45]

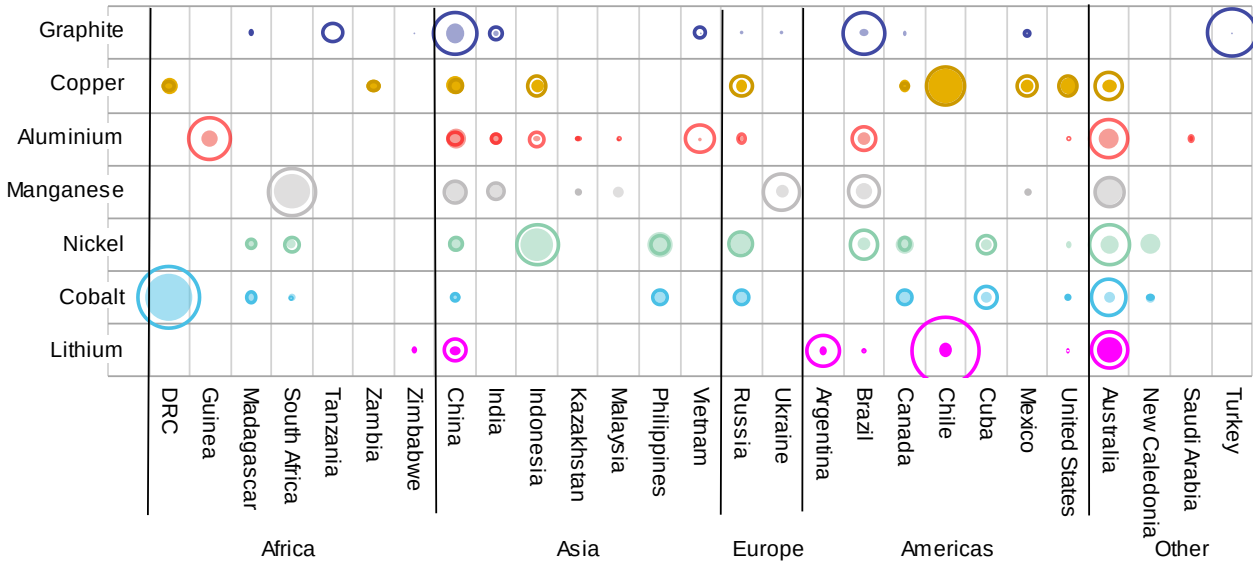
Africa is the second most important region for supplying critical raw materials to Europe after China. Unlike other regions, Africa does not have any official list of metals it considers critical to its economy and manufacturing products. We, however, select some key metals that will play a role in the energy transition and define those as key metals that could enhance Africa's economic and manufacturing capabilities. **Over half of African countries host at least one of the nine metals used in lithium-ion battery technologies either under exploration, development or production**. These mineral resources can be found in abundance in Zambia, the Democratic Republic of Congo (DRC), South Africa and Ghana, among others (Figure 12). South Africa is a major producer of manganese, nickel and iron. Zimbabwe produces lithium. There are lithium projects in Mali currently under development. Democratic Republic of Congo (DRC) is a major producer of copper and cobalt. Gabon is the third-largest producer of manganese globally. Tanzania is the biggest producer of graphite outside China. Morocco is the only country that produces cobalt as a primary product. It is also the leading producer of phosphate. Namibia is currently developing rare earth projects to extract metals such as niobium. Madagascar is a leading producer of high-quality nickel used in electric vehicle production. As of May 2022, **Ghana has five critical minerals in various degrees of abundance: manganese, bauxite (aluminium), iron ore and concentrates, silica sand and lithium.** With commodity prices forecast[46] to be at all-time highs into the foreseeable future (Figure 13), African countries such as Ghana can seize the opportunity and use the potential windfall to invest in downstream capacity, skill development and strengthening regulatory regimes.

[44] https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/why-the-automotive-future-is-electric

[45] *Electric Vehicles Drive up Metals Demand* (2021). Available at: https://www.visualcapitalist.com/electric-vehicles-drive-up-metals-demand

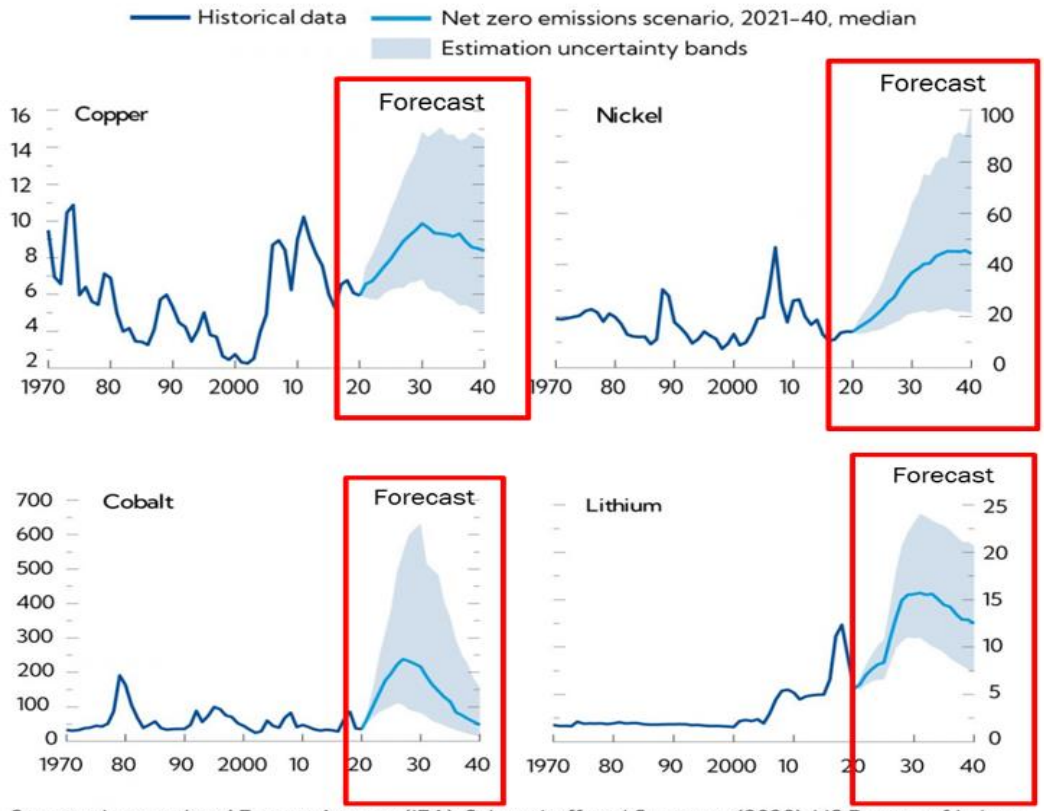
[46] IMF (2021). Soaring Metal Prices May Delay Energy Transition. https://blogs.imf.org/2021/11/10/soaring-metal-prices-may-delay-energy-transition/

Figure 12: Resource and production capacity of selected battery metals, country-level



Source: USGS 2019, BloombergNEF. The solid spheres represent 2019 production, and the outer circle represents the total reserves. The size of spheres and circles denote the proportionality of the resource between countries.

Figure 13 IMF metal price scenarios up to 2040



Sources: International Energy Agency (IEA); Schwerhoff and Stuermer (2020); US Bureau of Labor Statistics; US Geological Survey; and IMF staff calculations.
Note: Prices are adjusted using the US consumer price inflation index. The scenarios are based on a metal-specific demand shock. Bands show 40% highest posterior density credible sets.

2.4 Summary

Overall, the transition to clean energy will open new opportunities for metals and mining. It will create new demand and global supply chains that currently do not exist. Beyond just batteries, electric vehicles will demand higher volumes of iron, manganese, molybdenum, vanadium, dysprosium and neodymium. Solar photovoltaics will require more silica, while wind turbines require more steel and copper. Europe and North America want to reduce their manufacturing emissions by shortening their supply chain route to raw materials sources. This will see their reliance on Asia for raw materials decline in favour of regions such as Africa and South America, which are closer.

This is coupled with commodity prices being forecast to be at all-time highs in the foreseeable future due to the demand for these critical minerals. For example, IMF and other analyses show that soaring demand for metals and slower supply changes could push metals prices to reach historical peaks for an unprecedented length of time. Thus, African countries such as Ghana can seize the opportunity[47] and use the windfall to invest in developmental outcomes. Strengthening frameworks and practices for transparency and accountable governance, improving domestic resource mobilisation/allocation, diversifying the economy, building up downstream capacity and developing human capital are among the feasible policy options.

[47] We specifically address the issue of how to develop comparative advantage in the mid and downstream market in other sections of the report (See Sections 4 and 5). This argument is also supported by the historical narrative on lessons from past resource-based industrialisation.

3 Ghana critical minerals resource assessment

This section covers the following themes:

- Mapping of the scope and volume of proven critical minerals in Ghana
- Comparative benchmarking analysis of Ghana's critical mineral resources vis-à-vis other regional players such as Guinea, the Democratic Republic of Congo (DRC), Zambia and South Africa.

3.1 Mapping of the scope of proven critical minerals in Ghana

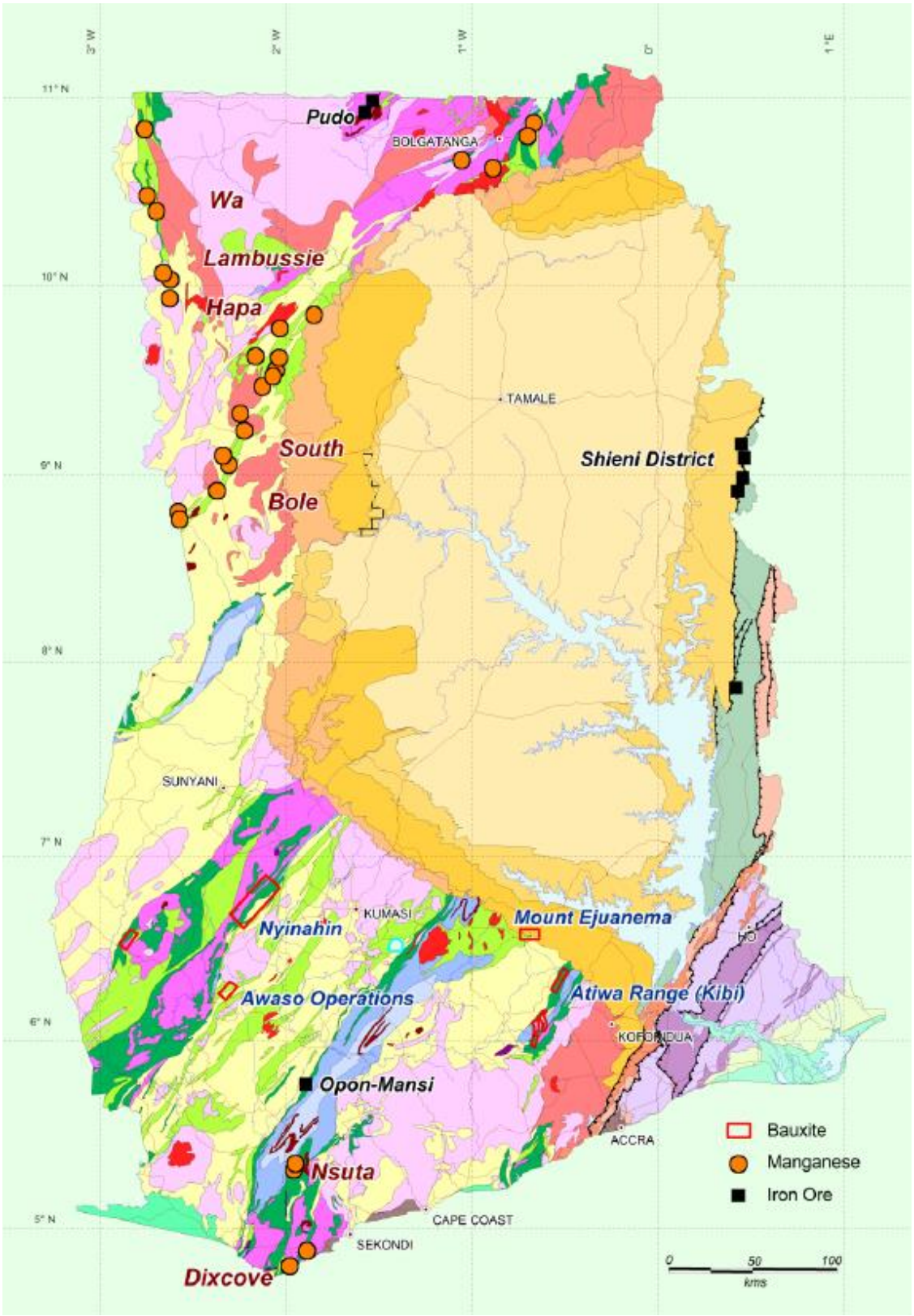
Ghana is endowed with significant mineral resources with a historical focus on gold mining[48]. Industrial metals such as manganese, bauxite, and iron ore (Figure 14) **have played a secondary role[49] in the country's mineral industry** despite various policy initiatives since independence to create value chain enhancing opportunities. Nevertheless, major countries worldwide are implementing plans to invest in green infrastructure as part of their post-COVID-19 recovery plans.[50] **These investments, coupled with the global transition towards clean energy, will boost demand for industrial metals. As a result,** Ghana can leverage its industrial raw materials to become a major hub for Africa and Europe in the energy transition. This strategic action will require a detailed understanding of Ghana's resource advantage and recommendations to harness the opportunity.

[48] Gold is Ghana's predominant mineral produced in the country accounting for over 90% of all mineral revenues annually over the past two decades, as EITI and other government statistics show.

[49] Some industrial minerals like clays, kaolin and silica sand are being used on a much small scale to supply local industries in ceramic, paint and glass manufacturing respectively.

[50] *Focus on green recovery* (2020). Available at: https://www.oecd.org/coronavirus/en/themes/green-recovery
A once-in-a-generation opportunity: How green infrastructure saves lives and livelihoods (2021). Available at: https://blogs.worldbank.org/ppps/once-generation-opportunity-how-green-infrastructure-saves-lives-and-livelihoods

Figure 14 Manganese, bauxite and iron ore occurrences in Ghana



Source: Minerals Commission

3.2 Bauxite/Aluminium

Aluminium is the most abundant metal in the earth's crust, but it is not found in its free form. It has extensive applications ranging from automobiles, building and construction, technology and packaging. It is used in cars, aeroplanes, kitchen foils and phones. Aluminium will play a key role in lightweight materials for the energy transition to maximise vehicle efficiency. Transitioning to cleaner energy technologies such as solar and wind energy requires an overhaul of current grid networks. Demand from aluminium alone to overhaul existing grids will reach 7 million tons per annum by 2050. Aluminium is also used in batteries as collectors. Demand from batteries alone will exceed over 1 million tons by 2030.

Australia is the leading producer of bauxite, with 2021 production totalling about 110 million tons. China follows with about 65 million tons. Overall, 370 million tons of bauxite were produced last year. Alumina is the intermediary product before aluminium. **Generally, 4 tons of dried bauxite is required to produce 2 tons of alumina, which, in turn, produces 1 ton of aluminium.** China dominates the alumina market with about 75 million tons capacity, with Australia following with 22 million tons capacity. Overall, alumina capacity currently sits at 138 million tons. In Africa, Guinea is the leading producer of bauxite, with a capacity reaching 22 million tons in 2020. It also holds the largest known global bauxite reserves, with around 25% of the total by 2020. It exports almost all its bauxite to China. China, the world's largest aluminium producer, imports almost half of its bauxite from Guinea. Top producers of aluminium include Hongqiao and Chalaco.

3.2.1 Ghana's current state

Ghana's bauxite reserves are estimated at 900 million tons, according to GIADEC.[51] With the right investments in exploration and infrastructure, such as roads and railways, the country can produce up to 10 million tons a year. The only bauxite mine in the country is in Awaso in the Anhwiaso-Bekwai Municipal district of the Western North Region. The mine is co-owned by the Government of Ghana with 20% equity and **China's Bosai Minerals holding 80%. All the bauxite produced is exported in concentrate form into China through the Takoradi Port.** The mine currently produces approximately 1 million tonnes of bauxite a year. VALCO was established to enable Ghana to become an integrated aluminium producer. However, Ghana does not have any domestic smelter to process bauxite into alumina for the VALCO plant. Hence, all the alumina refined at VALCO is imported. Currently, VALCO has an aluminium refinery capacity of about 60,000 metric tons per annum. There are plans to expand this to 300,000 metric tonnes as part of the integrated aluminium program. The Ghanaian government is currently considering commissioning a feasibility study to assess the commercial viability of building a domestic smelter.

3.2.2 Harnessing Ghana's potential

The Government of Ghana has set up the Ghana Integrated Aluminium Development Corporation (GIADEC) to facilitate the development of the country's manufacturing and industrialisation base. GIADEC was established through an Act of Parliament in August 2018 to promote and develop a globally competitive integrated aluminium industry in Ghana[52]. The company plans to achieve this by entering into strategic partnerships with investors to develop domestic capabilities across Ghana's entire aluminium value chain. In September 2021, the government selected Rocksure International as a strategic partner to build the bauxite mine and the proposed aluminium refinery[53].

Retaining the full value chain of the aluminium industry in-country can potentially create enormous value for Ghana and increase the country's drive toward industrialisation. The secondary impact on the domestic supply chain will include ancillary services such as equipment support, uniforms and plant services. This will push the country's industrialisation for low-value and high-value products.

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[51] *Ghana signs $1.2 billion deal to develop its bauxite resources* (2022). Available at: https://www.mining.com/web/ghana-signs-1-2-billion-deal-to-develop-its-bauxite-resources
Acheampong, T., & Mensah, K. A. (2018). Towards an Integrated Bauxite and Aluminium Industry in Ghana. *Natural Resources Governance Institute*.

[52] https://www.giadec.com

[53] *Ghana signs $1.2 billion deal to develop its bauxite resources* (2022). https://www.bloomberg.com/news/articles/2021-09-16/ghana-signs-1-2-billion-deal-to-develop-its-bauxite-resources

3.3 Manganese

Manganese is mainly used as a ferroalloy or deoxidiser and desulfuriser in steel production and increasingly in lithium-ion battery cathodes. It is the twelfth most common element in the earth's crust and is often found with iron ore deposits. South Africa, Australia and Gabon accounted for 58% of global manganese ore production in 2019. About 90% of manganese ore is refined into ferroalloys, used mainly in crude steel production. Only about 8% of manganese ore is converted into pure electrolytic manganese metal, used in stainless steel production and aluminium cans or converted to manganese sulphates for battery cathodes.

Manganese is an abundant mineral. According to the United States Geological Survey (USGS), the world has over 810 million tons of recoverable manganese reserves. However, it is not evenly distributed. South Africa accounts for 20% of recoverable reserves, followed by Brazil, Ukraine and Australia. Mined manganese can exist as a carbonate or oxide. It is processed on-site and refined based on its intended end-use. The four main intermediary products are (1) ferroalloys, which are used in crude steel, (2) electrolytic manganese dioxide used in dry cell and alkaline batteries, (3) electrolytic manganese metal used in stainless steel and aluminium cans, and (4) manganese sulphate used in lithium-ion battery cathodes.

3.3.1 Ghana's current state

Ningxia Tianyuan Manganese is currently the largest producer of electrolytic manganese metal, with a nameplate capacity of 800,000 tons globally. **It owns some captive manganese mines that supply feedstock, such as the Ghana Manganese Company mine in Nsuta, Ghana. The Ghana government owns 10% carried interest in the manganese mine.** Mining at Nsuta started in 1916 with the primary aim of providing raw materials to build steel to support the ongoing war in Europe. The company has operated for over a century, with the early 2000s seeing record production in response to China's growing demand for steel. The company produced about 4.6 million metric tons in 2018 after the Chinese company took over.

Production has since dropped due to railway capacity constraints, among other factors. There has been no significant exploration to expand existing operations or make new discoveries to extend the life of mine of the deposit. GHEITI's latest report shows that manganese production increased from 4.6 million tonnes in 2018 to 5.4 million tonnes in 2019, and that of bauxite improved from 1.0 million tonnes in 2018 to 1.1 million tonnes in 2019. The 18 per cent expansion in manganese production by the Ghana Manganese Company mirrored the firm's objective to ramp up production[54].

3.3.2 Harnessing Ghana's potential

Ghana reportedly has enormous deposits of manganese scattered across the country. There are significant occurrences in the Dixcove area, South Bole District in Northern Ghana, Axim Salman area and Wa. All these could be further studied, and the orebody well defined to attract the much-needed exploration and development investment.

The medium-grade carbonate Nsuta deposit is among the few deposits suitable for electrolytic manganese metals used in stainless steel and manganese dioxide battery raw materials[55]. Ghana can investigate the viability of **moving further down the value chain by building an EMD facility in-country to reduce the global reliance of this material on South Africa and China.** Europe's fast-growing battery industry could be a potential market.

3.4 Iron ore/steel

China uses and produces more than half of all steel globally today, with demand growing rapidly at around 13% per year since 2000. China's crude steel consumption will likely peak within the next decade at around 1.1 billion metric tons in 2029, up a further 25% from 874 Mt in 2019. Notably, by 2030, secondary steel production

[54] https://eiti.org/document/ghana-eiti-2019-reports

[55] https://news.metal.com/newscontent/100959107/[smm-analysis]-ghana-manganese-mine-is-rumored-to-be-shut-down-again-the-essence-is-still-a-game-of-interests

will meet 30% of China's steel demand as the country improves the recycling of steel scraps. An increase in steel recycling will lead to a decline in manganese use in steel making.

Europe and the U.S. are the second- and third-largest consumers of steel today, at 219Mt and 144Mt, making up a combined 19% of global demand. However, the use of steel in the U.S. is lower now than it was in 2000, and we expect the EU to follow a similar trend, declining slowly over time. By 2030, European steel demand will go down by 13% to 188 million tons, and demand in the U.S. will go down 20% to 114 million tons.

India ranks fourth in steel use, at around 120 million tons per year. However, demand in India grows at around a 6% compounded annual growth rate (CAGR) to overtake Europe in 2027 and reaches 245 million tons in 2030. India's growth comes from infrastructure development and an increasingly wealthy population that pushes up demand for passenger vehicles and consumer goods.

Flat steel products are more likely to be stainless steel, as they are used in products that require resistance to rust, like automobiles, electronics, and household appliances. Flat steel demand from automakers will grow significantly by 2030 because of the increase in vehicle ownership in Africa. However, as automakers look increasingly to develop lighter-weight electric vehicles, there may be more substitution away from steel for other materials like aluminium. China's demand for flat steel products is also likely to rise over the coming decade. For example, demand for flat steel products used in the automotive sector will grow from 200 million tons to 236 million tons by 2030. Iron ore used in steel will play a significant role in constructing the platforms to mount wind turbines. Overall, steel will play a key role in developing the supporting infrastructure to host the various energy transition technologies.

3.4.1 Ghana's current state

Ghana has no domestic iron ore production. However, there are known iron ore deposits in Shieni in the northern region. In the 1960s, with help from the Soviet Union, the Geological Survey Authority conducted several drilling data in the region to define the deposit. The exploration revealed that the deposit could have variable thicknesses of about 40-70m. Although no detailed resource study has been conducted, the geological resource could be about 300 million tons of iron with an average grade of 45% Fe. There are minor grades of silica and alumina recorded in the region. According to the Ghana Minerals Commission, other deposits in the region could have a resource capacity of 500 million tons with an average grade of 25% to 45% Fe.

Opon Mansi in the Western Region is also an area with potential iron ore deposits. The iron-rich laterites with about 10m thickness could harbour about 150 million tons of iron ore with an average grade of 50% Fe.

3.4.2 Harnessing Ghana's potential

The Ghana government formed the Ghana Integrated Iron and Steel Development Corporation in March 2019 through (GIISDEC) an Act of Parliament to explore the potential of developing the country's iron and steel capabilities. The Corporation could serve as a catalyst to unlock the country's iron and steel potential. The Southwest region of Ghana has manganese, silica, limestone and charcoal. These are all essential raw materials required for the production of steel.

