Africa's critical minerals

Africa at the heart of a low-carbon future

MO IBRAHIM FOUNDATION

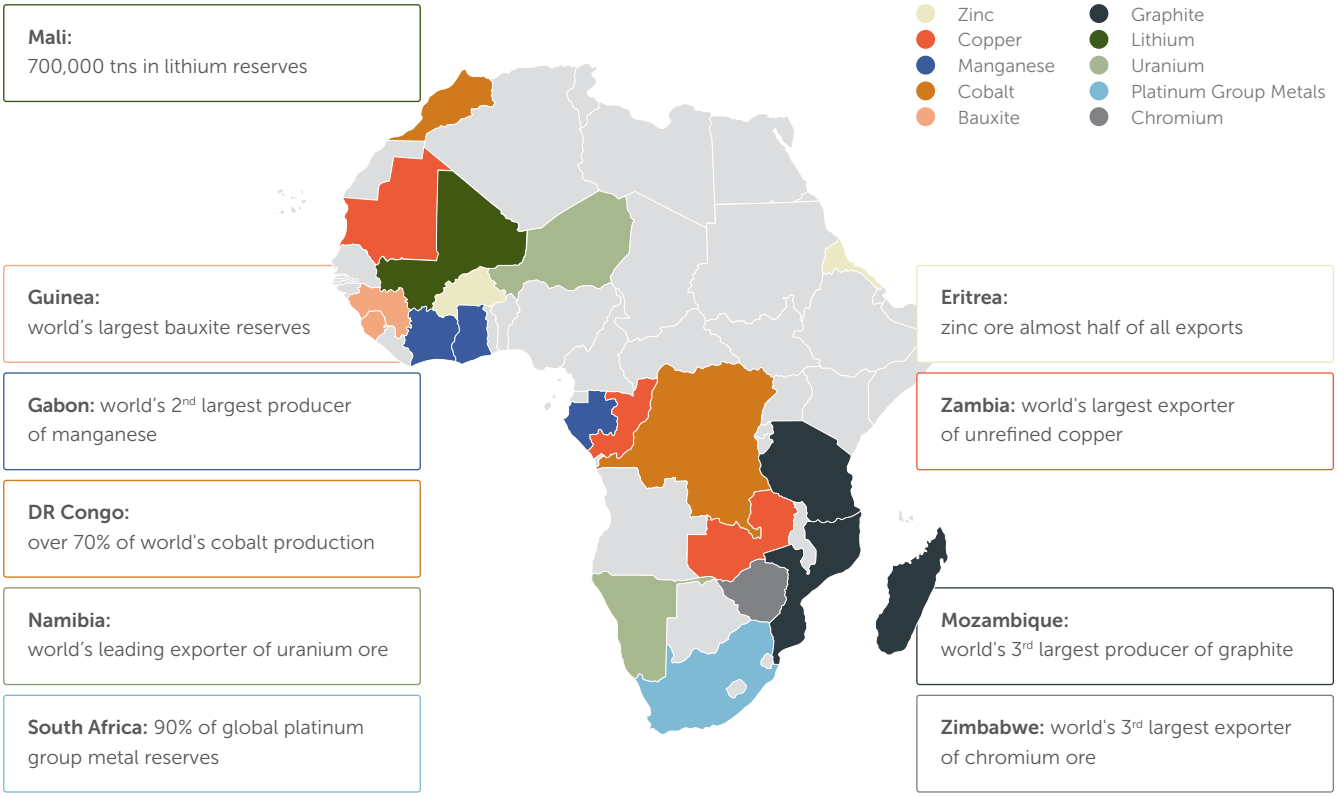
Africa's critical minerals place it at the heart of a global low-carbon future

Africa holds 30% of the world's mineral reserves, many of which are critical to renewable and low-carbon technologies including solar, electric vehicles, battery storage, green hydrogen, and geothermal. To meet the expected rise in global demand, production of minerals and metals such as lithium, graphite and cobalt will need to increase by nearly 500% by 2050. This cannot be achieved without Africa's resources.

Many such critical minerals are also increasingly taking centre-stage in global geo-politics, especially in the increasing competition between the US and China, specifically, China's strategic control over global critical mineral supply chains. Competition for access to the continent's critical materials will increase dramatically, placing Africa at the heart of the green energy future, both in environmental and geo-political terms.