3.5 Silica sand

Silica sand is the crucial raw material for glassmaking. Solar panels also require a high-purity, low-iron type that makes up only a small percentage of the global supply.[56] As solar demand rose, the price of this silica sand almost doubled in 2021. Glass manufacturing is a key end-use of silica. The sand serves as the source of Silicon Dioxide used in glass production[57].

[56] Maldonado, S. (2020). The importance of new "sand-to-silicon" processes for the rapid future increase of photovoltaics. *ACS Energy Letters*, *5*(11), 3628-3632. https://doi.org/10.1021/acsenergylett.0c02100
Gribov, B. G., & Zinov'Ev, K. V. (2003). Preparation of high-purity silicon for solar cells. *Inorganic materials*, *39*(7), 653-662. https://doi.org/10.1023/A:1024553420534

[57] https://www.marketsandmarkets.com/Market-Reports/washed-silica-sand-market-23955586.html

3.5.1 Ghana's current state

Ghana has not conducted a recent technical geological study on its sand silica potential that is publicly available. Existing studies date to the 1960s and 70s**.** Such a study which includes a market scope and the feasibility of developing the deposits, will go a long way to enhance the country's mineral fortunes.

3.5.2 Harnessing Ghana's potential

Growing construction activities and infrastructure projects in Africa will drive the demand for glass, mainly made of quartz sand. Silica is also widely used in solar photovoltaics and wind turbines. Their expected growth should catalyse silica demand as well. Silica sand is one of the rare sub-segments under short supply within the solar value chain. According to some other reports[58] citing Ghana Geological Survey officials, **Ghana has good quality silica sands in the Atuabo area of the Western Region. However, they are yet to ascertain its commercial viability.** Ghana lacks a clear silica sand policy, defined geological data and investment drive to attract capital to develop this resource. A key potential could be revitalising and expanding the Abosso Glass Factory and other ceramics factories such as Wangkang (Ghana) Ceramic Co., Ltd, Sentuo Ceramic Ghana and Twyford Ghana to process domestic silica to support glass manufacturing in Ghana as well as photovoltaics.

3.6 Lithium

There are currently 12 million passenger electric vehicles on the road, representing 1% of the global fleet. This will rise to 54 million by 2025. Other road transport segments are already much further along on electric vehicle adoption. Some 44% of global two-and three-wheeler sales annually and 25% of the existing fleet are already electric. China accounts for the bulk of two-wheeler electrification, but sales are growing rapidly in other markets like Taiwan, Vietnam and India.[59] **Almost all the electric vehicles currently on the road use lithium.** Due to this growth, demand for high-purity battery-grade lithium chemicals is seen to reach nearly 700,000 metric tons LCE by 2025 and 1.6 million metric tons LCE by 2030.

The market is currently in a deficit; hence we have recorded significant lithium investments in Africa from other countries. Last year, Ganfeng Lithium Co, one of the world's biggest lithium producers, paid US$130 million[60] for a stake in the Goulamina hard-rock mine in Mali in exchange for at least half of its first-phase output. Australia's AVZ Minerals made a US$17.9 million (A$25m) investment to support early works and exploration drilling at the Manono Lithium Project in the Democratic Republic of the Congo (DRC). In early 2022, Chinese company Zhejiang Huayou acquired controlling rights to Zimbabwe's Arcadia Lithium Mine in a US$422 million deal.

3.6.1 Ghana's current state

The Ewoyaa mine[61] had an initial JORC-compliant mineral resource estimate of 14.5 million tonnes (Mt) at 1.31% Li_2O in the inferred and indicated category. **IronRidge Resources, now Atlantic Lithium, recently increased the lithium resource by nearly 50% to 21.3 Mt at 1.31% Li_2O.** This latest assessment does not include some 28,000 metres of infill and extensional drilling, according to regulatory filings. This means the resource estimate is highly likely to be much bigger than anticipated. The company has signed a conditional binding agreement with Piedmont Lithium to fund the Ghana-based Ewoyaa lithium project fully. Piedmont will fund the project's total estimated CAPEX spend of only US$70m. **In addition, it has signed an offtake agreement for 50% of the spodumene concentrate[62]** produced from the Ewoyaa mine during its operational life. **Piedmont has an offtake**

[58] Ghana in catch 22 situation: Atuabo sits on prime silica deposit: https://www.ghanaweb.com/GhanaHomePage/business/Ghana-in-catch-22-situation-Atuabo-sits-on-prime-silica-deposit-425918

[59] https://bnef.turtl.co/story/evo-2021

[60] https://www.reuters.com/article/ganfeng-lithium-mali-mine-idCNL2N2NW0MR

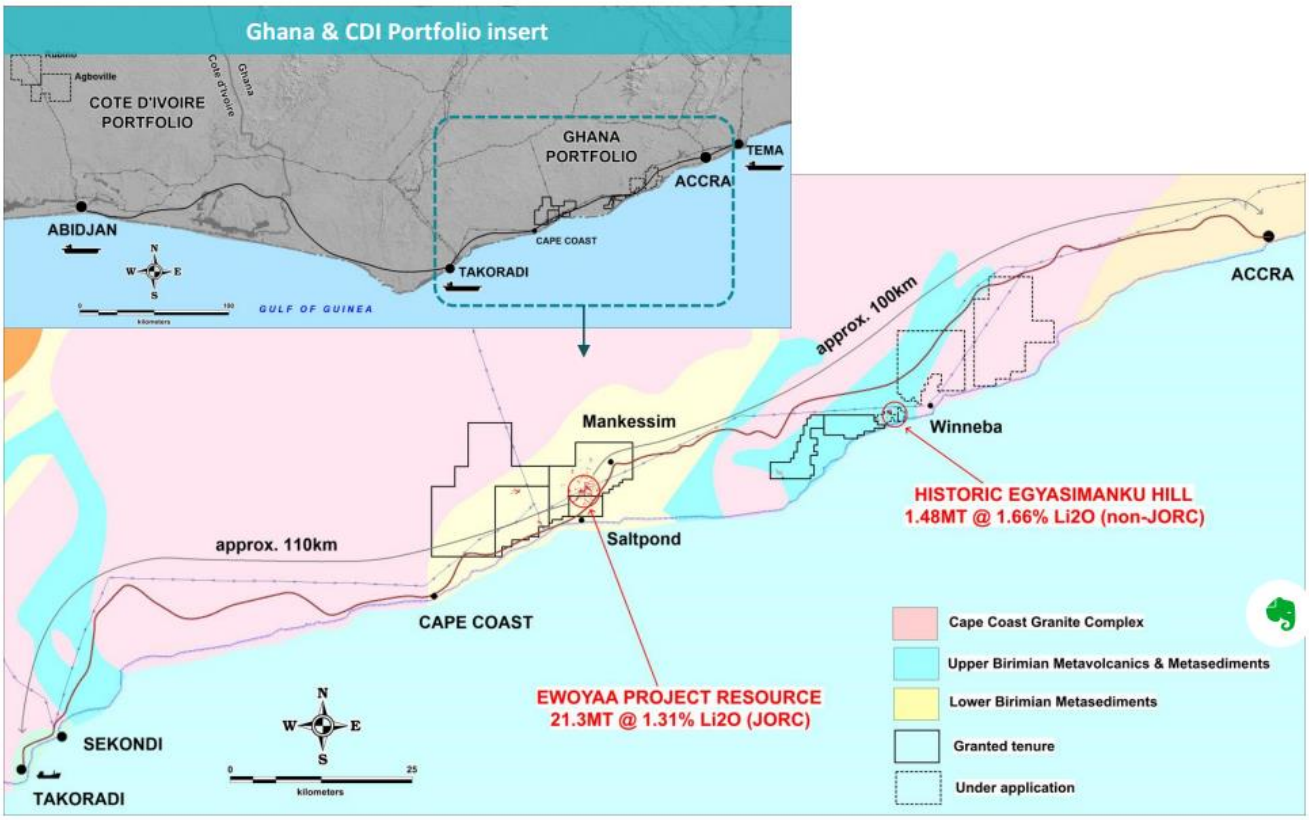
[61] Atlantic Lithium Limited (2022). https://www.atlanticlithium.com.au/projects-1-1

[62] Dessemond, C., Lajoie-Leroux, F., Soucy, G., Laroche, N., & Magnan, J. F. (2019). Spodumene: The lithium market, resources and processes. *Minerals*, *9*(6), 334.
Bibienne, T., Magnan, J. F., Rupp, A., & Laroche, N. (2020). From mine to mind and mobiles: Society's increasing

agreement with global electric vehicle company Tesla to supply finished lithium products used in the production of batteries. Ewoyaa has high-grade mineralisation – Atlantic Lithium reports that *"due to the coarse nature of the spodumene dominant mineralisation, metallurgical test-work to date has consistently delivered high-purity, low contaminants >6% Li2O spodumene concentrate …boding well for low capital, operating and carbon intensities"*.

Direct export of raw materials in the form of concentrates or intermediary products is not economically beneficial to countries in the long term. Instead, countries can retain more value locally by investing in manufacturing facilities that refine these raw materials into semi-finished or finished products. Finished lithium products like lithium carbonate and lithium hydroxides used in batteries can provide an enormous opportunity to the country. In Ghana's case, the discovered lithium resources are close to major transport infrastructure (Figure 15). According to Atlantic Lithium, *"the mineral resource is exceptionally well located, being only 1 km from the sealed national highway [Accra-Cape Coast Road] and 110 km from the deep-sea port of Takoradi with adjacent grid power; it is challenging to find other lithium pegmatite projects better located"*.

Figure 15 Ewoyaa project location in Central Region, Ghana



Source: Atlantic Petroleum Limited (2022)

3.6.2 Harnessing Ghana's potential

Electric vehicles represent a US$7 trillion market opportunity between today and 2030 and US$46 trillion between today and 2050. Therefore, Ghana should give serious consideration to how they can create economic value-add and domestic jobs from this growth.

dependence on lithium. *Elements: An International Magazine of Mineralogy, Geochemistry, and Petrology*, *16*(4), 265-270.

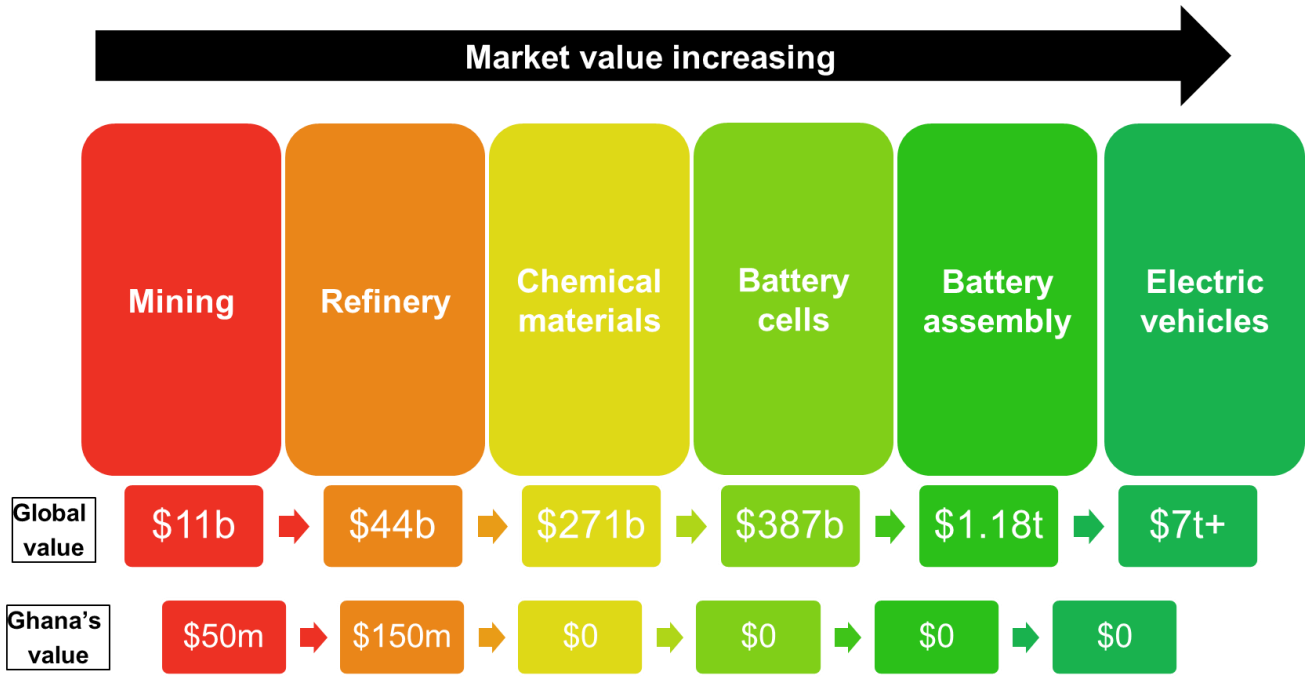
Two-and three-wheeler sales are growing rapidly in markets such as India and Vietnam. Increasing population, GDP per capita, and urbanisation in emerging markets help drive two-and three-wheeler[63] sales up from 88 million in 2020 to 114 million in 2040 in the long-term outlook. **Two-and three-wheeler electrification is a big opportunity for African markets as it has been over the last decade in Asia. However, less than 0.1% of vehicles sold in the last five years in Africa are electric. This low demand hinders growth in downstream sectors such as cell manufacturing. South Africa, Egypt, Morocco and Ghana have all implemented automotive policies to attract investments into their auto sectors.** As a result, the following companies have established assembly plants in Ghana: Nissan and Volkswagen.

Ghana is an emerging automotive destination. As a new entrant, the country can work with automakers to build forward-facing assembly lines which prioritise new technologies such as electric vehicles. Leveraging the country's lithium and resources from other African countries, the government can formulate policies that attract and retain downstream manufacturing capacity in-country. Policymakers can begin with electric vehicle focused special exclusive zones, good policy action plans, investment in skills upgrades and transport and port infrastructure to make Ghana a competitive destination for the global automotive industry.

3.7 Ghana's resources vis-à-vis other regional players

The electric vehicle industry will be worth more than US$7 trillion by 2035. Ghana can capitalise on this emerging sector to retain significant value domestically. Below, we detail the market value of the value chain by 2035 relative to Ghana's share (Figure 16).

Figure 16: Market value of the electric vehicle industry by 2035 as a share of Ghana's value



Source: Author's construct and data from Bloomberg

Globally, countries such as Australia have formulated and implemented strategies to ensure they retain as much value from the supply chain domestically to improve the economic benefits, ensure supply chain security and provide local jobs[64]. The United States is implementing its ***"Securing a Made in America Supply***

[63] https://reglobal.co/advantage-africa-low-cost-of-producing-lithium-ion-battery-precursors-in-the-drc
[64] https://www.industry.gov.au/news-media/critical-minerals-facilitation-office-news/national-roadmap-for-critical-minerals-development

Chain for Critical Minerals" policy. Finland is implementing its National Battery Strategy, which has already started bearing fruits. Australia is at the early stages of its Future Battery Industry Strategy. In Africa, South Africa has enforced its National Hydrogen Society Roadmap with the private sector and the roadmap to domestic electric vehicle production.

For Ghana to harness its full potential in the energy transition, it must actively work on improving its three main resources: natural, capital, and human resources. Moving up the value chain will result in fierce competition from other resource-rich African countries like Morocco, South Africa and the DRC.

Table 1 highlights Ghana's key competitive advantages and weaknesses and benchmarks them with other countries in Africa.

Table 1 Ghana's key competitive advantages (green) and weaknesses (red)

Theme	Ghana	Morocco	South Africa	DRC
Natural resource	The country is endowed with aluminium, iron, bauxite and lithium. However, the country's limited infrastructure makes the cost of developing these resources difficult compared to other countries despite the quality grades.	It has cobalt and phosphate in commercial quantities. Both are needed in batteries; it also has silver in abundance. The country has relatively good infrastructure with a simplified structure for developing mineral projects.	South Africa has nickel, cobalt, manganese, iron, and platinum groups metals and copper. Higher cost of mining as well as frequent labour disruptions has resulted in declining development of new mining projects	The country mines copper and cobalt. It has marginal manganese production as well as lithium deposit under development. poor infrastructure and the high cost of doing business hinder the development of deposits
Capital resource	The Ghana Stock Exchange has a market cap of about US$9 billion with very stringent listing policies, which discourages new entrants in mining or manufacturing from raising capital with ease. The country also has a high cost of borrowing due to the high-interest rates. Hence the only source of capital for a large project is through government support or funding from the balance sheet of an incumbent. This starves emerging businesses of capital and discourages diversification.	The Casablanca Stock Exchange has a market cap of about US$71 billion with flexible listing rules for companies raising capital for strategic businesses. Casablanca is a major global financial hub with diverse capital raising options. This makes it easy for new entrants to access finance or for existing businesses to expand capacity. Its proximity to Europe also serves as a gateway to tap into the continent's vast financial markets as well	The Johannesburg Stock Exchange dominates the African market. It has a market capitalization of US$1.2 trillion. The financial sector in the country is very mature and sophisticated, creating fundraising opportunities for both new industrial entrants and incumbents seeking to expand. The Industrial Development Corporation is a development finance institution mandated to provide investment support to high-risk sectors with economic importance.	The DRC has no domestic stock exchange limiting the ability of local companies to raise big capital through equity. This leaves the private sector with leverage from banks as the main source of capital to invest in new areas and projects. Interest rates are very high in the country as well as patchy financial regulations and enforcement agencies. Most major manufacturing projects in the country are either funded by the government, development banks or balance sheets of major companies
Human resource	Ghana has several engineering-oriented tertiary institutions. They provide the talent base for manufacturing activities. Large-scale mining operation has been in existence in Ghana for 100 years leading to a highly-skilled workforce. The country, however, lacks the requisite skillset for	Morocco has a relatively stable manufacturing base with a highly skilled workforce. Its tertiary institutions are also engineering oriented. The country is a pioneer in PV solar and hence has developed technical capabilities over the last decade.	South Africa has a very mature power and grid system with a highly skilled workforce. It has reputable mining research and innovation institutions credited with breakthrough technologies in research extraction. The government	The DRC has one of the lowest R&D spendings per capita. The country has a weak domestic manufacturing base with materials exported in their raw form and finished products imported. However, the country's research institutions have been

	clean technologies like solar, batteries and wind		has invested in training the workforce for the future of energy	improving their research output and quality over the last decade.

Source: Author's construct

3.8 Summary

Africa has an abundance of the critical mineral resources needed for the energy transition. These mineral resources can be found in abundance in Zambia, the Democratic Republic of Congo (DRC), South Africa, and Ghana, among others. Ghana has five of these critical minerals in varying abundance. However, some of their commerciality is yet to be proven: manganese, bauxite/aluminium, iron ore, silica sand, and lithium (new one).

Regarding bauxite, Ghana's bauxite reserves are estimated at 900 million tons, with the potential to produce 10 million to 20 million tons a year of mostly high alumina and low silica bauxite ore. The Government of Ghana has identified the creation and development of an Integrated Aluminium Industry in Ghana as one of the major pillars for transforming the Ghanaian economy. Retaining the full value-chain of the aluminium industry in-country will create enormous value for Ghana and increase the country's drive toward industrialisation. The secondary impact on the domestic supply chain will include ancillary services such as equipment support, uniforms and plant services. This will push the country's industrialisation for low-value and high-value products.

Ghana also has significant manganese reserves and has been producing since 1916. There are significant occurrences in the Dixcove area, South Bole District in Northern Ghana, Axim Salman area and Wa. All these could be further studied, and the orebody well defined to attract the much-needed exploration and development investment. Production in recent times from the existing mine at Nsuta in the Western Region has since dropped in recent years due to railway capacity constraints, among other factors. The medium-grade Nsuta deposit is one of the high-quality blends suitable for electrolytic manganese metals used in stainless steel and manganese dioxide battery raw materials. Ghana can move further down the value chain by building an EMD facility in-country to reduce the global reliance of this material on South Africa and China. Europe's fast-growing battery market could be a potential market.

Ghana currently has known iron ore deposits in Shieni in the Northern Region when it comes to iron ore. Opon Mansi in the Western Region is also an area with potential iron ore deposits. The Southwest region of Ghana has manganese, silica, limestone and charcoal. These are all important raw materials required for the production of steel. Coupling this with the region's railway infrastructure and port could make Ghana a cost-competitive steel manufacturer meeting African domestic demand.

Regarding silica, Ghana has not conducted a technical geological study on its sand silica potential that is publicly available. Nonetheless, some other estimates indicate that Ghana has good quality silica sands. However, it currently lacks a policy, defined geological data and investment drive to attract capital to develop this resource. Therefore, there is a need for a geological study which includes a market scope and the feasibility of developing the deposits. This will go a long way to enhance the country's mineral fortunes.

Furthermore, with lithium, IronRidge Resources (now Atlantic Lithium) recently increased the lithium resource estimate of its flagship high-purity, low contaminants Ewoyaa discovery in the Central Region by nearly 50% to 21.3 Mt at 1.31% Li2O. It is reported that the company has signed an offtake agreement for 50% of the spodumene concentrate produced from the Ewoyaa mine during its operational life with global electric vehicle company Tesla. Electric vehicles represent a US$7 trillion market opportunity between today and 2030 and US$46 trillion between today and 2050. Ghana should give serious consideration to how they can create economic value-add and domestic jobs from this growth. South Africa, Egypt, Morocco and Ghana have all implemented automotive policies to attract investments into their auto sectors. Ghana is an emerging automotive destination. As a new entrant, Ghana can work with automakers to build forward-facing assembly lines which prioritise new technologies such as electric vehicles. In addition, leveraging the country's lithium and resources from other African countries, the government can formulate policies that attract and retain downstream manufacturing capacity in-country.

Overall, Ghana can leverage its industrial raw materials to become a major hub for Africa and Europe in the energy transition.

4 Ghana: Legal and regulatory regime for mining and critical minerals

This section covers the following themes:

- Review and discussion of existing fiscal and legal regime guiding the mining sub-sector with particular emphasis on critical minerals
- Review and discuss how emerging fiscal and legal regime reflect recent and future developments in the mining sector in other jurisdictions in light of the energy transition.

4.1 Mining governance in Ghana's Fourth Republic

Figure 17 shows the principal legislative and regulatory instruments governing Ghana's mining industry. These include, among others, the Minerals and Mining Act, 2006 (Act 703), as amended by the Minerals and Mining (Amendment) Act, 2015 (Act 900) and the Minerals and Mining (Amendment) Act, 2019 (Act 995). Other substantive enactments include the Minerals Commission Act, 1993 (Act 450), Minerals Development Fund Act, 2016 (Act 912), Minerals Income Investment Fund Act 2018 (Act 978), and the Kimberley Process Certificate Act, 2003 (Act 652).

Figure 17 Principal legislation and policies governing Ghana's mining industry

Key Acts	Key Regulations	National policies with relevance to critical minerals in Ghana
1.Minerals and Mining Act, 2006 (Act 703), as amended by the Minerals and Mining (Amendment) Act, 2015 (Act 900), the Minerals and Mining (Amendment) Act, 2019 (Act 995) 2.Minerals Commission Act, 1993 (Act 450) 3.Other substantive enactments o Minerals Development Fund Act, 2016 (Act 912) o Minerals Income Investment Fund Act 2018 (Act 978) o Kimberley Process Certificate Act, 2003 (Act 652)	1.Minerals and Mining (General) Regulations, 2012 (L.I 2173) 2.Minerals and Mining (Support Services) Regulations, 2012 (L.I 2174) 3.Minerals and Mining (Compensation and Resettlement) Regulations, 2012 (L.I 2175) 4.Minerals and Mining (Licensing) Regulations, 2012 (L.I 2176) 5.Minerals and Mining (Explosives) Regulations, 2012 (L.I 2177) 6.Minerals and Mining (Health, Safety and Technical) Regulations, 2012 7.Minerals and Mining (Mineral Operations Tracking of Earth Moving and Mining Equipment) Regulations, 2020 (L.I. 2404) 8.Minerals and Mining (Ground Rent) Regulations, 2018 (L.I 2357) 9.Minerals and Mining (Local Content and Local Participation) Regulations, 2020 (L.I. 2431)	1.Minerals and Mining policy 2.National Environmental Policy 3.National Land Policy 4.National Water Policy 5.National Climate Change Policy 6.Ghana's intended nationally determined contribution (INDC) 7.National Budget Statements 8.Coordinated Programme of Economic and Social Development Policies (CPESDP), 2017-2024

The prevailing legal and regulatory instruments underpinning Ghana's mining industry are premised on Article 257(6) of the 1992 Fourth Republican Constitution, which states that *"every mineral in its natural state found in Ghana is the property of the Republic of Ghana and is vested in the President for and on behalf of the people"*. The preceding constitutional provision makes it imperative that all minerals, including critical minerals such as lithium and silica sand, are vested in the President in trust for the citizens of Ghana. This constitutional provision mandates licensing to be done by the Executive via the sector minister, for and on behalf of the President. Article 268(1) requires ratification of all natural resource agreements unless exempted by Parliament under Article 268(2). Also, Article 269(1) mandates the formation of natural resource commissions for the regulation, management and utilisation of natural resources and the coordination of policies thereto. Under the aegis of this provision, the Minerals Commission, the regulator, was formed.

Ghana's Minerals Commission is primarily responsible for developing and coordinating mineral sector policies and monitoring their implementation thereof.[65] The Commission began operating in September 1984 but was reconstituted in 1993 under the *Minerals Commission Act, 1993 (Act 450)*, thus giving it legal backing as required by Article 269(1) of the Constitution. Before its establishment, two government agencies, namely the Aluminium Industries Commission (AIC) for Bauxite and the Integrated Iron and Steel Commission (IISC) for iron ore, had responsibility for promoting the development of industries around specific industries minerals in Ghana. However, responsibility for regulating and managing all aspects of the mining value chain in Ghana reverted to the Minerals Commission following its creation. During the early post-independence days, mining governance was under the aegis of the Minerals Act 1962 (Act 126). On the other hand, it depended on various concession agreements signed between local chiefs and European mining concerns during colonial times, often with 'expansive terms'.[66]

The 25-plus years status quo of the Minerals Commission being the single body organisation responsible for developing and coordinating all mineral sector policy and monitoring its implementation saw a new turn in 2018. **The new government of the New Patriotic Party (NPP) in 2018 and 2019 created two new vehicles to give a dedicated focus back to two other minerals: bauxite and iron ore. In this regard, the government passed the following laws to create two new vehicles, similar to what pertained in the 1970s and early 1980s:**

- ***The Ghana Integrated Iron and Steel Development Act 2019 (Act 988)*** - to develop and promote an Integrated Iron and Steel Industry.
- ***The Ghana Integrated Aluminium Development Corporation (GIADEC) Act, 2018 (Act 976)*** - to promote and develop a globally competitive integrated aluminium industry in Ghana

The state institutions involved in regulating and partaking in mining activities and influence dynamics around mining management are shown in **Figures 18-19** and discussed.

[65] https://www.mincom.gov.gh/organisation-profile/

[66] Adomako-Kwakye, C., & Mensah, R. O. (2022) Too Much, Too Little: The Dilemma of Ghana's Legal Regime for Investment in the Mining Sector. https://article.sciencepublishinggroup.com/pdf/10.11648.j.ijls.20220501.24.pdf

Figure 18 State institutions involved in mining management

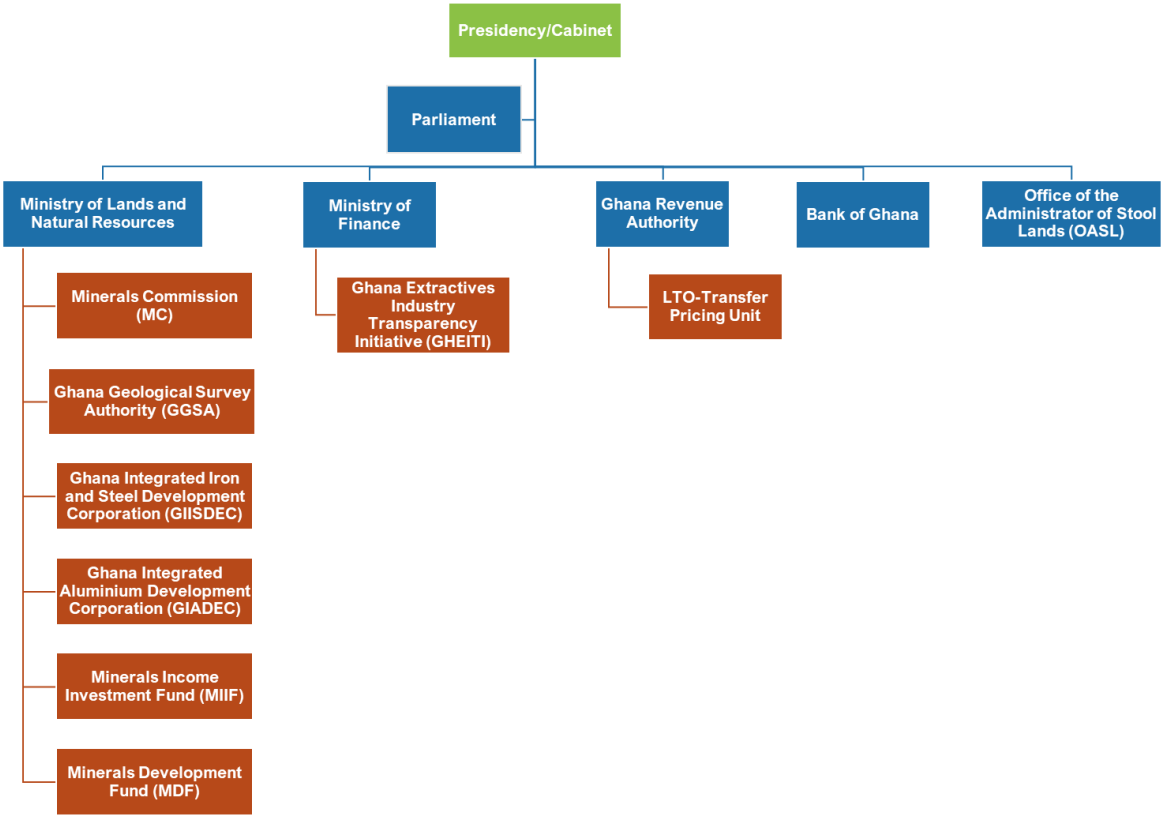
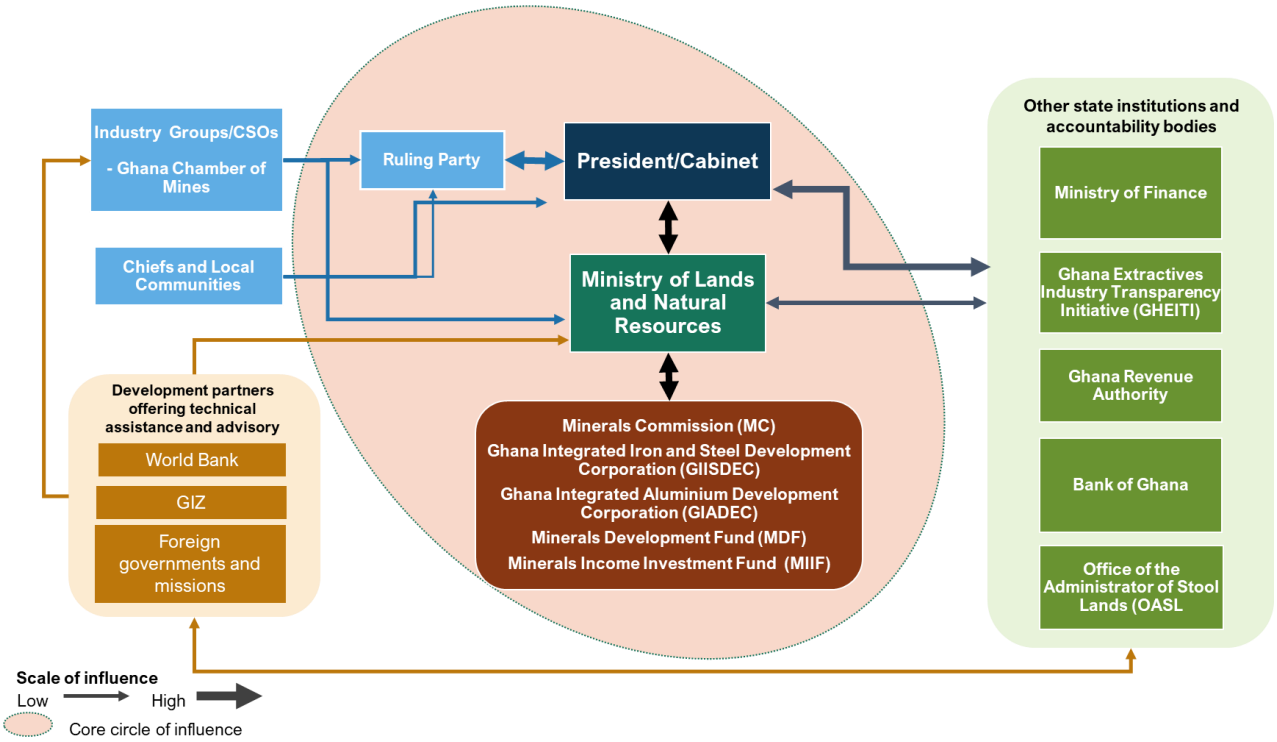


Figure 19 Influence dynamics around mining management



Source: Authors' construct

- **Presidency/Cabinet:** Ghana runs an Executive Presidency under the country's 1992 Constitution. Executive power is vested in the president, who is head of both state and government and Commander-in-Chief of the armed forces. The president runs the nation with the support of a Cabinet, which consists of the president, vice-president, and ministers appointed by the president with prior parliamentary approval. The presidency sets the industry's general policy direction within the mining sector, including minerals revenue management issues. The political party manifesto is often the cardinal instrument within which these policies are framed and implemented. Pressure is often exerted on the Presidency by various external and internal interest groups such as the ruling party, chiefs and local communities, civic organisations, and development partners and donors, as Figure 19 shows.

- **Parliament:** Parliament has responsibility under the Minerals and Mining Act, 2006 [Act 703] to ratify any transaction contract or undertaking involving the grant of a right or concession by or on behalf of a person or body of persons for the exploitation of a mineral in Ghana.[67] In this regard, all mineral agreements must be ratified by the House to have legal validity. This also includes ratification of Stability Agreements entered into by the Minister of Lands and Natural Resources covering issues such as fixing the level of and payment of royalties, taxes, fees and other fiscal imports, and capital controls.[68]

- **Ministry of Lands and Natural Resources:** This is the principal government ministry responsible for ensuring "the sustainable management and utilisation of Ghana's lands, forests and wildlife resources as well as the efficient management of the mineral resources for socio-economic growth and development".[69] As can be observed, the ministry's remit is broad in covering not only all aspects of natural resources in the country but these must be used to drive inclusive growth and development. Under the Minerals and Mining Act, 2006 [Act 703], the minister has a broad remit to, among others: (1) reserve land from mining, (2) grant, negotiate and revoke mineral rights to companies on behalf of the President and the recommendation of the Minerals Commission, and (3) exercise the right of pre-emption on all minerals found in Ghana, among others.

- **Minerals Commission (MC):** The Minerals Commission is the main government agency entrusted with the primary responsibility of developing and coordinating mineral sector policies and monitoring their implementation. As highlighted in the beginning part of this section, the Commission was established in 1984 under the Minerals Commission Law (PNDCL154)[70] and subsequently in 1993 under the Minerals Commission Act, 1993 (Act 450) following the return the multiparty democracy and as required by Article 269(1) of the 1992 Fourth Republican Constitution. The Ministry also maintains the mining cadastre [mining repository][71]. In addition, it regularly publishes key industry statistics[72] and other publications, including development and investment agreements[73] reached between Ghana and the various mining companies.

- **Ghana Integrated Aluminium Development Corporation (GIADEC)**: In 2018, Ghana set up GIADEC by Ghana Integrated Aluminium Development Corporation Act, 2018 (Act 976) to provide a singular focus on promoting and developing a globally competitive integrated aluminium industry in Ghana. GIADEC is a holding company for all of the State's investments and interests in the integrated aluminium industry. These investments and interests include the Volta Aluminium Company Limited (VALCO) and the Ghana Bauxite Company as well as the mining rights to Ghana's bauxite reserves.[74] In addition, as part of its strategic acquisitions across the entire bauxite and aluminium value chain, GIADEC seeks to hold a minimum 30% stake in any new mine, refinery or smelter.[75]

[67] Section 5(4) of Act 703 (as amended)
[68] Section 48(b) of Act 703 (as amended)
[69] https://mlnr.gov.gh/index.php/the-ministry/
[70] https://www.mincom.gov.gh/organisation-profile/
[71] https://miningrepository.mincom.gov.gh/map
[72] https://www.mincom.gov.gh/industry-statistics/
[73] https://www.mincom.gov.gh/development-and-investment-agreement/
[74] See Section 3.1.1 for a discussion of Ghana's bauxite reserves
[75] https://www.giadec.com/who-we-are/company-profile/

- **Ghana Integrated Iron and Steel Development Corporation (GIISDEC):** GIISDEC was established in 2019 by the Ghana Integrated Iron and Steel Development Act 2019 (Act 988) to develop and promote Ghana's integrated iron and steel industry. GIISDEC seeks to accelerate the promotion and development of an iron and steel industry in Ghana by building operating capability to manage a portfolio of producing iron ore mines (especially the Opon-Mansi and Sheini mines) and related value chain infrastructure.[76] This will be done in partnership with other investors.
- **Ghana Geological Survey Authority (GGSA):** The erstwhile Geological Survey Department, established in 1962, was upgraded to an Authority in 2016 under the Ghana Geological Survey Authority Act 2016 (Act 928). Its mandate is to "advise, promote and research on geoscientific issues concerning mineral resources, groundwater, environment, geo-hazards and land use planning to support sustainable economic development in Ghana".[77] In this regard, the GGSA undertakes active mapping [and sometimes exploration/prospecting] of all of Ghana's virgin areas to identify various rock types and possible economic mineral potentials.[78] This includes non-traditional base metals, coltan and other industrial minerals.
- **Minerals Income Investment Fund (MIIF):** MIIF was established by the Minerals Development Fund Act, 2016 (Act 912) to (1) manage Ghana's equity interests in mining companies, (2) to receive mineral royalties and other related income due to the State from mining operations, (3) to provide for the management and investment of the assets of the Fund and for related matters. Since its establishment, MIIF has sought to significantly increase the nation's returns from its interests in various mining leases through additional acquisitions and investments[79] in mines as well as seeking to collateralise the country's gold mineral royalties. The latter has proven to be controversial[80] despite the finance ministry saying it is the best deal[81] for Ghana's gold. MIIF seeks to become the biggest minerals fund in Africa.[82]
- **Minerals Development Fund (MDF):** The MDF was established by the Minerals Development Fund Act, 2016 (Act 912) to provide direct financial resources for the benefit of mining communities, traditional and local governments within mining communities, and institutions responsible for developing the mining industry in Ghana.[83] The primary source of funding for the MDF is the allocation of 20% of mineral royalties from mining leases. The Fund is overseen by an eleven (11) member Board with various institutional representations, including the Ministry of Finance, Ministry of Environment, Ministry of Local Government, Minerals Commission, Ghana Chamber of Mines, and National House of Chiefs, among others.[84]
- **Ministry of Finance:** The Ministry of Finance ensures effective and efficient macroeconomic and financial management of Ghana's economy.[85] Within the context of mining and Act 703 (as amended), the finance ministry is responsible for collaborating with the Bank of Ghana and the Minister of Lands and Natural

[76] https://giisdec.com/profile/
[77] https://mlnr.gov.gh/index.php/geological-survey-department/
[78] ibid
[79] *Build A World Class Minerals Industry-Finance Minister Charges New MIIF Board | Ministry of Finance | Ghana* (2022). Available at: https://mofep.gov.gh/news-and-events/2021-10-14/build-a-world-class-minerals-industry-finance-minister-charges-new-miif-board; Ghana's Minerals Income Investment Fund to Invest $60 million in 2022 - https://www.mining-turkey.com/ghanas-minerals-income-investment-fund-to-invest-60-million-in-2022
[80] *Agyapa deal: Ghana could be short-changed – Lord Mensah | 3NEWS* (2020). Available at: https://3news.com/agyapa-deal-ghana-could-be-short-changed-lord-mensah; NRGI Impact: Demystifying Ghana's Agyapa Royalties Deal: https://resourcegovernance.org/analysis-tools/publications/nrgi-impact-demystifying-ghana-agyapa-royalties-deal-gold; *Ghana: What is going on with the controversial Agyapa gold royalties…* (2022). Available at: https://www.transparency.org/en/blog/ghana-what-is-going-on-with-the-controversial-agyapa-gold-royalties-deal
[81] *Agyapa Royalties best deal for Ghana's Gold – Ken Ofori-Atta | Ministry of Finance | Ghana* (2022). Available at: https://mofep.gov.gh/news-and-events/2020-08-29/agyapa-royalties-best-deal-for-ghana%E2%80%99s-gold-ken-ofori-atta
[82] *Minerals Income and Investment Fund to raise $500m worth of assets in 3 years - CEO - MyJoyOnline.com* (2022). Available at: https://www.myjoyonline.com/minerals-income-and-investment-fund-to-raise-500m-worth-of-assets-in-3-years-ceo
[83] Section 2 of Act 912
[84] Section 6 of Act 912
[85] https://mofep.gov.gh/about-mof

Resources to ensure that miners can open foreign exchange accounts in Ghana and freely repatriate their profits.[86]

- **Bank of Ghana:** The Central Bank is primarily responsible for coordinating monetary policy in Ghana. In the mining industry context, the Bank of Ghana helps miners set up foreign exchange accounts to retain a portion of their earnings and support miners' free transferability of convertible currency.[87]
- **Ghana Extractives Industry Transparency Initiative (GHEITI):** In 2003, Ghana signed on to the Extractive Industry Transparency Initiative (EITI) protocols which seek to promote the open and accountable management of extractive resources. Following this, the country has enacted several required implementation structures, leading to the publication of fifteen (15) reports for mining and seven (7) reports for oil and gas. Ghana also became the first country to apply the EITI principles and criteria to mining as well as the first to disaggregate EITI data, and the first country to implement the EITI initiative at the sub-national level. This led to the country being declared EITI compliant in 2010 and 2016 following international validation. The 2016 international validation resulted in Ghana being proclaimed as a star performer in using EITI to influence policy reforms. Annual EITI reports capture revenue generations, transparency and accountability at both national and sub-national levels, and revenue management issues. The reports also capture other specific institutional challenges that impact both revenue generation and management and corporate practices of both state agencies and international companies that affect revenue mobilisation. The issues raised in the EITI reports are often used by the government, civil society, the media and mining companies as the basis for dialogue to enhance the transparency and accountability of all stakeholders involved in the mining value chain. GHEITI comprises a multistakeholder group of key government agencies and companies operating in the extractives industry. It is run by a Secretariat operating out of the Ministry of Finance.
- **Ghana Revenue Authority:** The Ghana Revenue Authority, established by law under the *Ghana Revenue Authority Act, 2009* (Act 791), acts as the State's fiscal agent responsible for assessing, collecting and accounting for mining revenues due to the State.
- **Office of the Administrator of Stool Lands (OASL):** The OASL is a creature of the 1992 constitution, deriving its mandate under Article 267(2) and the Office of the Administrator of Stool Lands Act 1994, (Act 481).[88] It exists to enhance stool land revenue mobilisation and disbursement and facilitate sustainable development and efficient management of stool lands for intergenerational equity — that is, the benefit of present and future generations.

We now focus our attention on reviewing the existing fiscal, legal, and regulatory regime guiding the mining sub-sector in Ghana, emphasising critical minerals.

4.2 Review of existing fiscal, legal and regulatory regime in the mining sector with particular emphasis on critical minerals

4.2.1 National policies with relevance to critical minerals in Ghana

While most of the various policies enacted by the government do not specifically mention critical minerals, they reference the components needed to develop a viable critical minerals value chain and employment generating opportunities. The starting policy anchor is Ghana's 2014 minerals and mining policy[89], which consolidates various scattered policies in the mining sector. Some of the principal objectives of the country's minerals and mining policy relevant to developing critical minerals are highlighted in Box 1. Attaining these objectives requires a delicate balance between safeguarding the interests of the State and the investor community, be it the State providing an enabling environment for investors (based upon modern regulatory arrangements and attractive terms) while also seeking to optimise the tax returns and create other value chain linkages. As indicated

[86] Section 30(2) of Act 703 (as amended)
[87] Section 30(1) of Act 703 (as amended)
[88] https://oasl.gov.gh/
[89] https://www.mincom.gov.gh/wp-content/uploads/2021/06/Mineral-and-Mining-Policy-Ghana.pdf

earlier in Section 3, Ghana already has a varying abundance of five of the critical minerals needed for the energy transition. In some instances, it has been producing some of them (manganese and bauxite/aluminium) for several decades now. For others, their commerciality is yet to be proven. The new ones that the country seeks to leverage are iron ore, silica sand and lithium.

Box 1 – Objectives of Ghana's mining and mineral policy

(1) Diversify the country's mineral production base to promote a more sustainable support base for the economy.
(2) Promote linkages (backward, forward and sidestream) to minerals produced locally to the maximum extent possible.
(3) Generate adequate geoscientific data to promote investment.
(4) Generate detailed geological information in designated areas for demarcation to artisanal and small scale miners.
(5) Provide opportunities for artisanal and small scale miners to access financing to upscale their activities.
(6) Enhance the capacity of state institutions and strengthen inter-agency collaboration in the management and development of mineral resources.
(7) Optimize tax revenue generation and ensure transparent and equitable distribution of mineral wealth.
(8) Assist in the development of skilled human resource and develop local industrial capacity for the mineral industry.
(9) Contribute to infrastructure development in mining areas.
(10) Use mining as a catalyst for wider investment in the economy.
(11) Ensure high level of environmental stewardship in the exploitation and use of minerals.
(12) Promote social harmony between the mines and adjoining communities.
(13) Collaborate in the harmonisation of mineral policy in ECOWAS and in Africa.
(14) Adopt principles of the AU and the Intergovernmental Forum on Mining in promoting good governance and transparency in the extractive sector.
(15) Implement through the African Mineral Development Centre policies outlined in the African Mining Vision and the Mining Policy Framework.
(16) Access the African Development Bank's African Legal Support Facility and the Facility for Fair Exploitation of Extractive Resources in Africa.

Ghana needs to update its mining and minerals policy, given the role of critical minerals in the energy transition; it must also align this to a well-defined broader industrial development strategy and commitments to meeting climate targets as per the nationally determined contributions (NDCs). While there are attempts to capture more of the value chain opportunities by creating dedicated state companies such as GIADEC and GIISDEC, there is a need to align this with the country's broader industrial policy. Ghana's industrial policy[90] (last updated in 2010) states that the "*local sources of supplies of non-agro raw materials such as limestone, kaolin and salt have not been fully explored and exploited. Production and supply are therefore inadequate and unreliable"*. Policy prescriptions include: *"(1) government will encourage extensive exploitation of mineral deposits such as limestone, kaolin, iron ore, clay, salt, aluminium sulphate, oil and natural gas*, and *(2) government will provide incentives to attract investments into non-agro raw material sector"*.