For African countries this is an opportunity they cannot let pass them by, not just in economic and environmental terms, but also political. Africa has for too long been marginalised from the climate debate and bringing greater attention to Africa's centrality to the green transition can surely amplify the continent's voices in global forums.

African countries: selected low carbon minerals (2019)



Source: MIF based on Atlas of Economic Complexity, United States Geological Survey & World Nuclear Association

Africa's home to an array of critical minerals

Aluminium (Al): Guinean bauxite key for solar PV

Aluminium is used in most low-carbon technologies but particularly solar, where it is a key component in both the cell and the frames that hold solar cells together. It is also one of the main materials used in wires and cables, making it a key mineral for expanding electricity grids.

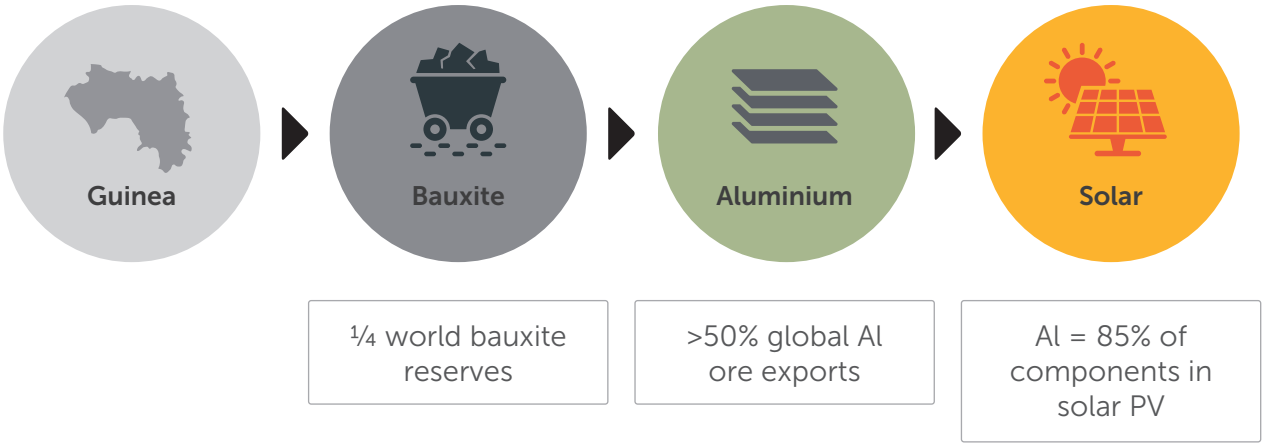
- Aluminium accounts for more than 85% of most solar PV (photovoltaic) components.

Bauxite is the most common aluminium ore, accounting for roughly 98% of primary aluminium production. Africa holds roughly one third of global bauxite resources, more than any other world region.

- Guinea alone holds almost one quarter of global bauxite reserves, more than any other country, and accounted for over half of global aluminium ore exports in 2020.

Demand for aluminium for solar power will have to more than double by 2050 in a scenario where warming is kept to below two degrees.

Guinea holds almost one quarter of global bauxite reserves.