What the industrial policy and the Industrial Sector Support Programme (ISSP)[91] — which is the means through which implementation of the industrial policy is actually effected — lacks is the "how" and also the extent to which it addresses fundamental structural bottlenecks for doing business in Ghana's mining sector. **Therefore, for Ghana to benefit from leveraging the critical minerals supply chain as one of its growth anchors, it needs to, among other things, systematically address the constraints to growth, namely[92]:**

[90] Ministry of Trade and Industry (2010). Ghana Industrial Policy. Available: https://www.moti.gov.gh/docs/Industrial%20Policy.pdf
[91] UNIDO (2013). The industrial policy process in Ghana. Available: https://www.unido.org/api/opentext/documents/download/9929467/unido-file-9929467; Ministry of Trade and Industry (2011). Industrial Sector Support Programme (ISSP) 2011-2015. Available: http://www.ghanaiandiaspora.com/wp/wp-content/uploads/2014/08/ISSP.pdf
[92] See Chapter 5 for more analysis of these factors.

1. **Provision of relatively cheaper and reliable electricity (especially for aluminium refining and smelting)**
2. **Development of rail, road and port infrastructure to evacuate products to market, and**
3. **Addressing governance risks, including environmental governance and lowering the carbon footprint of mining by reducing the emissions output of mines and processing facilities.**

Regarding the latter point, both manufacturing and mining are expected to contribute 68% and 27% of Ghana's forecast 8.5 MtCO2e of industrial emissions by 2030.[93] For manufacturing, this will be predominantly due to higher energy demand for the processing and refining of bauxite and iron integrated industries. Thus, emissions are likely to rise if production fails to use best-in-class environmental practices to reduce emissions (especially Scope 1 and 2 emissions) from the mines and value chain processing infrastructure.

Industrial policymaking in Ghana has been notably cyclical. The country experienced some limited success with import substitution industrialisation in the early post-independence years.[94] However, these were curtailed by the subsequent military coups of the mid-1960s to1980s. The structural adjustment programmes (SAPs) of the 1980s, which sought to liberalise the economy, did little to fundamentally change the industrial architecture of several economies, including Ghana. The evidence shows that Ghana's economy is still dominated by primary commodities extraction with little to show in export diversification or creating the necessary forward and backward linkages. UNCTADStats data shows that Ghana's export diversification has not improved that much (from 0.837 in 1995 to 0.813 in 2020.[95] The diversification index measures the extent to which the export structure by product differs from the world patterns — higher values indicate lower diversification. This indicates an increasing tendency towards export concentration in Ghana at sectoral and product levels. In other words, the portfolio of exports from Ghana is less diversified relative to other countries and regions such as South Africa, Kenya, India and South Korea. The reliance on mostly primary commodities means that the oft-touted higher GDP growth rates have barely translated into sustainable jobs ("jobless growth").

While the intended objectives of the national minerals and mining policy are noble, there is a lack of synergy between it and other major climate policy initiatives, such as Ghana's nationally determined contribution (NDC). In November 2021, Ghana submitted its Updated Nationally Determined Contribution under Article 4 of the Paris Agreement (2020 – 2030) to the United Nations Framework Convention on Climate Change (UNFCCC) with an enhanced NDC target.[96] The updated document covers 19 policy areas, translating into 47 adaptation and mitigation programmes of action aimed at reducing Ghana's greenhouse gas (GHG) emissions of 64 metric tons of carbon dioxide equivalent (MtCO2e) by 2030 (Figures 20 and 21). In Ghana, GHG emissions (including forestry and other land uses) have increased by 66.3%, from 25.34 MtCO2e in 1990 to 42.15 MtCO2e in 2016 (Table 2).[97] The rise in emissions is due to the increasing energy intensity of the growing economy and

[93] Ghana's Fourth National Communication to the United Nations Framework Convention on Climate Change. Available: https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/562873149_Ghana-NC4-2-Gh_NC4.pdf, at p.135

[94] Whitfield, L., & Buur, L. (2014). The politics of industrial policy: ruling elites and their alliances. *Third World Quarterly*, *35*(1), 126-144.;
Ackah, C., Adjasi, C., & Turkson, F. E. (2016). Industrial policy in Ghana: its evolution and impact. Oxford University Press.
Whitfield, L. (2018). Conclusion: Can Industrial Policy Work in Ghana? In *Economies after Colonialism: Ghana and the Struggle for Power* (pp. 309-328). Cambridge: Cambridge University Press.

[95] *Beyond 20/20 WDS - Table view* (2022). Available at: https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=120
TCdata360: Merchandise: Concentration and diversification indices of exports by country (2022). Available at: https://tcdata360.worldbank.org/indicators/conc.dvsct.idx.ex?country=GHA&indicator=3001&countries=BRA&viz=line_chart&years=1995,2020

[96] Ghana Updated Nationally Determined Contribution under the Paris Agreement (2020 - 2030). Available: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Ghana%20First/Ghana%27s%20Updated%20Nationally%20Determined%20Contribution%20to%20the%20UNFCCC_2021.pdf

[97] https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/562873149_Ghana-NC4-2-Gh_NC4.pdf, at p.xxv

resultant demand by industry, transportation and households.[98] Some other estimates indicate that 53% of Ghana's emissions came from the land-use change and forestry sector, while 25% came from energy use and another 15% from agriculture.[99]

In terms of financing, it is estimated that Ghana requires between US$9.3 and US$ 15.5 billion of investment to be able to implement all the 47 nationally determined contribution measures by 2030. The lower end of the cost estimate of US$9.3 billion **amounts to 12.81% of Ghana's 2020 GDP or US$926 million in annual investments** into both climate adaptation and mitigation projects. Of this amount, Ghana estimates that it requires US$3.9 billion to implement the 16 unconditional programmes and another US$5.4 billion for 31 conditional programmes, primarily sourced from public, international, and private sector sources and carbon markets.[100] Using the almost 1 million direct jobs that could potentially be created translates into US$9,319 funding per job created. Ghana would need to significantly attract funding despite these lofty projections as past climate financing inflows paint a different picture. For example, data from Ghana's Fourth National Communication to the UNFCCC (2020) indicates that **total climate-related financial inflows (excluding financing for the development of the gas industry) for the period 2011-2019 amounted to US$1.3 billion or US144 million per annum**.[101]

Juxtaposing the historical inflows against the projections leaves almost a deficit of US$781 million, indicating that Ghana will have triple its efforts to attract climate financing. Further compounding this is also the fact that most of the historical financing that Ghana has attracted primarily grants climate financing (72.1%) from bilateral channels and, to a smaller extent, loans (19.1%) and direct budget support (8.5%). Also, the data shows that the energy sector has been leading in the receipt of climate-funding inflows making up US$758.8 million (57.8%) of total funds committed.[102] However, given the availability of market-based instruments and financiers, it might be helpful to revise the NDCs to include other projects with value-adding potential, such as in the critical minerals supply chain.

Table 2 Trends in GHG emission by sectors in Ghana

IPCC Sectors/Categories	Total Emissions ($MtCO_2e$)					Change (%)			
	1990	2000	2010	2012	2016	1990-2016	2000-2016	2010-2016	2012-2016
National Emissions with FOLU	25.34	27.26	35.23	39.35	42.15	66.3	54.6	19.6	7.1
National Emissions without FOLU	11.32	14.53	22.5	26.39	29.28	158.7	101.5	30.1	10.9
Energy	3.73	5.96	10.11	13.07	15.02	302.7	152.0	48.6	14.9
Industrial Processes and Product Use	0.49	0.36	1.09	1.52	1.04	112.2	188.9	-4.6	-31.3
Agriculture, Forestry, and Other Land Use	20.10	19.47	21.49	22.05	22.92	14.0	17.7	6.7	4.0
Waste	1.02	1.48	2.53	2.71	3.17	210.8	114.2	25.3	17.0

Source: Environmental Protection Agency (2020; p.xxv)[103]

[98] Abokyi, E., Appiah-Konadu, P., Abokyi, F., & Oteng-Abayie, E. F. (2019). Industrial growth and emissions of CO2 in Ghana: The role of financial development and fossil fuel consumption. *Energy Reports*, *5*, 1339-1353. https://doi.org/10.1016/j.egyr.2019.09.002

[99] https://www.climatelinks.org/sites/default/files/asset/document/GHG%20Emissions%20Factsheet%20Ghana_6-17-16_edited_rev08-18-2016.pdf

[100] Ghana Updated Nationally Determined Contribution under the Paris Agreement (2020 - 2030). Available: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Ghana%20First/Ghana%27s%20Updated%20Nationally%20Determined%20Contribution%20to%20the%20UNFCCC_2021.pdf, at p.10

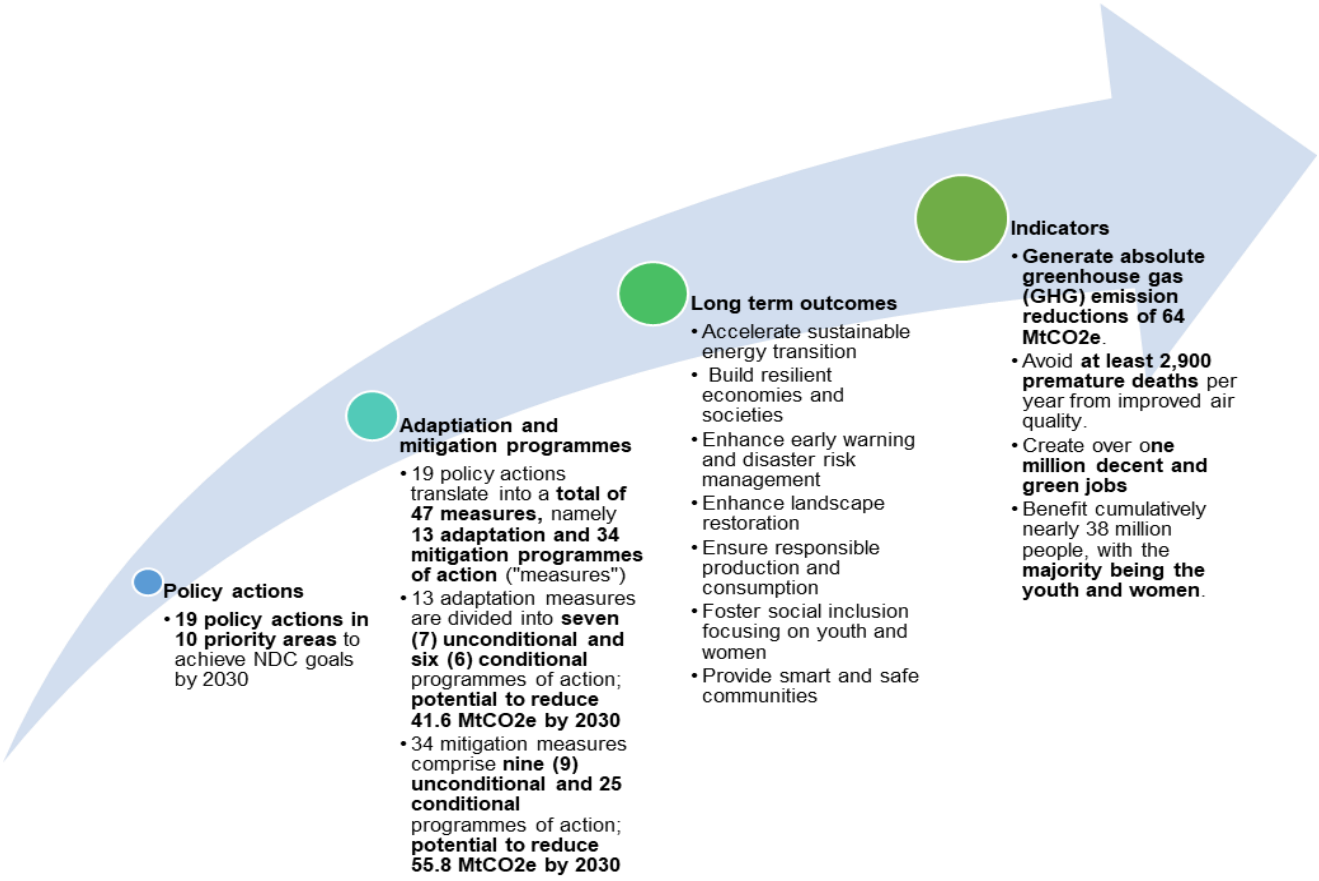
[101] Ghana's Fourth National Communication to the United Nations Framework Convention on Climate Change. Available: https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/562873149_Ghana-NC4-2-Gh_NC4.pdf, at p.305-306

[102] Ibid, at p.306

[103] Ghana's Fourth National Communication to the United Nations Framework Convention on Climate Change. Available: https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/562873149_Ghana-NC4-2-Gh_NC4.pdf

Ghana's updated NDCs, while useful, are generally more focused on attracting mitigation and adaptation funding for (1) scaling renewable energy penetration of the energy mix from the current less than 1% to 10% by 2030, (2) expansion of inter-and-intra-city transportation modes, and (3) building resilience and promote livelihood opportunities for the youth and women in climate-vulnerable agriculture landscapes and food systems (Table 3). A closer analysis of the NDCs and the 2020 National Climate Change Report shows several potential projects. However, **these are not linked systematically to the country's industrial policy and long term aspirations. In essence, there is a lack of synergy between the lofty ideals of the NDCs, "how" they will be financed/attained and importantly, how a country like Ghana can leverage the opportunities** therein to develop a new industrial base including in the critical minerals supply chain.

Figure 20 Summary of Ghana's updated nationally determined contributions (NDC)



Source: Author's construct based on Ghana's updated NDC

Figure 21 Ghana's number of proposed adaptation and mitigation programmes, 2020-2030

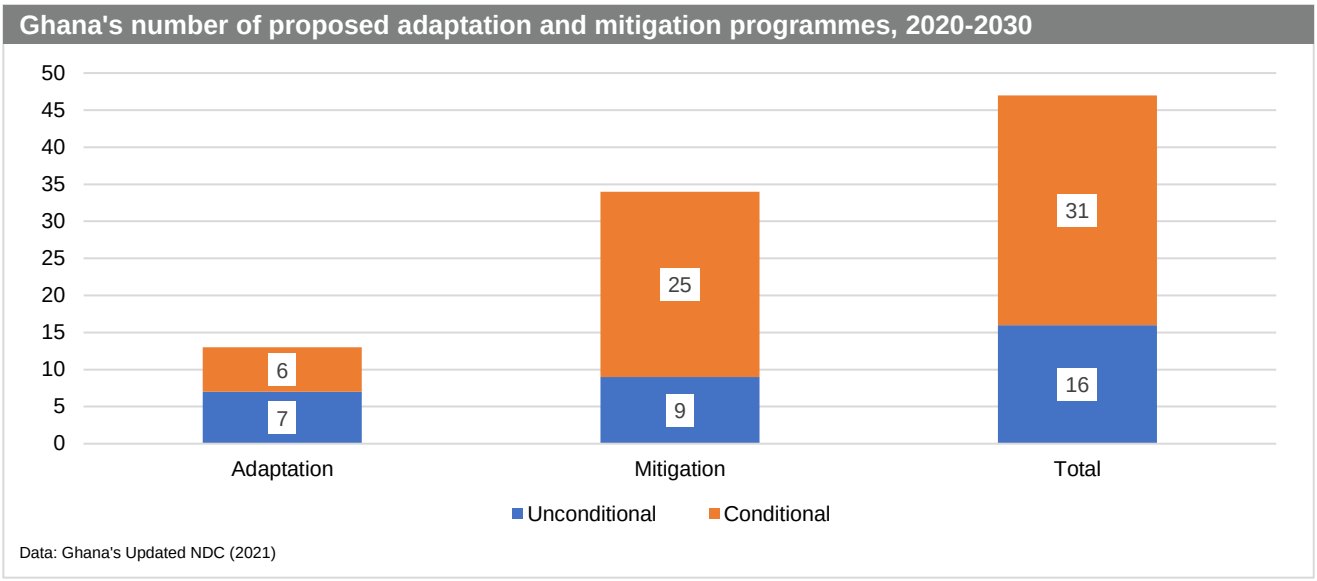


Table 3 Financing requirements of Ghana's NDCs

19 Policy Actions from 2020-2030	Area	Funding (US$ million)	Funding (%)
Scale-up renewable energy penetration by 10% by 2030	Mitigation	2,296.9	24.81%
Expansion of inter-and-intra-city transportation modes.	Mitigation	1,890.5	20.42%
Build resilience and promote livelihood opportunities for the youth and women in climate-vulnerable agriculture landscapes and food systems	Adaptation	1,855.0	20.03%
City-wide resilient infrastructure planning.	Adaptation	827.0	8.93%
Promotion of energy efficiency in homes, industry and commerce	Mitigation	786.9	8.50%
Promote gender-responsive sustainable forest management	Adaptation/Mitigation	392.5	4.24%
Expand the adoption of market based cleaner cooking solutions.	Mitigation	386.4	4.17%
Promote sustainable charcoal production, including youth and women entrepreneurs.	Mitigation	292.1	3.15%
Low carbon electricity generation	Mitigation	141.4	1.53%
Manage climate-induced and gender-related health risks.	Adaptation	117.0	1.26%
Integrated water resources management	Adaptation	108.0	1.17%
Adopt alternative urban solid waste management	Mitigation	60.4	0.65%
Promote clean rural households lighting.	Mitigation	35.7	0.39%
Decarbonisation of oil and gas production	Mitigation	31.5	0.34%
Early warning and disaster risk management.	Adaptation	15.0	0.16%
Enhance climate services for efficient weather information management.	Adaptation	10.0	0.11%
Sustainable production in Industry	Mitigation	7.4	0.08%
Refrigeration and Air Conditioning (RAC)	Mitigation	3.2	0.03%
Enhance climate resilience of women and the vulnerable.	Adaptation	2.2	0.02%
Total		**9,259.1**	**100.00%**

Source: Author's construct based on Ghana's Updated NDC (2021) submitted to the UNFCCC.

Tracking progress on the NDCs is a possible entry point for GHEITI MSG to consider reporting yearly progress and status. However, **we are unsure If GHEITI has the mandate to do so or whether it is well resourced financially and technically to track this data and report on it.**

4.2.2 Legal and regulatory regime

The current legal and regulatory regime for mining in Ghana is reasonably adequate to address the prevailing issues in the industry; the challenge is not one of the laws but enforcement, including environmental governance, especially with artisanal mining. Since 2006, Ghana has passed and amended a raft of laws and regulations to govern the mining industry. A review of the laws and regulations indicates that they are expansive and aligned with some of the best practices in the global mining industry. Rather, Ghana continues to suffer from an inability to enforce these laws and regulations rigorously.[104]

Key Acts

1. Minerals and Mining Act, 2006 (Act 703), as amended by the Minerals and Mining (Amendment) Act, 2015 (Act 900), the Minerals and Mining (Amendment) Act, 2019 (Act 995)
2. Minerals Commission Act, 1993 (Act 450)
3. Other substantive enactments
    - Kimberley Process Certificate Act, 2003 (Act 652)
    - Minerals Development Fund Act, 2016 (Act 912)
    - Minerals Income Investment Fund Act 2018 (Act 978)

Key Regulations

1. Minerals and Mining (General) Regulations, 2012 (L.I 2173)
2. Minerals and Mining (Support Services) Regulations, 2012 (L.I 2174)
3. Minerals and Mining (Compensation and Resettlement) Regulations, 2012 (L.I 2175)
4. Minerals and Mining (Licensing) Regulations, 2012 (L.I 2176)
5. Minerals and Mining (Explosives) Regulations, 2012 (L.I 2177)
6. Minerals and Mining (Health, Safety and Technical) Regulations, 2012
7. Minerals and Mining (Mineral Operations Tracking of Earth Moving and Mining Equipment) Regulations, 2020 (L.I. 2404)
8. Minerals and Mining (Ground Rent) Regulations, 2018 (L.I 2357)
9. Minerals and Mining (Local Content and Local Participation) Regulations, 2020 (L.I. 2431)

In the context of the critical minerals needed for the energy transition, most of the five minerals available in Ghana — manganese, bauxite/aluminium, iron ore, silica and lithium (new one) — are highly likely to be mined and processed by multinational miners together with State partners such as GIISDEC, GIADEC and MIIF. **Nonetheless, significant concerns have been raised about land compensation issues and the possible negative externalities (environmental impacts) of some extraction forms, particularly for bauxite and, to an extent, lithium**.

Environmental and land compensation regime for bauxite and lithium

Under the auspices of GIADEC, Ghana seeks to develop an integrated aluminium industry and supply chain. This is, in essence, a revamped attempt at completing Ghana's first President Kwame Nkrumah's vision of the Volta River Project (1959-1966). **Despite these plans to exploit mineral resources, most of Ghana's bauxite deposits lie within protected forest reserves, which raises environmental issues** (Figure 22)**.** For example, the Atewa forest range, which hosts the Kibi bauxite deposit, is a world-acclaimed biodiversity landmark boasting 1,100 plant species, 100 threatened or endangered species —such as the white-collared mangabay, a primate recently found in Atewa and one close to extinction—, and over 570 species of butterfly, the highest number in

[104]Appiah, D. O., & Osman, B. (2014). Environmental impact assessment: insights from mining communities in Ghana. *Journal of Environmental Assessment Policy and Management*, *16*(04), 1450031. https://doi.org/10.1142/S1464333214500318; Teschner, B. A. (2012). Small-scale mining in Ghana: The government and the galamsey. *Resources policy*, *37*(3), 308-314. https://doi.org/10.1016/j.resourpol.2012.02.001; Armah, F. A., Luginaah, I. N., Taabazuing, J., & Odoi, J. O. (2013). Artisanal gold mining and surface water pollution in Ghana: have the foreign invaders come to stay?. *Environmental justice*, *6*(3), 94-102. https://doi.org/10.1089/env.2013.0006; Domfeh, K. A. (2003). Compliance and enforcement in environmental management: a case of mining in Ghana. *Environmental Practice*, *5*(2), 154-165. https://doi.org/10.1017/S1466046603031107

West Africa.[105] Atewa also hosts the heads of major rivers such as the River Densu and Birim, which serve downstream communities in the Greater Accra and the Eastern Region as their primary source of drinking water. Various NGOs[106], environmental activists[107], and international advocacy groups[108] have urged the government to scrap its plans to mine bauxite from the Atewa Forest through a proposed US$2 billion Chinese resource-backed loan[109] and instead turn it into a National Park[110]. In 2018, Ghana signed a reported US$2 billion agreement with Chinese state-owned hydropower and construction company Sinohydro Corp. Under a Master Project Support Agreement (MPSA), Sinohydro will finance and construct various infrastructural projects in Ghana. Ghana seeks to repay the loan amount by granting access to 5% of Ghana's bauxite reserves and earnings from yet-to-be-established refined bauxite. This includes bauxite from the Atewa Range Forest Reserve — one of the sources of the raw materials to service the Chinese loan.[111]

Figure 22 Location of the Atewa forest reserve and planned bauxite mines

Source: ChinaDialogue.net/Nosmot Gbadamosi[112]

[105] *Protecting Ghana's Atewa Range Forest Reserve from Bauxite mining* (2022). Available at: https://www.clientearth.org/latest/latest-updates/news/protecting-ghana-s-atewa-range-forest-reserve-from-bauxite-mining

[106] Ghana high court considers NGO case against bauxite mine - https://chinadialogue.net/en/nature/ghana-high-court-considers-ngo-case-against-bauxite-mine

[107] *Major manufacturing companies oppose mining in Atewa Forest, Ghana*, *BirdLife International*. Available at: https://www.birdlife.org/news/2021/02/03/major-manufacturing-companies-oppose-mining-in-atewa-forest-ghana

[108] Ansah, C. S. (2020). *International Non-Governmental Organisations and Environmental Policies in Ghana: The Case of "Save Atewa Forest" Campaign* (Doctoral dissertation, University of Cape Coast).

[109] *Promises and Pitfalls: China's Financing of the Atewa Bauxite Mining Project in Ghana - Georgetown Journal of International Affairs* (2021). Available at: https://gjia.georgetown.edu/2021/07/11/promises-and-pitfalls-chinas-financing-of-the-atewa-bauxite-mining-project-in-ghana

[110] Purwins, S. (2020). Bauxite mining at Atewa Forest Reserve, Ghana: a political ecology of a conservation-exploitation conflict. *GeoJournal*, 1-13.

[111] Neal, T. & Losos, E. (2021). The Environmental Implications of China-Africa Resource-Financed Infrastructure Agreements: Lessons Learned from Ghana's Sinohydro Agreement. Nicholas Institute for Environmental Policy Solutions, Duke University. https://nicholasinstitute.duke.edu/sites/default/files/publications/The-Environmental-Implications-of-China-Africa-Resource-Financed-Infrastructure-Agreements-Lessons-Learned-from-Ghana%E2%80%99s-Sinohydro-Agreement.pdf

[112] *Ghana high court considers NGO case against bauxite mine* (2020). Available at: https://chinadialogue.net/en/nature/ghana-high-court-considers-ngo-case-against-bauxite-mine

Also, lithium mining and processing are known to have considerable potential social, occupational health and safety, and environmental impacts.[113] Economic extraction of lithium comes from two sources: brines and hard rock ores (spodumenes). For example, it is estimated that two-thirds of the world's lithium production is extracted from brine concentrates, with the remainder coming from ore production.[114] Brine production of lithium uses a considerable amount of water as the practice evaporates on average 500,000 litres of brine per ton of lithium carbonate.[115] These large volumes of saltwater are, in essence, lost in the mineral conversion/processing process, raising questions about the sustainability of the process.

While it is possible to desalinise the process water for reuse in the facilities or other household needs, it comes at high costs. For example, studies show that the mining industry extracts large amounts of groundwater close to major nature conservation areas in Chile and Bolivia, among the driest regions globally.[116] This has resulted in ecosystem degradation and the forced migration of populations from ancestral settlements.[117] Likewise, in places like Tibet in the Himalayas, toxic chemicals such as hydrochloric acid and other waste products leaked from the Ganzizhou Rongda Lithium mine in 2016 into the municipal water supply system.[118] **Rock mining of lithium in Australia and North America[119] have also been associated with impacts on ecosystems, including fisheries**.[120]

In the Ghanaian context, Atlantic Lithium Ltd (formerly IronRidge Resources Ltd)[121], which holds the min-

[113] Kaunda, R. B. (2020). Potential environmental impacts of lithium mining. *Journal of Energy & Natural Resources Law*, *38*(3), 237-244. https://doi.org/10.1080/02646811.2020.1754596; Katwala, A. (2018). The spiralling environmental cost of our lithium battery addiction. *Wired UK*, *5*
Wanger, T. C. (2011). The Lithium future—resources, recycling, and the environment. *Conservation Letters*, *4*(3), 202-206. https://doi.org/10.1111/j.1755-263X.2011.00166.x;

[114] Tadesse, B., Makuei, F., Albijanic, B., & Dyer, L. (2019). The beneficiation of lithium minerals from hard rock ores: A review. *Minerals Engineering*, *131*, 170-184. https://doi.org/10.1016/j.mineng.2018.11.023

[115] Flexer, V., Baspineiro, C. F., & Galli, C. I. (2018). Lithium recovery from brines: A vital raw material for green energies with a potential environmental impact in its mining and processing. *Science of the Total Environment*, *639*, 1188-1204. https://doi.org/10.1016/j.scitotenv.2018.05.223;

[116] South America's Lithium Triangle comprises Argentina, Bolivia and Chile. They are estimated to holds more than half the world's supply of Lithium in its salt flats. See https://www.wecanfigurethisout.org/ENERGY/Web_notes/Energy_Consumption/Greener_Cars_and_Trucks_Supporting_Files/Spiralling%20environmental%20cost%20of%20our%20lithium%20battery%20addiction%20-%20WIRED%20UK%20-%202018.pdf

[117] Agusdinata, D. B., Liu, W., Eakin, H., & Romero, H. (2018). Socio-environmental impacts of lithium mineral extraction: towards a research agenda. *Environmental Research Letters*, *13*(12), 123001. https://doi.org/10.1088/1748-9326/aae9b1

[118] Child labour, toxic leaks: the price we could pay for a greener future (2021). Available at: https://www.theguardian.com/environment/2021/jan/03/child-labour-toxic-leaks-the-price-we-could-pay-for-a-greener-future; *Protests against mining of lithium by the Lichu River in Kangding, TAP Ganzi, Sichuan, China | EJAtlas* (2022). Available at: https://ejatlas.org/conflict/a-sudden-mass-death-of-fish-in-the-lichu-river-in-minyak-lhagang-dartsedo-county-in-karze-prefecture; Denyer, S. (2016). Tibetans in anguish as Chinese mines pollute their sacred grasslands. https://www.washingtonpost.com/world/asia_pacific/tibetans-in-anguish-as-chinese-mines-pollute-their-sacred-grasslands/2016/12/25/bb6aad06-63bc-11e6-b4d8-33e931b5a26d_story.html

[119] *Plans To Dig the Biggest Lithium Mine in the US Face Mounting Opposition - Inside Climate News* (2021). Available at: https://insideclimatenews.org/news/07112021/lithium-mining-thacker-pass-nevada-electric-vehicles-climate; Ella Nilsen and Rene Marsh, C. (2022) *A rush to mine lithium in Nevada is pitting climate advocates and environmental groups against each other*, *CNN*. Available at: https://edition.cnn.com/2021/12/17/politics/lithium-mining-energy-climate/index.html

[120] *The Lithium Gold Rush: Inside the Race to Power Electric Vehicles* (2021). Available at: https://www.nytimes.com/2021/05/06/business/lithium-mining-race.html

[121] See Atlantic Petroleum Limited February 2022 investor presentation. https://static1.squarespace.com/static/61711d27ed0db12cacbcfb5a/t/62160572ce33c746df9b80da/1645610360706/Atlantic+Lithium+Presentation+-+February+2022+-+Final%5B71%5D.pdf

eral rights to the highly prospective Ewoyaa discovery in the Makessim-Saltpond area of the Central Region, plans to use traditional rock mining techniques to extract high-grade lithium spodumene pegmatite ore[122] — a silicate mineral also known as lithium feldspar or aluminium inosilicate, $LiAlSi_2O_6$.

Interviews with some industry stakeholders indicate that the company [Barari DV Ghana Limited], which has the prospecting license rights to the Ewoyaa discovery, is yet to submit a feasibility study or full development plan, including an environmental impact assessment plant (EIA) for mining the lithium pegmatites. Indeed, the company would have to apply to convert their prospecting license to a full mining lease before commercially extracting the lithium.

Nonetheless, the above case studies illustrate that any exploitation and extraction of critical minerals such as bauxite (for aluminium) and lithium would have to comply with strict environmental regulations and procedures. There is a need to ensure that any grant of rights strictly adheres to the following:

- The grant of minerals rights or other licences and permits required under the Minerals and Mining Act, 2006 (Act 703), as amended by the Minerals and Mining (Amendment) Act, 2015 (Act 900), the Minerals and Mining (Amendment) Act, 2019 (Act 995)
- Minerals and Mining (General) Regulations, 2012 (L.I 2173) and other ones.
- Environmental permits required under the Environmental Protection Agency Act, 1994 (Act 490) and LI 1652.
- Permits required under the Forestry Commission Act, 1999 (Act 571).
- Permits required under the Water Resources Commission Act, 1996 (Act 522).

4.2.3 Licensing and fiscal

Regarding lithium, a search on Ghana's mining registry [cadastre][123] reveals that Barari DV Ghana Limited, with registration number CA-88,483 and TIN 324V077753, is the company that holds the **prospecting license** (RL3/55) for columbite-tantalite, lithium and other base metals at Ewoyaa near Saltpond in the Mfantsiman Municipality of the Central Region. **Media reports[124] and other open-source searches (OSINT) indicate that Barari operates through a joint venture with Ironridge Resources Limited (now Atlantic Lithium Limited)** —an Australian incorporated company listed on the Alternative Investment Market (AIM) of the London Stock Exchange. Atlantic Lithium Limited (formerly IronRidge Resources) entered into earn-in arrangements with local companies — Obotan Minerals Limited, Merlink Resources Limited, Barari Developments Limited and Joy Transporters Limited — which granted them first access rights to acquire the historical Egyasimanku Hill spodumene rich lithium deposits.[125] On 23 March 2018, the initial license was converted from a **mineral reconnaissance license to a mineral prospecting license** (Table 4). The prospecting license, which was valid until 23 March 2021, has been further extended for another three years until 26 July 2024 to allow further appraisal works. It covers 360 cadastre units/contiguous blocks.[126]

Neither Barari DV Ghana Limited nor their joint venture partner Ironridge Resources Limited (now Atlantic Lithium Limited) has been granted as yet mining lease to mine lithium in Ghana. Nevertheless, Atlantic Lithium Limited, in a series of investor presentations,[127] have clearly indicated the high likelihood of the project proceeding to the mining stage. Should this go ahead, **there would be an opportunity for Ghana to have more stake in the project using the Minerals Income Investment Fund (MIIF) as an acquisition vehicle for extra**

[122] Tadesse, B., Makuei, F., Albijanic, B., & Dyer, L. (2019). The beneficiation of lithium minerals from hard rock ores: A review. *Minerals Engineering*, *131*, 170-184. https://doi.org/10.1016/j.mineng.2018.11.023

[123] See https://miningrepository.mincom.gov.gh/license/64494

[124] *Minerals Commission denies aspects of reports on Lithium discovery | 3NEWS* (2021). Available at: https://3news.com/minerals-commission-denies-aspects-of-reports-on-lithium-discovery

[125] *IronRidge Resources Limited Maiden Lithium Mineral Resource Estimate at Ewoyaa* (2022). Available at: https://uk.advfn.com/stock-market/london/ironridge-resources-IRR/share-news/IronRidge-Resources-Limited-Maiden-Lithium-Mineral/81609326.

[126] https://miningrepository.mincom.gov.gh/license/64494

[127] Atlantic Lithium Investor Presentation February 2022 - https://static1.squarespace.com/static/61711d27ed0db12cacbcfb5a/t/62160572ce33c746df9b80da/1645610360706/Atlantic+Lithium+Presentation+-+February+2022+-+Final%5B71%5D.pdf

paid interest. This proposition to have more direct stakes in the project or related value chain activities also holds for other minerals like bauxite, iron ore, manganese and silica sand.

Table 4 The various types of Mineral Rights and Licences available in Ghana

LICENSE TYPE	PURPOSE	AREA	MAXIMUM DURATION
Reconnaissance Licence (RL)	Regional exploration not including drilling & excavation	Blocks of 21 hectares, not exceeding 5,000 contiguous blocks	12 months renewable
Prospecting Licence (PL)	Search for minerals and evaluation	Not exceeding 750 contiguous blocks	3 years, renewable with reduction of area to not more than half
Mining Lease (ML)	Extraction of minerals	Not exceeding 300 contiguous blocks	30 years or less depending on mine life. Renewable
Restricted Mining Lease (RML)	Building and Industrial minerals	Not exceeding 300 contiguous blocks	15 years or less depending on mine life. Renewable
Small Scale Mining Licence (Reserve for Ghanaians only)	Extraction of minerals	In accordance with the number of blocks prescribed in Regulations	5 years, renewable

Source: Minerals Commission <https://www.mincom.gov.gh/mineral-rights>

Ghana does not have a dedicated fiscal regime for the critical minerals sector; instead, what pertains is the normal royalty-tax system under the existing mining development and investment agreements signed between Ghana and the various mining companies. This is not too surprising, given that the issue of critical minerals is more of a recent occurrence driven by the energy transition. Nevertheless, designing a mineral taxation regime is often a herculean task as it must address the multiple objectives and risk-reward balance between the host government on one side and investors on the other. Extractive fiscal regimes must be (1) neutral and non-distortionary taxation, (2) progressive or flexible, (3) encourage risk-sharing between investors and the State, (4) be simple to administer and comply with, and (5) offer stability and international competitiveness.[128]

Several elements of Ghana's underlying mineral fiscal regime are inflexible and do not allow the capture of enough value to the state, especially for an emerging critical minerals industry (Table 5). Therefore, there is a need for the Ghanaian State to do the following:

i. **Consider whether the level of government equity at 10% is adequate in capturing potential value in the sector and balancing this with attracting investment**. The government could, after careful consideration, get MIIF to own extra participating (paid) interest in proven critical minerals deposits (as is done with petroleum via GNPC Explorco).
ii. **Review role of MIIF in the mining value chain:** MIIF could be a vehicle to own processing infrastructure and retain more of the value chain. This could be done on a joint-venture basis to reduce the project risks. Companies that set up processing infrastructure can be offered additional tax incentives.
iii. **Consider whether tax and or other incentives would be appropriate to attract investment:** There is a need for a ring-fence regime to curtail gold-plating (deliberate cost reductions). This is a lesson from the gold mining and oil and gas industries that need to be learned. Robust cost control is fundamental to the ability to collect taxes on income, such as corporate income tax and windfall taxes. The State could also consider introducing a windfall tax at the mine level. However, these need to be tied to mine profitability and could be calculated on a pre or post-tax basis.

[128] Calder, M. J. (2014). *Administering fiscal regimes for extractive industries: a handbook*. International Monetary Fund.
Otto, J. M. (2017). *The taxation of extractive industries: Mining* (No. 2017/75). WIDER Working Paper.
Daniel, P., Keen, M., Świstak, A., & Thuronyi, V. (Eds.). (2017). *International Taxation and the Extractive Industries*. New York, NY: Routledge.

Table 5 Ghana mining fiscal instruments and incentives

Fiscal Instrument	Application Rate
Mineral Royalty	5%
Corporate Income Tax	35%
Capital Allowance	20% straight line on mining assets for 5 years
Losses carried forward	5 years
Thin Capitalization	03:01
VAT	12.5% (Refundable)
NHIL & GET Fund Levy	2.5% each and tax deductible
Pay As You Earn (PAYE tax)	Graduated rate
Dividend tax	8%
National Fiscal Stabilization Levy (NFSL)	5% of profit before tax
Government Carried Equity	10%
Annual Mineral Right Fees	As prescribed by L.I. 2176
Withholding tax on resident entities	Goods 3%, Works 5%, Service 7.5%
Withholding tax on interest payable to non-residents	8%
Withholding tax on royalties, natural resource payments and rents	15%
Ground Rent	As prescribed by L. I. 2357
Fiscal Incentives	**Details**
Double taxation relief	Royalties paid is tax deductible
Incentive for employing fresh graduates	▪ Hiring of up to 1% of fresh graduates in workforce attracts additional deduction of 10% of salaries and wages ▪ Hiring of up to 1% but not more than 5% in workforce attracts additional deduction of 30% of salaries and wages ▪ Hiring of up to above 5% of fresh graduates in workforce attracts additional deduction of 50% of salaries and wages
Concessionary rate for the payment of custom duties	▪ Concessionary rate for the payment of custom duties on Plant, Machinery & Equipment exclusively for Mining Operations as approved (The Mining List)
Capitalisation of expenditure on reconnaissance and prospecting	▪ The holder of a mining lease is entitled to the capitalisation of expenditure on reconnaissance and prospecting approved by the Minister on the advice of the Commission where the holder starts development of a commercial find.
Retention of a portion of export	▪ Retention of a portion of export proceeds in an external account to finance purchase of inputs
Immigration quotas	▪ Immigration quota in respect of approved number of expatriate personnel in line with Minerals and Mining (Local Content & Local Participation) Regulations, 2020 (L.I. 2431)

Source: Adapted from Minerals Commission

4.3 Summary

The prevailing legal and regulatory instruments underpinning Ghana's mining industry are premised on Article 257(6) of the 1992 Fourth Republican Constitution, which states that *"every mineral in its natural state found in Ghana is the property of the Republic of Ghana and is vested in the President for and on behalf of the people"*. The foregoing constitutional provision makes it imperative that all minerals, including critical minerals such as lithium and silica sand, are vested in the President in trust for the citizens of Ghana. This constitutional provision mandates for licensing to be done by the Executive via the sector minister, for and on behalf of the President. This provision is what currently pertains to minerals licensing in the country.

Ghana's Minerals Commission, which has been operating since the 1980s, has the primary responsibility for developing and coordinating mineral sector policies and monitoring their implementation thereof. Despite the work of the Minerals Commission, the new government of the New Patriotic Party (NPP) in 2018 decided to create two new vehicles to give a dedicated focus back to two other minerals: namely, bauxite and iron ore. In this regard, the government passed the *Ghana Integrated Iron and Steel Development Act 2019 (Act 988)* and *Ghana Integrated Aluminium Development Corporation (GIADEC) Act, 2018 (Act 976)* to create two new vehicles, similar to what pertained in the 1970s and early 1980s.

Regarding national policies relevant to critical minerals in Ghana, while most of the principal policies enacted by the government do not specifically mention critical minerals, they do, however, reference the components needed to develop a viable critical minerals value chain and employment generating opportunities. Also, Ghana needs to update its mining and minerals policy, given the role of critical minerals in the energy transition. This must also align with a well-defined industrial development strategy and commitments to meeting climate targets per Ghana's nationally determined contribution (NDC). While the intended objectives of the national minerals and mining policy are noble, there is a lack of synergy between it and other major climate policy initiatives, such as Ghana's NDC.

The current legal and regulatory regime for mining in Ghana is reasonably adequate to address the prevailing issues in the industry; the challenge is not one of the laws but enforcement, including environmental governance, especially with artisanal mining. Nonetheless, significant concerns have been raised about land compensation issues and the possible negative externalities (environmental impacts) of some extraction forms, particularly for bauxite and, to an extent, lithium. Lithium mining and processing have considerable potential social, occupational health and safety, and environmental impacts.

Ghana does not have a dedicated fiscal regime for the critical minerals sector; instead, what pertains is the normal royalty-tax system under the existing development and investment agreements signed between Ghana and the various mining companies. This is not too surprising, given that the issue of critical minerals is more of a recent occurrence driven by the energy transition. Nevertheless, several elements of Ghana's underlying mineral fiscal regime are inflexible and do not allow capture of enough value to the State, especially for an emerging critical minerals industry. These need reforming.

Finally, increased activity in critical minerals as a sub-sector brings to the fore issues of public participation and accountability on contracts, beneficial ownership, and resource-backed loans. These are important governance areas that accountability bodies such as GHEITI must emphasise their advocacy and stakeholder engagement campaigns on critical minerals. GHEITI's work needs to be complemented by wider non-state demand-side accountability actors in Ghana's civic space.

5 Emerging socio-economic and governance issues

This section covers the following themes:

- Potential fiscal, social and environmental risks and opportunities that the energy transition presents for Ghana's critical minerals industry.
- Examines lessons and pitfalls from past resource-based industrialisation efforts.
- Case study of how Ghana's participation in the EITI has helped improve extractives governance and how can we improve and deploy this for critical minerals governance.

5.1 Corruption risks in Ghana's mining sector

The extractives industry is often associated with significant corruption across all segments of the value chain.[129] The unique features of the extractive sector — namely the high economic rent potential, extensive involvement of multinationals giving rise to complex tax issues, unique cost-sharing and financing arrangements, sensitivities on sharing the benefits from national resources, and cross-border supply chains – make it particularly susceptible to the various forms of corruption and illicit financial flows (IFFs). These corruption risks are exacerbated by weaknesses in governance systems and political institutions.[130]

Within Ghana's mining sector in the past, corruption risks have manifested in the abuse of the licensing process to award mining contracts to politically exposed persons (PEPs) and well-connected insiders — sometimes using companies registered in offshore tax havens and secrecy jurisdictions —, companies with very little financial and or technical muscle to sustain exploration campaigns, and inability to enforce environmental governance standards.[131] We further illustrate this using the gold mining industry, where there is ample documented evidence of collusion at all facets of the industry involving officials sitting in Accra to State security and Chiefs in the mining communities.[132] This can be characterised in some respect as elite capture and political corruption[133] whereby *"the dominance of the political class in decision-making in respect of mineral licensing makes it susceptible to political influence in the processing and granting of gold mining licenses… [and] there are no laid down procedures for the prevention and management of the potential conflict of interests [that]*

[129] Tacconi, L., & Williams, D. A. (2020). Corruption and anti-corruption in environmental and resource management. *Annual Review of Environment and Resources*, *45*, 305-329. https://doi.org/10.1146/annurev-environ-012320-083949
OECD (2016). *Corruption in the extractive value chain: Typology of risks, mitigation measures and incentives*. OECD Publishing. https://www.oecd.org/dev/Corruption-in-the-extractive-value-chain.pdf
Papyrakis, E., Rieger, M., & Gilberthorpe, E. (2017). Corruption and the extractive industries transparency initiative. *The Journal of Development Studies*, *53*(2), 295-309. https://doi.org/10.1080/00220388.2016.1160065
Öge, K. (2016). Which transparency matters? Compliance with anti-corruption efforts in extractive industries. *Resources Policy*, *49*, 41-50.
[130] Villar, P. F. (2020). The extractive industries transparency initiative (EITI) and trust in politicians. *Resources Policy*, *68*, 101713. https://doi.org/10.1016/j.resourpol.2020.101713
[131] Transparency International (2020). Ghana – Corruption Risk Assessment Report on Mineral Mining Licensing. Available at https://transparency.org.au/wp-content/uploads/2020/05/Ghana-Report.pdf, at pp.31-32
[132] Crawford, G., & Botchwey, G. (2017). Conflict, collusion and corruption in small-scale gold mining: Chinese miners and the state in Ghana. *Commonwealth & Comparative Politics*, *55*(4), 444-470.
Teschner, B. A. (2012). Small-scale mining in Ghana: The government and the galamsey. *Resources policy*, *37*(3), 308-314.
[133] Standing, A., & Hilson, G. (2013). Distributing mining wealth to communities in Ghana: Addressing problems of elite capture and political corruption. U4 Issue. https://www.u4.no/publications/distributing-mining-wealth-to-communities-in-ghana-addressing-problems-of-elite-capture-and-political-corruption.pdf

may arise in the mining license application process"[134]. A 2020 Transparency International (TI) corruption risk assessment report[135] on mineral mining licensing in Ghana noted that

> *"Interviews with a company official and a license applicant on 12th November 2019, revealed, that it is a practice in Ghana that some board members of the Minerals Commission also serve as directors of some [mining] companies."*

The problem is most manifest within the small scale artisanal mining sector, which despite it being 'reserved for Ghanaian citizens' by law, has seen tens of thousands of foreign miners (some estimates indicate 50,000 plus[136]), particularly from China, being openly involved in it. This unregistered and unregulated artisanal gold mining in Ghana is locally known as *'galamsey'*.[137] Some of these small scale miners have been alleged to procure the services of officers from the police and military to provide security at the mine sites while also heavily polluting the river bodies[138]. In Southwestern Ghana, for example, it has been shown that small-scale mines leave a large footprint which is nearly seven times (7X) greater than that of industrial mines, increasing the potential pollution impact.[139] Indeed, studies have shown high levels of arsenic, cadmium and mercury at some of these mine sites, which have already entered into the drinking water of entire communities.[140] These heavy metals are known to cause major ailments such as kidney problems and neurological disorders.[141]

A review of Ghana's mining scores and trends between 2017 and 2021, as captured by the Resource Governance Index (RGI), shows that there has been a considerable improvement in the country's mining governance regime, albeit focused on the gold mining sector (Figure 23). For example, there was a 13 point improvement in Ghana's RGI score from 59 to 69. This improvement in resource governance from 2017 to 2021 was driven by gains in value realisation and revenue management components. On the value realisation component, Ghana improved by four points on licensing, 10 points on taxation and 29 points on local impact. These sub-improvements resulted in an overall gain of 22 points from 61 to 83 points (Figure 23). Likewise, on revenue management, the country improved its scoring from 37 to 54 points. The biggest gain was in national

[134] Transparency International (2020). Ghana – Corruption Risk Assessment Report on Mineral Mining Licensing. Available at https://transparency.org.au/wp-content/uploads/2020/05/Ghana-Report.pdf, at p.24

[135] Transparency International (2020). Ghana – Corruption Risk Assessment Report on Mineral Mining Licensing. Available at https://transparency.org.au/wp-content/uploads/2020/05/Ghana-Report.pdf, at p.34

[136] https://www.asiabyafrica.com/point-a-to-a/galamsey-ghana-illegal-mining-china

[137] Aidoo, R. (2016). The political economy of galamsey and anti-Chinese sentiment in Ghana. *African Studies Quarterly*, *16*(3/4), 55.