Chromium (Cr): African chromium integral for many low-carbon technologies

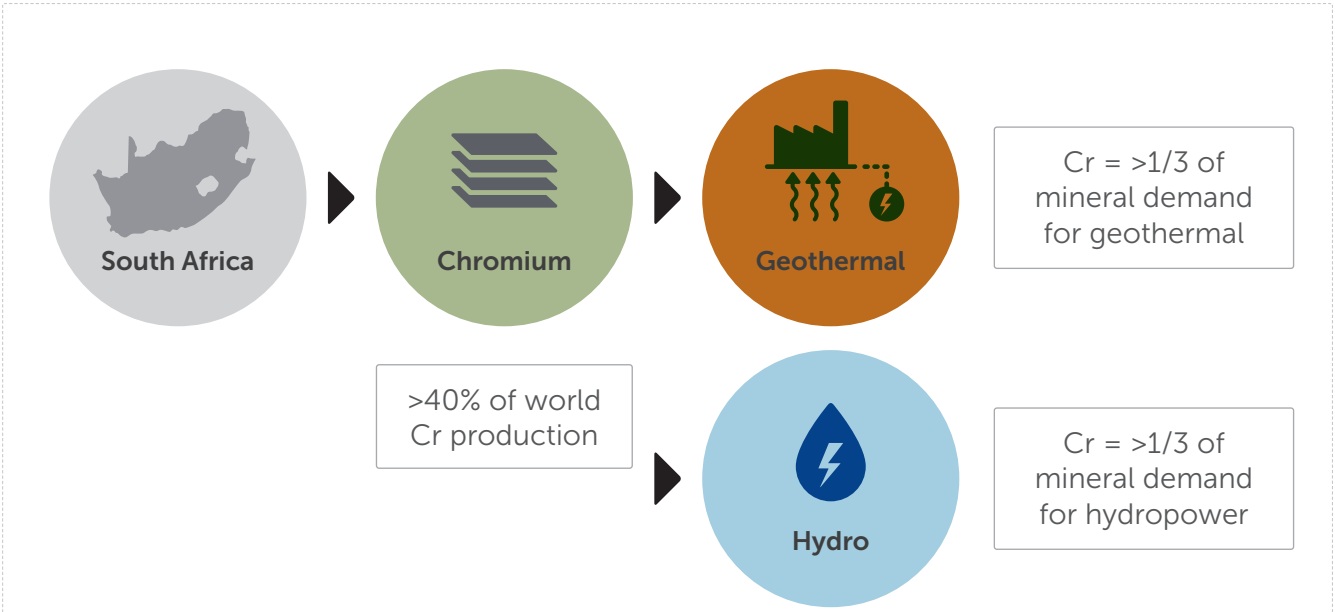
Chromium is an important mineral in concentrated solar power, geothermal, nuclear, hydropower, and wind technologies. There is little substitute for chromium in most end-uses.

- Chromium accounts for over one third of the mineral demand for both geothermal and hydropower energy.

95% of world chromium resources are concentrated in Southern Africa and Kazakhstan.

- South Africa alone accounted for 43.9% of the world's chromium production in 2021.
- African countries accounted for over 80% of global chromium ore exports in 2020.

The IEA predicts that based on current policies chromium demand will almost treble by 2030, while in a 'Sustainable Development Scenario' demand would more than quadruple.



IEA Sustainable Development Scenario

The IEA's Sustainable Development Scenario represents a gateway to the outcomes targeted by the Paris Agreement. It is based on a surge in clean energy policies and investment that puts the energy system on track to meet key Sustainable Development Goals (SDGs). In this scenario, all current net zero pledges are achieved in full and there are extensive efforts to realise near-term emissions reductions; advanced economies reach net zero emissions by 2050, China around 2060, and all other countries by 2070 at the latest. This scenario is consistent with limiting the global temperature rise to 1.65 °C.

African countries accounted for 80% of global chromium ore exports in 2020.

Cobalt (Co): Congolese minerals key for electric vehicles and energy storage

Cobalt is an essential mineral in lithium-ion batteries, used in electric vehicles and energy storage technologies. It is also important for wind energy and biogas.