[138] CitiFM (2021). Fight against Galamsey: 'Operation Halt' arrests Chinese nationals and destroys some equipment | CNR. https://www.youtube.com/watch?v=GUqQ_x13nJE

[139] Barenblitt, A., Payton, A., Lagomasino, D., Fatoyinbo, L., Asare, K., Aidoo, K., ... & Wood, D. (2021). The large footprint of small-scale artisanal gold mining in Ghana. *Science of the Total Environment*, *781*, 146644. https://doi.org/10.1016/j.scitotenv.2021.146644

[140] Armah, F. A., Luginaah, I., & Odoi, J. (2013). Artisanal small-scale mining and mercury pollution in Ghana: a critical examination of a messy minerals and gold mining policy. *Journal of Environmental Studies and Sciences*, *3*(4), 381-390. https://link.springer.com/article/10.1007/s13412-013-0147-7

Kwaansa-Ansah, E. E., Armah, E. K., & Opoku, F. (2019). Assessment of total mercury in hair, urine and fingernails of small–scale gold miners in the Amansie West District, Ghana. *Journal of Health and Pollution*, *9*(21). https://doi.org/10.5696/2156-9614-9.21.190306

[141] Mensah, A. K., Marschner, B., Shaheen, S. M., Wang, J., Wang, S. L., & Rinklebe, J. (2020). Arsenic contamination in abandoned and active gold mine spoils in Ghana: Geochemical fractionation, speciation, and assessment of the potential human health risk. *Environmental Pollution*, *261*, 114116. https://doi.org/10.1016/j.envpol.2020.114116

Mensah, A. K., Mahiri, I. O., Owusu, O., Mireku, O. D., Wireko, I., & Kissi, E. A. (2015). Environmental impacts of mining: a study of mining communities in Ghana. *Applied Ecology and Environmental Sciences*, *3*(3), 81-94.

Mensah, A. K., Marschner, B., Antoniadis, V., Stemn, E., Shaheen, S. M., & Rinklebe, J. (2021). Human health risk via soil ingestion of potentially toxic elements and remediation potential of native plants near an abandoned mine spoil in Ghana. *Science of The Total Environment*, *798*, 149272. https://doi.org/10.1016/j.scitotenv.2021.149272

budgeting, with a 34 point improvement from 36 to 70 points. Within the broader African region, Ghana's mining sector is also ranked as one of the most well-governed, according to the RGI.[142]

Despite these positives, Ghana's mining sector lags behind the country's upstream oil and gas sector on resource governance (Figure 24). In other words, upstream oil and gas, which has only been in existence for ten-plus years, is relatively better governed and managed than mining, the latter which has been in existence for over a century. For instance, compared to the upstream oil and gas sector, Ghana's mining industry lags in licensing areas such as financial interest disclosure rules, financial interest disclosure practice, contract disclosure rules and practice, and environmental governance, among others.[143]

Figure 23 Overview of Ghana's mining scores and trends between the 2017 and 2021 Resource Governance Index

Overview of the scores and trends between the 2017 and 2021 Resource Governance Index

		2017 RGI Score	2021 RGI Score	Trend
	Resource Governance Index	**56**	**69**	**13**
1	VALUE REALIZATION	61	83	22
1.1	Licensing	62	66	4
1.2	Taxation	72	82	10
1.3	Local impact	71	100	29
1.4	State-owned enterprises	41	0	-41
2	REVENUE MANAGEMENT	37	54	17
2.1	National budgeting	36	70	34
2.2	Subnational resource revenue sharing	39	39	0
2.3	Sovereign wealth funds	0	0	0
3	ENABLING ENVIRONMENT	70	71	1
3.1	Voice and accountability	90	89	-1
3.2	Government effectiveness	60	60	0
3.3	Regulatory quality	76	74	-2
3.4	Rule of law	83	82	-1
3.5	Control of corruption	79	79	0
3.6	Political stability and absence of violence	78	80	2
3.7	Open data	27	31	4

PERFORMANCE BANDS

Good	Scores over 75
Satisfactory	Scores 60-74
Weak	Scores 45-59
Poor	Scores 30-44
Failing	Scores under 30

Source: RGI/NRGI

[142] *Resource Governance Index* (2022). Available at: https://resourcegovernanceindex.org/data/both/issue?region=SSA&years=2017&years=2021

[143] https://resourcegovernance.org/sites/default/files/documents/2021_rgi_ghana_mining_workbook.xlsx and https://resourcegovernance.org/sites/default/files/documents/2021_rgi_ghana_oil_and_gas_workbook.xlsx

Figure 24 Comparison of Ghana's oil and gas versus mining

		2021 RGI Score Mining	2021 RGI Score Oil and Gas	Trend
	Resource Governance Index	69	78	-9
1	VALUE REALIZATION	83	79	4
1.1	Licensing	66	75	-9
1.2	Taxation	82	80	2
1.3	Local impact	100	78	22
1.4	State-owned enterprises	0	84	-84
2	REVENUE MANAGEMENT	54	85	-31
2.1	National budgeting	70	70	0
2.2	Subnational resource revenue sharing	39		39
2.3	Sovereign wealth funds	0	100	-100
3	ENABLING ENVIRONMENT	71	71	0
3.1	Voice and accountability	89	89	0
3.2	Government effectiveness	60	60	0
3.3	Regulatory quality	74	74	0
3.4	Rule of law	82	82	0
3.5	Control of corruption	79	79	0
3.6	Political stability and absence of violence	80	80	0
3.7	Open data	31	31	0

PERFORMANCE BANDS	
Good	Scores over 75
Satisfactory	Scores 60-74
Weak	Scores 45-59
Poor	Scores 30-44
Failing	Scores under 30

Source: RGI/NRGI

Corruption risks could become elevated in Ghana with the soaring demand for critical minerals to power the energy transition. Historically, both large and small scale corruption offences in the global extractives value chain have included *"bribery of foreign officials, embezzlement, misappropriation and diversion of public funds, abuse of office, trading in influence, favouritism and extortion, bribery of domestic officials and facilitation payments"*.[144] Large-scale corruption involving high-level public officials and State-Owned enterprises (SOEs) has been observed in *"the awarding of mining and oil and gas rights, procurement of goods and services, commodity trading, revenue management through natural resource funds, and public spending"*[145]. Within the Ghana context, the March 2020 corruption risk assessment report[146] by Transparency International (TI) noted that

> *"The face-to-face (manual) processing of applications exposes both the applicants and public officials to potential corruption. It should therefore be substituted with an electronic system of application to minimise or eliminate the risk. The digitisation is not only consistent with national policy but also eliminates the incentives for corrupt practices associated with the face-to-face manual processing of mining license application."*

[144] OECD (2016). *Corruption in the extractive value chain: Typology of risks, mitigation measures and incentives*. OECD Publishing. https://www.oecd.org/dev/Corruption-in-the-extractive-value-chain.pdf, at p.10
[145] ibid, at p.10
[146] Transparency International (2020). Ghana – Corruption Risk Assessment Report on Mineral Mining Licensing. Available at https://transparency.org.au/wp-content/uploads/2020/05/Ghana-Report.pdf, at p.x

The TI study identified 17 vulnerabilities to corruption, out of which six (6) came from political factors, three (3) were due to economic factors, six (6) from social factors, and two (2) from technological factors. Within these 17 vulnerabilities, the study identified and assessed 19 risks to corruption and found high scores of 4 and 5 (based on a scale of 1-5) in 14 out of the 19 identified risks to corruption.[147] This means there is certainty in their occurrence in the mining license application process. For example, the study notes that *"Ghana's use of the first come-first served approach for the allocation of mineral rights does not allow the selection of applicants based on merit"*.[148]

While most of the critical minerals in Ghana are likely to be mined and extracted at an industrial scale for it to benefit from economies of scale, it could nonetheless drive a new boom or rush for licenses by miners who may not be qualified to hold such licenses. Some of these miners will likely not even conduct any exploration work on their licenses but seek to flip them around to the next highest bidder – speculative activities. Anecdotal evidence from source interviews undertaken during this study indicates that some companies with doubtful or politically exposed backgrounds have applied or are seeking to apply to be awarded mineral prospecting licenses, some of these covering critical minerals.[149] Unlike in the upstream oil and gas sector, Ghana allocates mining concessions on an open door 'first-come first-served' basis, which could further exacerbate corruption risks. There are plans, however, to adopt a hybrid regime that includes an open competitive tendering process just as is done for the country's upstream oil and gas industry, although no timelines have been offered as yet on when this competitive licensing (auction) process will be implemented.[150]

Ghana has sought to mitigate some of the corruption risks within the mining sector by introducing a beneficial ownership regime for company registration, and launching a national mining repository/cadastre, and contracts portal, among others. In March 2020, the country's Registrar-General's Department (RGD) introduced the Beneficial Ownership (BO) Transparency Regime as part of the Company Registration processes under the *Companies Act 2019 (*Act 992).[151] Under this provision, any individual seeking to "register companies such as a Company Limited by Shares (Public &Private), a Company Limited by Guarantee (Public & Private), an Unlimited Company (Public & Private) and an External Company" is required to provide their beneficial ownership details to the RGD. For existing companies, they are expected to do this during the annual returns filing or upon request by the Registrar. Individuals with ownership of more than 20% of the shares and those with significant influence or control over the company will be declared beneficial owners under the regime. Furthermore, the

The Minerals Commission, with the support from some donors, has launched the Ghana Mining Repository (GMR) — https://ghana.revenuedev.org/dashboard. The GMR, which is publicly accessible through an initial registration on the portal, contains updated information on all mineral licenses issued in Ghana, the owner/company/entity and spatial maps of the license areas and resource type (Figure 25). There are currently 1,252 total map records, 6,180 owner/company/entity records, and 1,509 license records in the portal as of 05 April 2022. Furthermore, the Minerals Commission has also started disclosing some mining contracts on their website at https://www.mincom.gov.gh/development-and-investment-agreement. However, these cover only gold mining.

We encourage the Minerals Commission and other State institutions to broaden such disclosures for new contracts involving critical minerals. This would allow stakeholders to review and assess company efforts to meet contract provisions. Finally, there is an opportunity for all stakeholders, including non-state actors such as civil society and GHEITI to ensure that any potential conversion of prospecting licenses such as the one granted

[147] ibid, at p.viii

[148] ibid, at p.24

[149] These corruption risks have also been more systematically documented in a 2020 Civil Society Platform on Oil and Gas (CSPOG) Anti Corruption Report titled 'Lifting the Veil on the Typologies and Nature of Corruption Risks in Ghana's Mining, Oil and Gas Sectors,' undertaken with funding from star Ghana. See https://www.petrocom.gov.gh/amend-laws-to-tackle-corruption-in-extractive-sector-cspog/ and

[150] https://eiti.org/countries/ghana

[151] *Ghana introduces beneficial ownership regime for company registration - Ghana Business News* (2021). Available at: https://www.ghanabusinessnews.com/2021/03/30/ghana-introduces-beneficial-ownership-regime-for-company-registration

to Barari DV Ghana Limited and their joint venture partner Ironridge Resources Limited (now Atlantic Lithium Limited) to a mining license follows the due processes entrenched in the country's legal frameworks, and also secures the maximum possible take to the Ghanaian State. As the experience of reforms within Ghana's mining and oil and gas sectors over the past years show, some of these critical reform interventions can only be attained with a cleared and focused advocacy campaign. **The expectation is that these interventions would limit the opportunities for corruption in the allocation/renewal of new licenses, ensure improved contract negotiation and open contract disclosure, reduce revenue leakages and facilitate domestic resource mobilisation and community development**.

Figure 25 Snippet of Ghana Mining Repository

Source: https://ghana.revenuedev.org/dashboard

5.2 Lessons and pitfalls from past resource-based industrialisation efforts

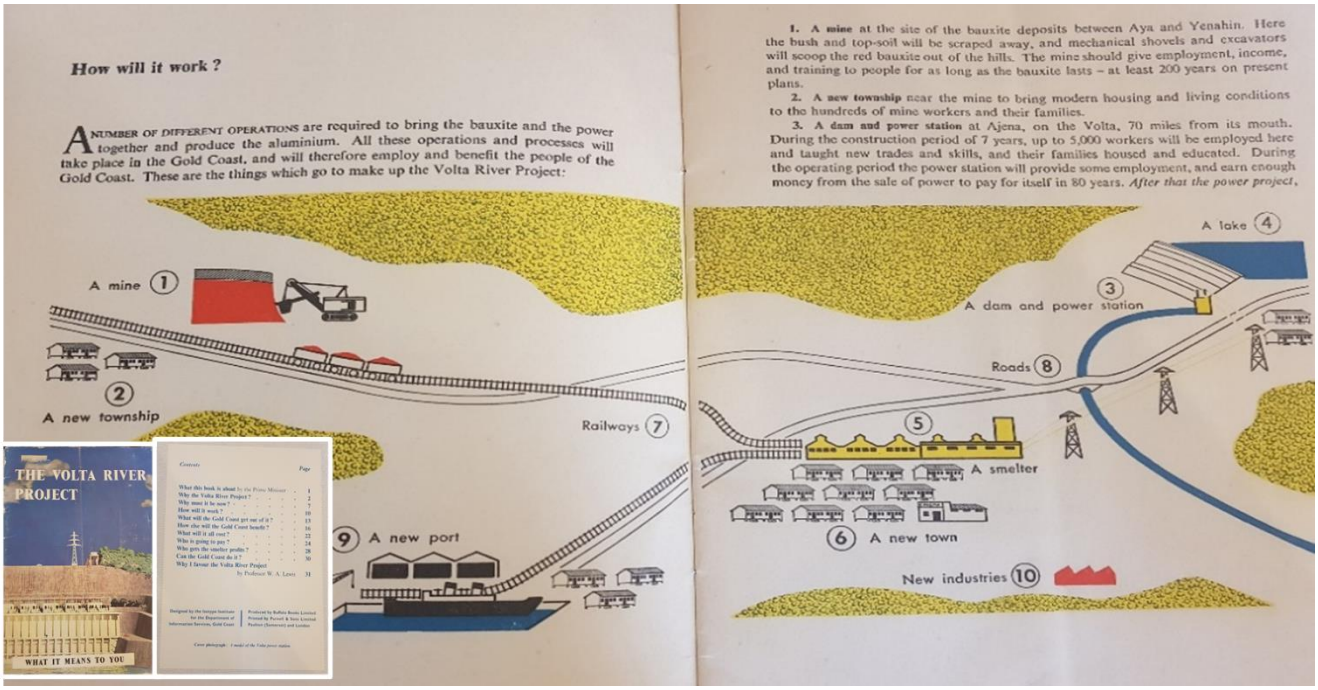
This section of the report focuses on the lessons and pitfalls from past resource-based industrialisation efforts, which should guide the development of Ghana's critical minerals industry.

5.2.1 Synchronisation of mineral development plans and operations with national industrial priorities (need for integrated mining planning)

One of the key lessons from our past resource-based industrialisation effort is the need to ensure synergies between energy and industrial policies — the **need for integrated mining planning.** The Volta River Project (VRP) of the 1960s is one such example of the deep-rooted fundamental thinking that is required if Ghana is to fully take advantage of the opportunities that the energy transition presents with soaring demand for critical minerals (Figure 26). The VRP, a key component of Kwame Nkrumah's industrialisation agenda, saw the building of the Akosombo Dam in 1965 with the primary aim of providing relatively cheap dedicated electricity to the Volta Aluminum Company's (VALCO) aluminium smelter located in the newly-created coastal industrial enclave and Port of Tema.[152] This smelter was to be backlinked to the development of a refinery which in turn would allow the processing of local bauxite deposits at Awaso and Nyinahin - to feed the VALCO smelter.

However, the crucial refinery within the middle chain was never built following President Nkrumah's overthrow in the 1966 coup. This was also dealt a fatal blow by some rather incoherent advice that Ghana received from some multinational organisations that the country's bauxite was of a lower grade and thus could not be refined in the country. The latter turned out to be incorrect, and subsequent improvement in technologies over the years has meant that certain refineries – for example, in Australia – are able to process much lower grade bauxite (less than 30% aluminium oxide: Al_2O_3%). Ghana's bauxite resources are estimated to have 44%-49% Al_2O_3% content and moderately low reactive silica content of less than 4%.[153] **In essence, the lack of a refinery has severely limited Ghana's ability to fully exploit the potential of her bauxite resources for inclusive growth and development.** Had Ghana been able to run a refinery, it would have captured as much as 50 times more value from operating an end-to-end process (Figures 27 and 28).

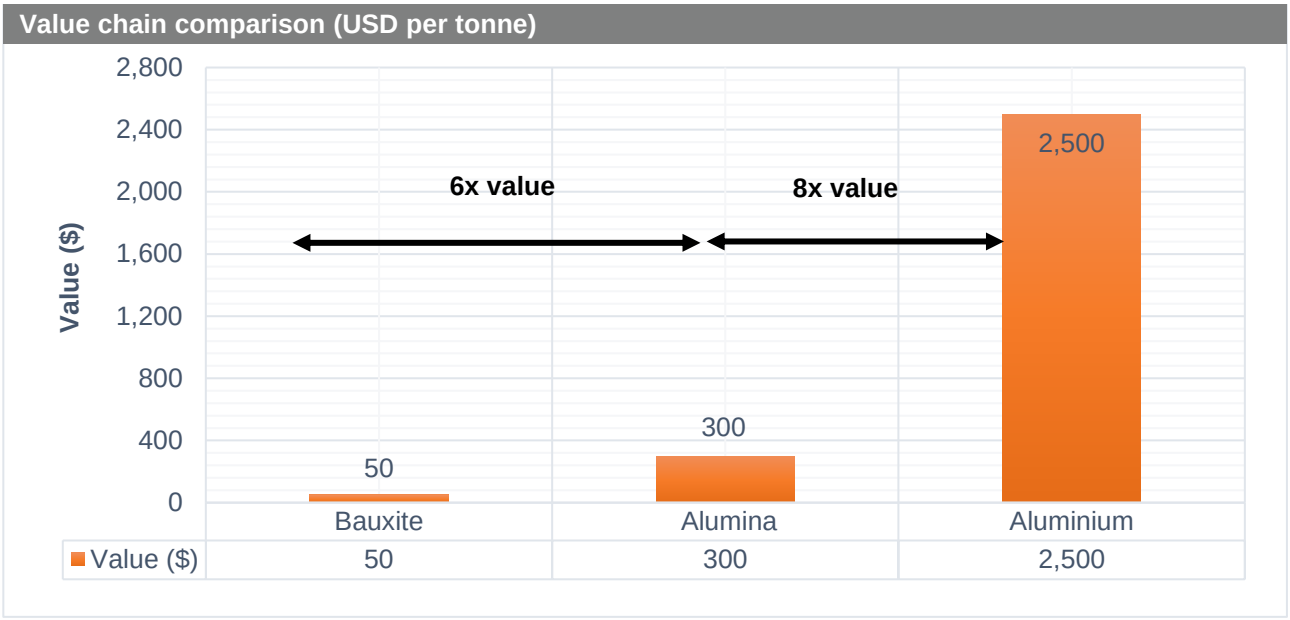
Figure 26 Integrated resource planning of the Volta River Project showing the development of mines, railways and other infrastructure such as a new Port



Source: Gold Coast. Dept. of Information Services (1955)

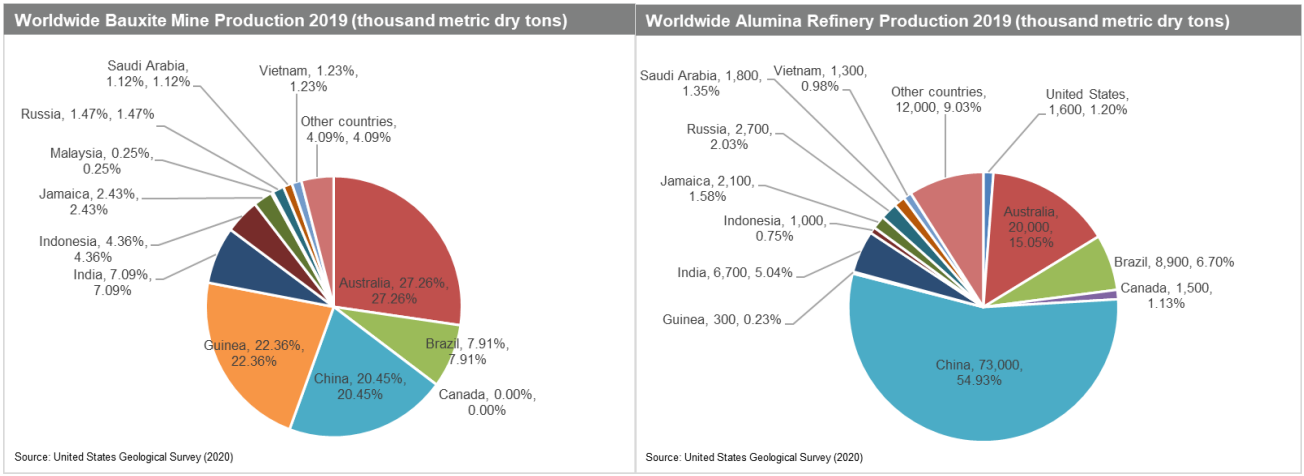
[152] Acheampong, T. and Mensah, K. A., 2018. Towards an Integrated Bauxite and Aluminium Industry in Ghana. Natural Resources Governance Institute. http://dx.doi.org/10.13140/RG.2.2.17985.40804
[153] ibid

Figure 27 Estimated multiplier values: $25-100/tonne (bauxite)[154] to $300/tonne (metallurgical-grade alumina) to $2,500/tonne (aluminium)



Source: Authors' construct

Figure 28 World alumina refinery and bauxite mine production and bauxite reserves



The other critical factors from past industrialisation efforts which should guide the future include:

- **Electricity: Cheap and reliable electricity is fundamental to any competitive industrialisation process.** However, industrial uptake in Ghana has been significantly hindered in the past by costly and unreliable electricity.[155] For Ghana to generate higher value-add from processing and value chain

[154] For example, Guinean FOB bauxite for delivery to China in Q3 2021 was about USD50.50 a tonne. See https://www.reuters.com/business/guinea-bauxite-prices-rise-political-turmoil-2021-09-06/. See also https://trade-metal.com/bauxite-ore-c930.html; https://en.institut-seltene-erden.de/aktuelle-preise-von-basismetallen; https://pubs.usgs.gov/periodicals/mcs2020/mcs2020-bauxite-alumina.pdf

[155] Acheampong, T., Menyeh, B. O., & Agbevivi, D. E. (2021). Ghana's Changing Electricity Supply Mix and Tariff Pricing Regime: Implications for the Energy Trilemma. *Oil, Gas & Energy Law*, *19*(3).
Abokyi, E., Appiah-Konadu, P., Sikayena, I., & Oteng-Abayie, E. F. (2018). Consumption of electricity and industrial growth

activities from critical minerals processing, refining and even smelting (such as the case of aluminium), industrial electricity pricing has to be cost-competitive instead of the current cost-prohibitive regime. To illustrate this point, VALCO, which is the largest individual consumer of electricity in Ghana with the 200,000 tonnes per annum aluminium smelter in Tema, is only currently able to operate one out of its six potlines, representing a 17% capacity. This is due to a shortage in the supply of relatively cheaper hydroelectricity. Statistics published by Ghana's Energy Commission show, for example, that VALCO operating on two pot-lines will use 5.0% of projected total electricity consumption in 2021.[156] In other words, for Ghana to benefit from critical minerals-led industrialisation, a relatively cheap supply of power under a long-term bulk supply contract is required. VALCO, for example, will require 380 megawatts (MW) to operate its six potlines at 75MW per potline. This excludes refining operations.[157]

- **Rail, road and port infrastructure:** There is a need to utilise roads and rail to transport finished products from mine and processing sites and from linkage industries across Ghana. For example, several kilometres of new and upgraded rail lines are needed, including that from Kumasi to Takoradi and extension to the northern parts of the country, to fully leverage the country's iron ore, manganese and bauxite resources. For lithium, the closeness of the Ewoyaa site in the Central Region to the Takoradi Port in the Western Region (less than 100 km) partly reduces some of the transportation costs.

5.2.2 Need for well-resourced geological information management as the basis for contract negotiations

One of the key issues that have often been cited for Ghana signing hitherto bad or one-sided extractives contracts in the past with international investors has been the lack of good geological data to underpin or strengthen the State's hand in negotiations. This is a shared issue across critical minerals, exacerbated by the time-constrained manner in which new projects are emerging. This is a particularly crucial issue to understand not only the extent of mineral deposits but to ensure robust ESG safeguards, particularly in ESIA's processes.

As has been shown oftentimes in several studies[158], Ghana and several developing countries enter into contractual negotiations with investors with a weak hand because they lack good quality data on the types, quality and commerciality of the mineral resources. The Africa Mining Vision (AMV)[159] poignantly captures the essence of the challenges as follows:

> *"The less that is known about the potential value of a resource, the greater the share of the rents that the investor will understandably demand [extremely favourable tax regime], due to the high risk of discovering or dimensioning the resource, which may be turn out to be sub-economic."*

in the case of Ghana. *Journal of Energy*, *2018*.
Kumi, E. N. (2017). *The electricity situation in Ghana: Challenges and opportunities* (p. 30). Washington, DC: Center for Global Development.

[156] http://www.energycom.gov.gh/planning/data-center/energy-outlook-for-ghana?download=120:energy-outlook-for-ghana-2021, at p.25

[157] Acheampong, T. and Mensah, K. A., 2018. Towards an Integrated Bauxite and Aluminium Industry in Ghana. Natural Resources Governance Institute. http://dx.doi.org/10.13140/RG.2.2.17985.40804

[158] ACEP (2016). Pressing The Undo Button: A Policy Gap Analysis of Ghana 'S Minerals and Mining Sector to Optimize Gains from the Sheini Iron Ore Wealth. https://acep.africa/file/2019/11/SHEINIPOLICYGAPFINALREPORT.pdf

[159] United Nations. Economic Commission for Africa; African Union Commission (2009-02). Africa Mining Vision. Addis Ababa. https://hdl.handle.net/10855/23743, p.15

AMV also advocates for countries to have dedicated action plan to deal with "geological and mining formation systems" and "research and development". These two are among the nine (9) key clusters [work themes] of the AMV.[160]

To support good quality data gathering, we strongly advocate allocating a portion of the Mineral Development Fund to fund extensive geological campaigns by both the Minerals Commission, Geological Survey Authority, GIISDEC and GIADEC to improve the data quality and availability, particularly for certain critical base metals. Section 5 of the Mineral Development Fund Act, 2016 (Act 912) allows the amounts of money in the Fund to be applied not only to address the harmful effects of mining in affected communities but to *"undertake minerals related research and development of capacity in human resource for mining institutions and institutions that train manpower for the regulatory institutions"*…*"undertake projects aimed at promoting the mining sector"* and *"support the policy planning, evaluation and monitoring functions of the Ministry in respect of mining-related activities".* These sections of the law can be broadly interpreted to fit within the wider remit of allocating Mineral Development Fund portions to fund extensive exploration campaigns. Such data gathering and processing exercise will significantly improve Ghana's bargaining hand in mineral lease negotiations, ensuring a much bigger government take in projects and ultimately more revenues to fund socio-economic needs.

5.3 Case study: how Ghana's participation in the EITI has helped improve extractives governance and how to improve and deploy this for critical minerals

In 2003, Ghana signed on to the Extractive Industry Transparency Initiative (EITI) protocols which seek to promote the open and accountable management of extractive resources. Following this, the country has enacted several required implementation structures, leading to the publication of fifteen (16) reports for mining and seven (9) reports for oil and gas.[161] Ghana also became the first country to apply the EITI principles and criteria to mining as well as the first to disaggregate EITI data, and the first country to implement the EITI initiative at the sub-national level. This led to the country being declared EITI compliant in 2010 and 2016 following international validation.[162] The 2016 international validation resulted in Ghana being proclaimed as a star performer in using EITI to influence policy reforms.

Annual EITI reports capture revenue generations, transparency and accountability of both national and sub-national levels as well as revenue management issues. The reports also capture other specific institutional challenges that impact both revenue generation and management as well as corporate practices of both state agencies and international companies, which affect revenue mobilisation. The issues raised in the EITI reports are often used by the government, civil society, the media and mining companies as the basis for dialogue to enhance the transparency and accountability of all stakeholders involved in the mining value chain.

EITI reporting has highlighted gaps in the way Ghana's extractive sector is managed, which have led to changes to the minerals fiscal regime governing the sector, such as:

- The revision of the royalty rate from a sliding scale of 3–6% to a fixed rate of 5%.
- Variation of the corporate income tax rate from 25% to 35%.
- Limitation of the period of capital allowance recovery to 20% over 5 years at a straight-line depreciation.
- Higher ground rents of about GHC36.50/Acre (GHC9,000/sq. km)

[160] Dauda, S. (2020). Operationalising the "Africa Mining Vision": critical reflections from Ghana. *Canadian Journal of Development Studies/Revue canadienne d'études du développement*, *41*(3), 504-524.
Pedro, A. M. (2016). The Africa Mining Vision as a model for natural resource governance in Africa. In *Governing Natural Resources for Africa's Development* (pp. 35-60). Routledge.
Busia, K., & Akong, C. (2017). The African mining vision: perspectives on mineral resource development in Africa. *Journal of Sustainable Development Law and Policy (The)*, *8*(1), 145-192.
Hilson, G. (2020). The Africa Mining Vision: a manifesto for more inclusive extractive industry-led development?. *Canadian Journal of Development Studies/Revue canadienne d'études du développement*, *41*(3), 417-431.
[161] See https://eiti.org/ghana
[162] ibid

- Ring-fencing
- Review of VAT and withholding taxes, and
- Renegotiation of the stability agreements of Newmont and AngloGold.

From a systematic data use standpoint, there is an opportunity to analyse and demonstrate how previous GHEITI (EITI) disclosures can inform forward-looking decisions, especially in the context of critical minerals, thus inspiring further disclosures. In this regard, we review historical EITI data (production, revenue, expenditure) to inform some of the policy choices that Ghana can make regarding critical minerals vis-à-vis the energy transition.

5.3.1 Analysing mining revenue disclosures – what can we learn about the performance of Ghana's mineral commodities and oil and gas?

Disclosed revenue data from 2004-2019 indicates that bauxite and manganese, which are the critical minerals currently mined in Ghana, generate paltry returns to the State compared to gold and or oil and gas (Table 6 and Figure 29). A multi-year review of trends in production volumes and values for both bauxite and manganese clearly demonstrates that not much value is being generated from these sectors despite significant production volumes. For example, **Ghana exported an estimated 1.1 million metric tonnes of bauxite[163] in 2019 at a reported US$32 per tonne[164], generating about US$35.2 million in export value** (Figure 30). **The State, however, only netted US$1.47 million of revenues, translating to 4.17% value retention per tonne of export** (Table 6).

The story is the same for manganese, where the value retention is very low due to the export of these commodities in their raw form with little to no value addition. **Interestingly, upstream oil and gas, which has only been exported from Ghana since 2011, has generated more revenues than the combined bauxite, gold, and manganese revenues.** Had Ghana decided to refine the bauxite into alumina before exporting, the country could have generated an estimated US$330 million using a conservative alumina price of US$300 per metric tonne.[165] **This is 9.4 times more value created than just exporting raw bauxite.** Clearly, this narrative must change if Ghana is to earn more revenues and also create wider value chain opportunities from its critical minerals industry, which would be catalysed by a forecasted boom in demand due to the global energy transition. **Ghana can increase revenue from the critical mining sector by implementing smarter policies that plug into capturing more share of the global value chains due to soaring demand**.

[163] https://ghanachamberofmines.org/wp-content/uploads/2020/07/2019-Mining-Industry-Statistics-and-Data-for-Ghana.pdf, at p.37

[164] https://www.statista.com/statistics/1199232/monthly-bauxite-prices-in-ghana/

[165] See Section 5.2 for a detailed discussion of this

Table 6 Total revenues for four commodities in Ghana, 2004-2019 (USD million)

Years/Commodity	Bauxite	Gold	Manganese	Oil and Gas	Grand Total (Mining: Bauxite, Gold and Manganese)	Grand Total (Mining plus Oil and Gas)
2004	0.36	25.26	1.40	-	27.02	27.02
2005	0.43	42.82	1.40	-	44.65	44.65
2006	0.67	64.40	1.15	-	66.22	66.22
2007	0.56	59.95	1.26	-	61.77	61.77
2008	0.45	86.82	3.93	-	91.19	91.19
2009	0.56	103.01	8.34	-	111.92	111.92
2010	0.73	200.49	8.55	-	209.76	209.76
2011	0.45	464.96	32.94	444.12	498.35	942.47
2012	1.08	587.73	15.70	541.98	604.51	1,146.49
2013	1.66	382.84	18.08	846.53	402.59	1,249.12
2014	1.94	315.59	15.33	978.89	332.86	1,311.75
2015	1.59	221.18	4.74	396.17	227.51	623.68
2016	2.01	232.23	8.67	247.18	242.91	490.08
2017	2.30	325.19	18.84	540.41	346.33	886.74
2018	2.58	353.45	50.09	977.12	406.13	1,383.25
2019	1.47	407.10	34.83	937.58	443.40	1,380.98
Grand Total	18.85	3,873.02	225.25	5,909.99	4,117.12	10,027.11

Data Source: EITI and PIAC

Figure 29 Total revenues for three commodities in Ghana, 2004-2019 (%)

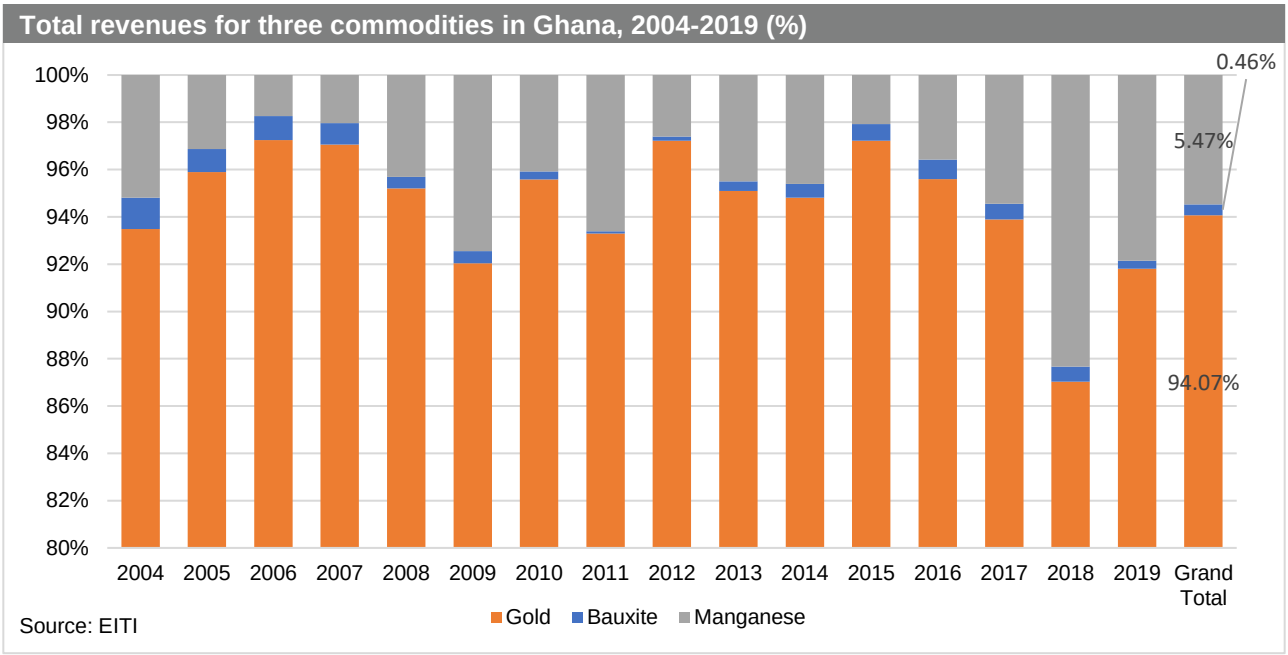
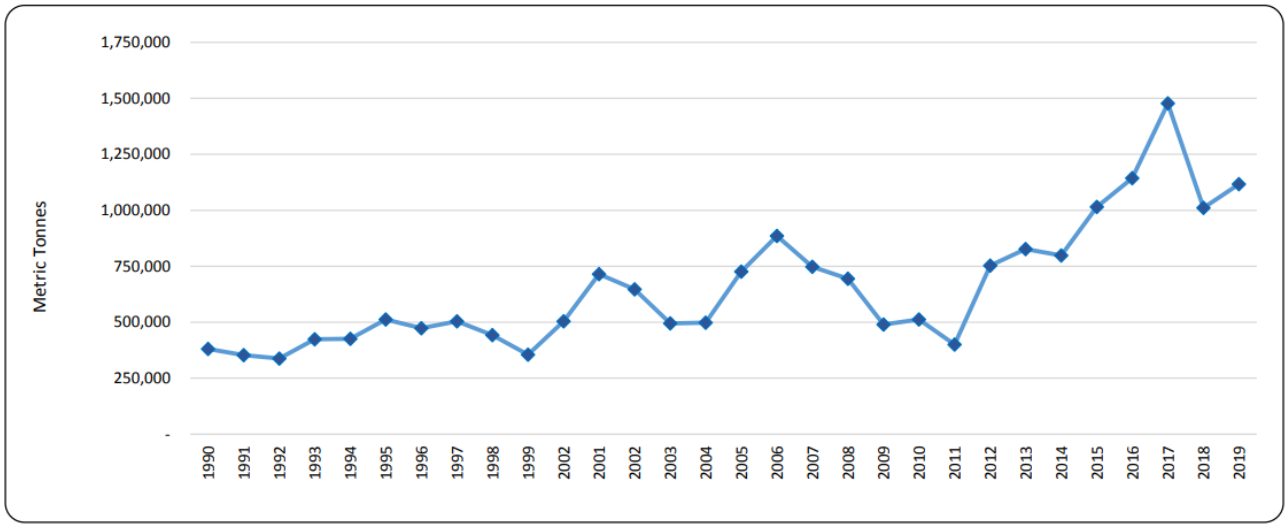


Figure 30 Export Trend for Bauxite (1990 – 2019)



Source: Ghana Chamber of Mines Annual Reports; Minerals Commission; Bank of Ghana

5.4 Other country case studies on leveraging the critical minerals value chain

This section reviews and discusses how the emerging fiscal, legal and regulatory regimes reflect recent and future developments in the mining sector in other jurisdictions in the light of the energy transition.

5.4.1 Latin America: Chile, Mexico, Bolivia and Argentina

Chile's attempt at developing and capturing a larger share of the EV value chain can serve as a guide for Ghana and SSA countries. Chile is one of the world's largest mining countries, responsible for an estimated 28% of global copper production, as well as being the world's second-largest lithium producer (22% share of world production).[166] The country also has the largest proven lithium reserves in the world.[167] Chile's mining sector contributes 11% of the country's and more than 50% of the country's total exports by value.[168] In March 2018, the Chilean government signed a deal with South Korea's POSCO and electronics giant Samsung SDI to build factories in the country which would produce EV battery parts — cathode materials such as Nickel Cobalt Aluminium and Nickel Cobalt Manganese.[169] In return, through CORFO, a government investment agency that oversees the country's lithium resources, Chile would provide a guaranteed supply of lithium at an agreed fixed price for up to 30 years. While reports indicate that the Chilean government has not been able to deliver on the promised volumes, the policy intent or signalling is right. Other reports indicate that what was required under the contractual agreement was lithium hydroxide and not lithium carbonate, which is what was being supplied.[170]

The Chilean government's policy intent is to capture as much of the lithium value chain as possible instead of just exporting the raw materials. In this regard, CORFO, the Chilean Economic Development Agency in 2019, launched a public campaign to attract foreign investors that are interested in transforming lithium in the

[166] Chile - Mining (2022). Available at: https://www.trade.gov/country-commercial-guides/chile-mining
[167] Lithium Data Sheet - Mineral Commodity Summaries 2020: https://pubs.usgs.gov/periodicals/mcs2020/mcs2020-lithium.pdf
[168] Chile - Mining (2022). Available at: https://www.trade.gov/country-commercial-guides/chile-mining
[169] South Korea's POSCO, Samsung SDI agree to build cathode plant in Chile by 2021: https://www.reuters.com/article/us-posco-chile-idUSKCN1GN04G
[170] *POSCO reportedly pulls out of battery plant plans in Chile* (2019). Available at: https://www.mining-journal.com/energy-minerals-news/news/1365789/posco-reportedly-pulls-out-of-battery-plant-plans-in-chile and https://www.reuters.com/article/us-chile-lithium-posco-idUSKCN1TM2LR

highly prospective Salar de Atacama region into value-added products such as batteries within the country.[171] In return, CORFO would guarantee the investors a preferential price which is a 20% discount on the weighted average FOB (Freight on Board) price of lithium products exported by Sociedad Química y Minera (SQM) in the last six months.[172]

Following the referendum in 2020 and the subsequent writing of a new constitution, Chile has sought to retain more control of its mining industry via changes to the fiscal regime and other regulatory initiatives. In August 2021, Chile's Upper House Senate delayed a vote on a bill which sought to ask mining more taxes by adding a progressive royalty rate to lithium and copper prices — that is, index the tax rate to the price of copper and ore grade starting at a base rate royalty of 3% on copper and lithium sales.[173] The Bill was approved by the Lower House earlier in May 2021.[174] Also, there has been controversy in the consultation processes as not involving all the stakeholders, especially the local communities[175] , as well as in the environmental management of these lithium projects[176], especially the depletion of the water table. These signal important lessons for other EITI countries.

Furthermore, the cases of Mexico[177] and Bolivia[178], both at different discussions on the nationalisation of lithium, are also useful to explore. In Mexico, the country's Lower House of Congress, in April 2022, passed a bill amending some portions of a 1992 legislation which allows the State to nationalise the country's lithium reserves.[179] Chile and Argentina are, on the other hand, at different stages of discussing the categorization of lithium as a strategic mineral. Argentina recently organised a multidisciplinary expert forum that looks precisely at opportunities to leverage the critical minerals value chain for lithium.[180] Ghana could consider setting up such a forum, leveraging the findings of this assessment report as a key input into developing a critical minerals action plan.

5.4.2 Sub-Saharan Africa: Democratic Republic of Congo and Zambia

Producing battery materials in the DRC could lower supply-chain emissions and add value to the country's cobalt. The DRC is one of the most natural resource-rich countries in the world, but these have often not been utilised for the broader development of the citizens. The country's mineral resources have fueled conflict and strife, manifesting in unending regional civil wars.[181] In an attempt to turn the proverbial resource curse

[171] *Corfo calls specialized lithium producers to invest in Chile with stable supply and at a preferential price | InvestChile* (2022). Available at: https://investchile.gob.cl/corfo-calls-specialized-lithium-producers-to-invest-in-chile-with-stable-supply-and-at-a-preferential-price

[172] ibid

[173] *Chile makes a play to add to its lithium market influence* (2022). Available at: https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/chile-makes-a-play-to-add-to-its-lithium-market-influence-67101005

[174] Chile copper miners cry foul as royalty bill advances to Senate - https://www.reuters.com/world/americas/chile-copper-miners-cry-foul-royalty-bill-advances-senate-2021-05-06

[175] Kalazich, F. et al. (2019) "'That's the problem with that lake; it changes sides': mapping extraction and ecological exhaustion in the Atacama", *Journal of Political Ecology*, 26(1). https://doi.org/10.2458/v26i1.23169

[176] Liu, W., & Agusdinata, D. B. (2020). Interdependencies of lithium mining and communities sustainability in Salar de Atacama, Chile. *Journal of Cleaner Production*, *260*, 120838. https://doi.org/10.1016/j.jclepro.2020.120838

[177] *Mexico's lower house backs lithium nationalization plans* (2022). Available at: https://www.mining.com/mexicos-lower-house-backs-lithium-nationalization-plans

[178] Hancock, L., Ralph, N., & Ali, S. H. (2018). Bolivia's lithium frontier: Can public private partnerships deliver a minerals boom for sustainable development?. *Journal of cleaner production*, *178*, 551-560. https://doi.org/10.1016/j.jclepro.2017.12.264

[179] *Mexico's lower house supports move to nationalise lithium reserves* (2022). Available at: https://www.mining-technology.com/news/mexicos-lower-house

[180] Foro Interuniversitario de Especialistas en Litio - Inicio, Forolitio.cin.edu.ar. Available at: https://forolitio.cin.edu.ar. See also https://publications.iadb.org/es/litio-en-la-argentina-oportunidades-y-desafios-para-el-desarrollo-de-la-cadena-de-valor

[181] Eichstaedt, P. (2011). *Consuming the Congo: War and conflict minerals in the world's deadliest place*. Chicago Review Press.

around, the DRC has launched a series of reform initiatives which include an increasingly assertive drive for local content and capturing more of the global minerals value chain, especially for copper and cobalt. A fundamental challenge for the DRC's mining industry is the lack of refining capacity to capture more of the value chain in mineral extraction and production. The DRC's first large-scale smelter came online only in 2020. The DRC produced about 70% of global cobalt supply in 2020, according to BloombergNEF estimates.

A 2021 study commissioned by the UN Economic Commission for Africa, Afreximbank, the African Development Bank, the Africa Finance Corporation, the Arab Bank for Economic Development in Africa, the African Legal Support Facility, and the UN Global Compact and led by BloombergNEF on a unified African supply chain identified DRC as a "favourable destination for the manufacturing of sustainable battery materials used in high-nickel batteries".[182] For example, the study[183] highlighted that the DRC could "leverage its abundant cobalt resources and hydroelectric power to become a low-cost and low-emissions producer of lithium-ion battery cathode precursor materials". **In terms of cost, building a 10,000 metric-ton cathode precursor plant in the DRC was shown to be competitive at scale**, costing an estimated US$39 million, whereas a similar plant in the United States, China and Poland would cost an estimated US$121 million, US$112 million, and US$65 million, respectively (Figure 31). **Furthermore, the DRC could not only be cost-competitive, but the cells produced will also have a lower carbon (environmental) footprint due to the use of hydropower.** Should this plant be eventually built in the DRC, it would help the country reduce the export of materials such as Cobalt to China (where the precursor market is mostly concentrated) which are subsequently used for battery manufacturing using more carbon-intensive energy forms. Even countries like Australia are looking to gain a larger share of the precursor battery market by moving further downstream to produce precursor materials to complement their mineral raw materials.[184]

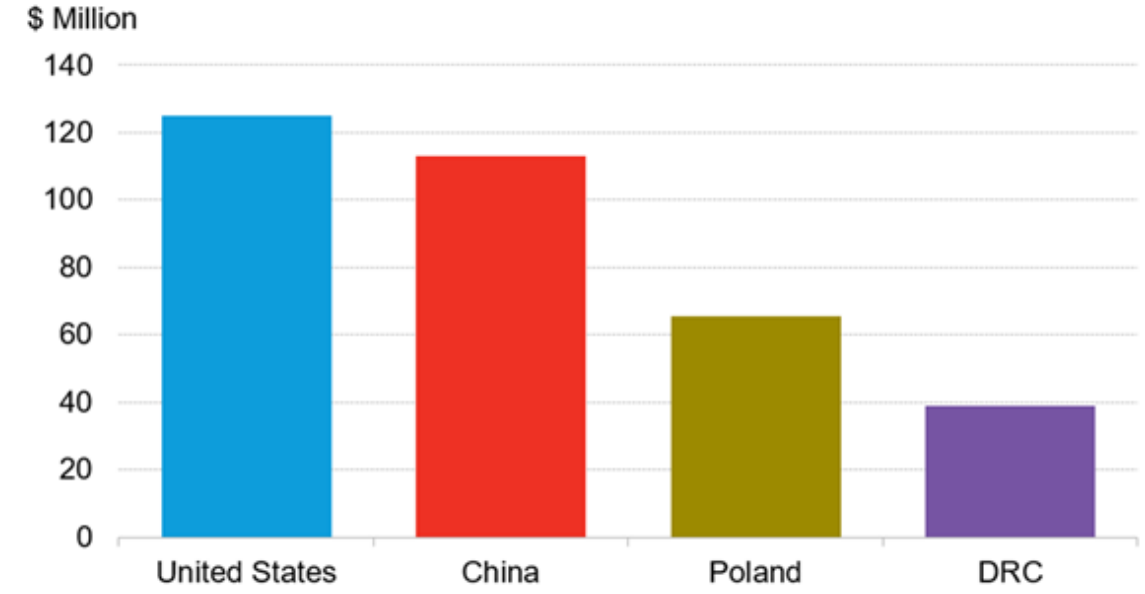
Radley, B., & Vogel, C. (2015). Fighting windmills in Eastern Congo? The ambiguous impact of the 'conflict minerals' movement. *The Extractive industries and society*, *2*(3), 406-410. https://doi.org/10.1016/j.exis.2015.05.005
Parker, D. P., & Vadheim, B. (2017). Resource cursed or policy cursed? US regulation of conflict minerals and violence in the Congo. *Journal of the Association of Environmental and Resource Economists*, *4*(1), 1-49. https://doi.org/10.1086/689865

[182] *Producing Battery Materials in the DRC Could Lower Supply-Chain Emissions and Add Value to the Country's Cobalt | BloombergNEF* (2021). Available at: https://about.bnef.com/blog/producing-battery-materials-in-the-drc-could-lower-supply-chain-emissions-and-add-value-to-the-countrys-cobalt

[183] BloombergNEF (2021). "The Cost of Producing Battery Precursors in the DRC. https://assets.bbhub.io/professional/sites/24/BNEF-The-Cost-of-Producing-Battery-Precursors-in-the-DRC_FINAL.pdf

[184] ibid

Figure 31 Capital cost to build a 10,000 metric ton battery precursor plant



Source: BloombergNEF. Note: The cost is for a 10,000 metric tons precursor facility and does not include any government subsidy.

Source: BloombergNEF (2021)

Likewise, in Zambia, copper and copper concentrates account for 12% of Zambia's GDP and 70% of its exports. **The new government is focusing on its objective of seeking to increase local processing from 30% to 100% of domestic production.** The ZCCM Investments Holdings PLC, a special purpose vehicle created by the Zambian government (78% government shares and 28% other minority shareholders), has sought to increase its stake in several mining chain companies in the country. ZCCM-IH has investments in the following companies in partnership with several leading mining firms such as First Quantum Minerals and Glencore:

- Central African Cement Ltd
- Chambishi Metals Plc
- Chibuluma Mines Plc
- Consolidated Gold Company of Zambia
- CNMC Luanshya Copper Mines Plc
- Copper Trees Minerals Ltd
- Copperbelt Energy Corporation Plc
- Investrust Bank Plc
- Kabundi Resources Ltd
- Kansanshi Mining Plc
- Kariba Minerals Ltd
- Konkola Copper Mines Plc
- Lubambe Copper Mines Plc
- Maamba Collieries Ltd
- Misenge Environmental & Technical Services Ltd
- Mopani Copper Mines Plc
- Mushe Milling Ltd
- Ndola Lime Company Ltd
- NFC Africa Mining Plc
- Rembrandt Properties Ltd
- Zambia Gold Company Ltd

ZCCM-IH is listed on both the Lusaka Securities Exchange in Zambia, the London Stock Exchange and the Euronext Access Exchange in Paris, which further ensures additional layers of corporate governance. Zambia's ZCCM-IH and Chile's Corporación Nacional del Cobre (CODELCO) are relatively better managed than Gecamines, their counterpart in the DRC (Table 7). Gécamines has been cited in several studies for entering into opaque mining deals and making poor investment decisions that serve private interests rather than the public.[185] A 2017 report by the Carter Centre indicates, for example, that "…of the US$1.1 billion that Gécamines was contractually entitled to between 2011 and 2014, US$750 million cannot be reliably tracked to Gécamines' accounts".[186] More recently, DRC's anti-corruption Czar indicated that the country's central bank has failed to account for US$530 million, which Gecamines claims it paid to the government during the administration of former President Joseph Kabila.[187]

The cost of electricity is a major cost constraint in Zambia as unit wholesale prices are often twice the retail prices. The supply, however, is relatively reliable (and coal-fired in some cases). Copperbelt Energy Corporation (CEC) and Zambia Electricity Supply Corporation (ZESCO) are dedicated to supplying mines power but have ongoing disputes around lucrative contracts.

Table 7 Composite resource governance index scores table for Zambia, DRC and Chile

	ZAMBIA (MINING) score (#/100)	DEMOCRATIC REPUBLIC OF CONGO (MINING) score (#/100)	CHILE (MINING) score (#/100)
Value realization	**58**	**52**	**74**
Licensing	47	64	51
Taxation	65	67	68
Local impact	50	42	86
State-owned enterprises	69	35	90
Revenue management	**35**	**35**	**81**
National budgeting	35	33	70
Subnational resource revenue sharing	-	36	-
Sovereign wealth funds	-	-	92
Enabling environment	**58**	**12**	**90**
Voice and accountability	71	22	93
Government effectiveness	50	5	91
Regulatory quality	57	12	94
Rule of law	73	6	93
Control of corruption	71	17	93
Political stability and absence of violence	80	7	84
Open data	7	16	80

Source: RGI/NRGI

[185] Mutize, M., & Tefera, E. (2020). The Governance of State-Owned Enterprises in Africa: an analysis of selected cases. *Journal of Economics and Behavioral Studies*, *12*(2 (J)), 9-16. https://doi.org/10.22610/jebs.v12i2(J).2992
Tshinu, G. M. (2022). Unpacking the Resource Curse and Realism Challenges on Economic Development in the Democratic Republic of Congo (DRC): Case of Gecamines. In *Handbook of Research on Resource Management and the Struggle for Water Sustainability in Africa* (pp. 318-336). IGI Global.

[186] A State Affair: Privatizing Congo's Copper Sector. https://www.cartercenter.org/resources/pdfs/news/peace_publications/democracy/congo-report-carter-center-nov-2017.pdf

[187] *Congo Anti–Graft Chief Says $530 Million Mining Payments Missing (*2021). Available at: https://www.bloomberg.com/news/articles/2021-12-16/congo-anti-graft-chief-says-530-million-mining-payments-missing

5.5 Summary

The extractives industry is often associated with significant corruption. The unique features of the extractive sector make it particularly susceptible to the various forms of corruption and illicit financial flows (IFFs). These corruption risks are exacerbated by weaknesses in governance systems and political institutions. Within Ghana's mining sector, corruption risks have manifested in the abuse of the licensing process to award mining contracts (both for large and small scale miners) to politically exposed persons (PEPs) and well-connected insiders — sometimes using companies registered in offshore tax havens and secrecy jurisdictions —, companies with very little financial and or technical muscle to sustain exploration campaigns, and inability to enforce environmental governance standards.

Corruption risks could become elevated in Ghana with the soaring demand for critical minerals to power the energy transition. While most of the critical minerals in Ghana are likely to be mined and extracted at an industrial scale for it to benefit from economies of scale, it could nonetheless drive a new boom or rush for licenses by both large and small scale miners who are hitherto unqualified to hold such licenses. Ghana has sought to mitigate some of the corruption risks within the mining sector by introducing a beneficial ownership regime for company registration, launching a national mining repository/cadastre, and contracts portal, among others. However, we encourage the Minerals Commission and other State institutions to broaden such disclosures for new contracts involving critical minerals.

One of the key lessons from our past resource-based industrialisation effort is the need to ensure synergies between energy and industrial policies — the need for integrated mining planning. The Volta River Project (VRP) of the 1960s is one such example of the deep-rooted fundamental thinking that is required if Ghana is to fully take advantage of the opportunities that the energy transition presents with soaring demand for critical minerals. The other critical factors from past industrialisation efforts which should guide the future include the need for cheap and reliable electricity – it is fundamental to any competitive industrialisation process – and the provision of adequate rail, road and port infrastructure to transport finished products from mine and processing sites and from linkage industries across Ghana.

To support in good quality data gathering, the report strongly advocates allocating a portion of the Mineral Development Fund to fund extensive geological campaigns by both the Minerals Commission, Geological Survey Authority, GIISDEC and GIADEC to improve the data quality and availability, particularly for certain critical base metals.

Disclosed revenue data from 2004-2019 indicates that bauxite and manganese, which are the critical minerals currently mined in Ghana, generate paltry returns to the State compared to gold and or oil and gas. Had Ghana decided to refine the bauxite into alumina before exporting, the country could have generated an estimated US$330 million of export value and more revenues instead of the paltry US$35.2 million in export value. Clearly, this narrative must change if Ghana is to earn more revenues and also create wider value chain opportunities from its critical minerals industry, which would be catalysed by a forecasted boom in demand due to the global energy transition. Lessons on value addition from other commodity-exporting countries such as Chile, Zambia and DRC can serve as a useful guide for Ghana.

6 Conclusions and policy recommendations

This section covers the following themes:

- Highlight recommendations, including practical guidance for mitigating risks and tapping into opportunities of the energy transition for Ghana's critical minerals industry.
- Propose transparency parameters that future GHEITI MSG reports could cover to inform public debates on the energy transition.

6.1 Summary

Most global governments have committed to doing more to tackle the existential threat of climate change, which is one of the foremost challenges facing humanity today. In giving meaning to this, global energy systems are rapidly transitioning from their hitherto massive dependence on conventional (fossil) fuels like oil and gas and coal to low and net-zero energy sources such as renewables and new mobility solutions like electric cars. For example, at last November's COP26 conference in Glasgow, United Kingdom, several global governments announced new investments in clean energy technologies, including making commitments to phasing down coal power in the next few decades. Additionally, more than 130 countries, including major equatorial ones such as Brazil, the Democratic Republic of the Congo and Indonesia, pledged to halt and reverse forest loss and land degradation over the next decade.

These low carbon energy forms require significant amounts of certain critical minerals such as lithium, cobalt, and manganese. Ghana, which has had a traditionally strong mining industry as one of its main economic anchors, has an opportunity to participate in this new global critical minerals value chain. Ghana has five of these minerals in various degrees of abundance: **manganese, bauxite/aluminium, iron ore, silica and lithium (new one).** Ghana has significant opportunities to develop the critical minerals value chain, allowing it to diversify its economic base and develop new industrial clusters with competitive and comparative advantages while sustaining viable long term jobs.

However, for Ghana to benefit from the transition, the development of value chains and beneficiation is key to avoiding a repeat of the paradox of plenty syndrome. Furthermore, developing value chains that also align with key continental strategic imperatives such as the African Union (AU) Agenda 2063, the African Continental Free Trade Area (AfCFTA), African Development Bank's (AfDB's) High 5s, and the Africa Mining Vision (AMV) is paramount. In planning to take advantage of the future opportunities, past lessons should guide Ghana and the continent: it is no longer justifiable to export raw minerals. However, to do this, structural bottlenecks need to be significantly addressed. These include the need for cheap and reliable dispatchable power to drive industrialisation. Likewise, good infrastructure such as roads and rail links to connect mines and spread spatial development more evenly is fundamental, especially in stemming the country's massive urbanisation. Finally, a stable investment regime and conducive business environment are necessary.

Below are the key findings of the report.

Global and local framing of the energy transition

1. **The energy transition, a pathway toward transforming the global energy sector to net-zero by 2050 and beyond, is no more a fringe idea.** The transition represents one of the most viable ways to mitigate the impacts of human-induced climate change. To put this into context, while it took 75 years for coal to be dethroned by oil as the main primary global energy source from 1900 to 1975, global governments are seeking to halve this time to 35 years for renewables share in the primary energy mix to catch up with oil at its peak in 1975. That is, about 50% of the global primary energy mix being RE by 2050 (net-zero).
2. **For many African countries, energy transition seems to be a tough sell and or ask.** A rapid transition means having to forego the significant oil and gas resources and revenues that have powered the economies of many of these countries, such as Nigeria and Angola, which could power new emerging producers such as Ghana, Tanzania, Uganda, Senegal, Mauritania and Mozambique.

3. **The energy transition is already having profound impacts on the global oil and gas market.** While prices have currently risen to near-decade highs mostly due to the ongoing Russia-Ukraine Conflict, in the longer term, the energy transition is anticipated to lead to lower demand and benefit lower-cost producers. Due to the transition, dwindling oil demand will push future prices towards the lower end of the marginal cost of the oil production curve. Thus, countries sitting at the lower end of the oil supply cost curve are likely to be the ones that will benefit as their barrels are likely to be produced and come to the market (that is, advantaged barrels) as compared to those at the mid to higher end of the cost curve.
4. **In the context of potential asset stranding due to the energy transition, Ghana's national oil company (GNPC) has sought to accelerate its drive towards more active participation in Ghana's upstream oil and gas industry via operatorship**. An example of this is GNPC's proposed controversial USD1.65-billion farm-out deal to acquire extra equity in the Deepwater Tano-Cape Three Points (DTCTP), and South Deepwater Tano (SDWT) blocks offshore Ghana and operated by Norwegian-based Aker Energy and sister company AGM Petroleum.
5. **Nevertheless, moving from the current fossil-based energy system to a cleaner one to meet global net-zero goals requires deploying new energy technologies**, many of which rely on critical minerals such as copper, lithium, nickel, manganese, graphite, cobalt and other rare earth elements. Critical minerals are broadly understood to mean those minerals fundamental to the fourth industrial revolution (4IR) and the global decarbonisation agenda — essential to producing high-tech, renewable energy and defence applications. For example, IEA estimates indicate that about four times (4X) more minerals from the current estimated 7 million tonnes (Mt) to 28 Mt are needed if the 2040 sustainable development scenarios (SDS) are to be met. Most of these new critical minerals will be used in electric vehicles and battery storage, electricity networks, and other low-carbon power generation.

Scope of proven critical minerals in Ghana, including the volumes

6. **The energy transition presents opportunities for countries with these critical mineral resources to capture a significant part of the global value chain**, such as producing electric vehicle (EV) battery components. In the African context, Ghana remains one of the leading mineral producing countries on the African continent. It has an opportunity to move away from the historical focus on gold mining.
7. **Ghana has some of the critical minerals needed for the energy transition in known and unknown commercial quantities** – these include manganese, bauxite/aluminium, iron ore, silica, and lithium. For example, Ghana has the second-largest reserves of bauxite deposits in Africa next to Guinea and recently discovered lithium in commercial quantities. **Ghana also has significant manganese reserves and has been producing in the Western Region since 1916 at Nsuta. Manganese is a key ingredient for producing cathode materials for electrical conduction: lithium-ion, alkaline and zinc-manganese batteries.** There are also significant occurrences in the Dixcove area, South Bole District in Northern Ghana, Axim Salman area and Wa. However, these need to be further studied, and the orebody well defined to attract the much-needed exploration and development investment. **The medium-grade Nsuta deposit is one of the high-quality blends suitable for electrolytic manganese metals used in stainless steel and manganese dioxide battery raw materials.** Ghana can move further down the value chain by building an Electrolytic manganese dioxide (EMD) facility in-country to reduce the global reliance of this material on South Africa and China. Europe's fast-growing battery market could be a potential market.
8. **Ghana currently has known iron ore deposits in Shieni in the northern region and Opon Mansi in the Western Region.** Renewable energy technologies such as wind turbines require significant amounts of iron ore, and copper and aluminium. Also, the iron core can be mixed with other raw materials like manganese, silica, limestone and charcoal/coking coal to produce steel. Studies by BloombergNEF show that "to build enough wind turbines to reach net-zero by 2050, 1.7 billion tons of steel will be needed." This is enough to make over 20,000 replicas of the iconic Golden Gate Bridge in San Franciso, United States of America. Ghana's iron ore deposits need significant infrastructure, especially railways, to evacuate them to steel production centres down the coast in the industrial Port City of Tema. Ghana could become a cost-competitive steel manufacturer to meet some of Africa's domestic demand. However, this requires relatively cheaper and more reliable electricity and improved environmental governance standards to curb or mitigate production lifecycle emissions (reduce the carbon footprint). Iron ore and steel production is a highly energy-intensive and polluting process.
9. **Regarding silica, some estimates indicate that Ghana has good quality silica sands/quartz sand from which silicon (silicon dioxide)**. Silicon is used to manufacture silicon chips and solar cells due to its excellent semiconductor properties. However, Ghana currently does not have a silica policy, defined

geological data and investment drive to attract capital to develop this resource. Therefore, there is a need for a geological study that includes a market scope and the feasibility of developing the deposits.

10. **Furthermore, the lithium resource estimate of the flagship high-purity, low contaminants Ewoyaa discovery in the Central Region has been increased by Atlantic Lithium Limited by nearly 50%.** In addition, it is reported that the company has signed an offtake agreement for 50% of the spodumene concentrate produced from the Ewoyaa mine during its operational life with global electric vehicle company Tesla.
11. **Electric vehicles represent a US$7 trillion market opportunity between today and 2030 and US$46 trillion between today and 2050. Ghana should give serious consideration to how they can create economic value-add and domestic jobs from this growth.** South Africa, Egypt, Morocco and Ghana have all implemented automotive policies to attract investments into their auto sectors. Ghana is an emerging automotive destination. As a new entrant, Ghana can work with automakers to build forward-facing assembly lines which prioritise new technologies such as electric vehicles. Leveraging the country's lithium and resources from other African countries, the government can formulate policies that attract and retain downstream manufacturing capacity in-country.
12. **Overall, Ghana can leverage its industrial raw materials to become a major hub for Africa and Europe in the energy transition.** However, this strategic action will require a detailed understanding of Ghana's resource advantage and recommendations to harness the value chain opportunities.

Review of the existing legal and regulatory regime guiding the mining sub-sector with particular emphasis on critical minerals

13. **The current legal and regulatory regime for mining in Ghana is largely adequate to address most of the prevailing issues in the industry; the challenge is not one of the laws but rather enforcement, including environmental governance, especially with artisanal mining.** The prevailing legal and regulatory instruments underpinning Ghana's mining industry are premised on Article 257(6) of the 1992 Fourth Republican Constitution. The preceding constitutional provision makes it imperative that all minerals, including critical minerals such as lithium and silica sand, are vested in the President in trust for the citizens of Ghana.
14. **Ghana's Minerals Commission is primarily responsible for developing and coordinating mineral sector policies and monitoring their implementation.** The new government of the New Patriotic Party (NPP) in 2018 and 2019 created two new vehicles to give a dedicated focus back to two other minerals: bauxite and iron ore. In this regard, the government passed the following laws to create two new vehicles — Ghana Integrated Iron and Steel Development Corporation (GIISDEC) and Ghana Integrated Aluminium Development Corporation (GIADEC) —similar to what pertained in the 1970s and early 1980s. While there are attempts to capture more of the value chain opportunities by creating dedicated state companies such as GIADEC and GIISDEC, there is a need to align this with the country's broader industrial policy and implementing vehicle of the Industrial Sector Support Programme (ISSP).
15. **Most of Ghana's mineral policies do not specifically mention critical minerals; however, they reference the components needed to develop a viable critical minerals value chain and employment generating opportunities**. Some of the principal objectives of the country's minerals and mining policy relevant for the development of the critical mineral include the need to (1) diversify the country's mineral production base to promote a more sustainable support base for the economy; (2) promote linkages (backward, forward and horizontal) to minerals produced locally to the maximum extent possible; (3) optimize tax revenue generation and ensure transparent and equitable distribution of mineral wealth; (4) assist in the development of skilled human resource and develop local industrial capacity for the mineral industry; and (5) use mining as a catalyst for wider investment in the economy Attaining these objectives, ultimately requires a delicate balance between safeguarding the interests of the State and investor community.
16. **While the intended objectives of the national minerals and mining policy are noble, there is a lack of synergy between it and other major climate policy initiatives, such as Ghana's nationally determined contribution (NDC).** Therefore, Ghana must align its critical mineral policies with a well-defined broader industrial development strategy and commitments to meeting climate targets as per the NDCs.
17. A closer analysis of the NDCs and the 2020 National Climate Change Report shows several potential projects. However, **these are not linked systematically to the country's industrial policy and long term aspirations. In essence, there is a lack of synergy between the lofty ideals of the NDCs, "how"**

they will be financed/attained and importantly, how a country like Ghana can leverage the opportunities therein to develop a new industrial base including in the critical minerals supply chain.

Potential fiscal, social and environmental risks and opportunities based on the resource mapping assessment

18. **One of the key lessons from our past resource-based industrialisation effort is the need to ensure synergies between energy and industrial policies — the need for integrated mining planning.** The Volta River Project (VRP) of the 1960s is one such example of the deep-rooted fundamental thinking required if Ghana fully takes advantage of the opportunities that the energy transition presents with soaring demand for critical minerals. However, for Ghana to benefit from leveraging the critical minerals supply chain as one of its growth anchors, it needs to systematically address the constraints to growth, namely: (1) provision of relatively cheaper and reliable electricity (especially for aluminium refining and smelting), (2) development of rail, road and port infrastructure to evacuate products to market, and (3) addressing environmental governance/ reducing the emissions output of mines and processing facilities.
19. In the context of the critical minerals needed for the energy transition, most of the five minerals available in Ghana — namely: manganese, bauxite/aluminium, iron ore, silica and lithium — are highly likely to be mined and processed by multinational miners together with State partners such as GIISDEC, GIADEC and MIIF. **Nonetheless, significant concerns have been raised about land compensation issues and the possible negative externalities (environmental impacts) of some extraction forms, particularly for bauxite and, to an extent, lithium**. For example, **most of Ghana's bauxite deposits lie within protected forest reserves, which raises environmental issues.**
20. **Ghana does not have a dedicated fiscal regime for the critical minerals sector; instead, what pertains is the normal royalty-tax (concession) system under the existing mineral development and investment agreements signed between Ghana and the various mining companies.** Several elements of Ghana's underlying mineral fiscal regime are inflexible and do not allow capture of enough value to the State, especially for an emerging critical minerals industry. These need reforming — for example, by considering adjustments to the State's 10% minimum free equity or carried interest or keeping the minimum equity at 10% but consider getting MIIF to own extra paid interest in proven critical minerals deposits (just as is done within the upstream petroleum industry via GNPC Explorco, a wholly-owned subsidiary of the national oil company)
21. **One of the key issues that have often been cited for Ghana signing hitherto bad or one-sided extractives contracts with international investors has been the lack of good geological data to underpin or strengthen the State's hand in negotiations.** To support good quality data gathering, we strongly advocate allocating a portion of the Mineral Development Fund to fund extensive geological campaigns by the Minerals Commission, Geological Survey Authority, GIISDEC and GIADEC to improve the data quality and availability, particularly for certain critical base metals.

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