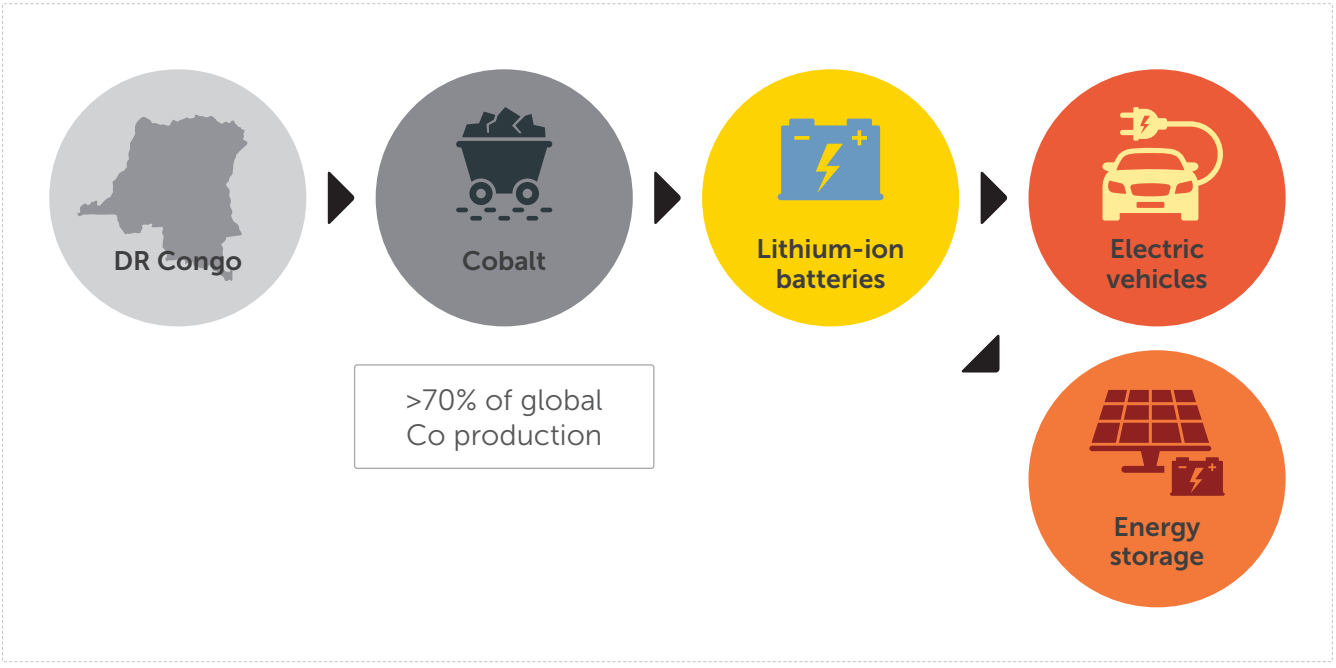
The vast majority of world cobalt resources are located in DR Congo and Zambia.

- DR Congo accounted for over 70% of cobalt mined globally in 2021.

The IEA predicts that based on current policies global demand for cobalt will rise six-fold by 2040, but in a genuine 'Sustainable Development Scenario' it would need to see a more than 20-fold increase.

Congolese cobalt will be key to shifting away from fossil fuels. As it stands, over 60% of global cobalt is processed in China. However, DR Congo and Zambia have recently signed an historic cooperation agreement to develop battery value chains locally.

DR Congo accounts for over 70% of cobalt mined globally, but 60% of global cobalt is processed in China.



Copper (Cu): DR Congo and Zambia can leverage increased copper demand

Copper is used in renewable energy systems to generate power from solar, hydro, thermal and wind energy. It is also a key material in wire and cable, key for the expansion of electric grids and electrification of the energy sector.

- In many renewable energy systems, there is 12 times more copper than in traditional systems.

Mines in Chile and Peru produce the most copper globally, while China dominates in terms of copper refiners. However, DR Congo mined the joint-third largest amount of copper of any country globally in 2021 and combined with Zambia accounts for over 12% of global production.

- Zambia has been the world's biggest exporter of unrefined copper for the last five years (2016-2020).

The IEA project that in a 'Sustainable Development Scenario' demand for copper will more than double by 2040, presenting an opportunity for both countries to develop their copper supply chains.

Graphite: Mozambique and Madagascar among top five global producers

Graphite is an essential material in lithium-ion batteries in electric vehicles and energy storage.

- Graphite accounts for almost one third of all minerals used in electric cars, while it is not used at all in conventional cars.

Mozambique (3rd) and Madagascar (5th) are among the top five producers of graphite globally, but China still overwhelming dominates global production of graphite, producing more than 80% of the global total in 2021.

However, Madagascar (8.1%), Mozambique (7.8%), and Tanzania (5.6%) combined account for over one fifth of global reserves, only just short of China's share of reserves (22.8%).

- In 2021, large graphite deposits were being developed in Madagascar, northern Mozambique, Namibia, and south-central Tanzania.

With demand for graphite needing to increase almost 25-fold by 2040 in a 'Sustainable Development Scenario', African graphite will almost certainly play a key role in meeting mineral demand for the green energy transition.

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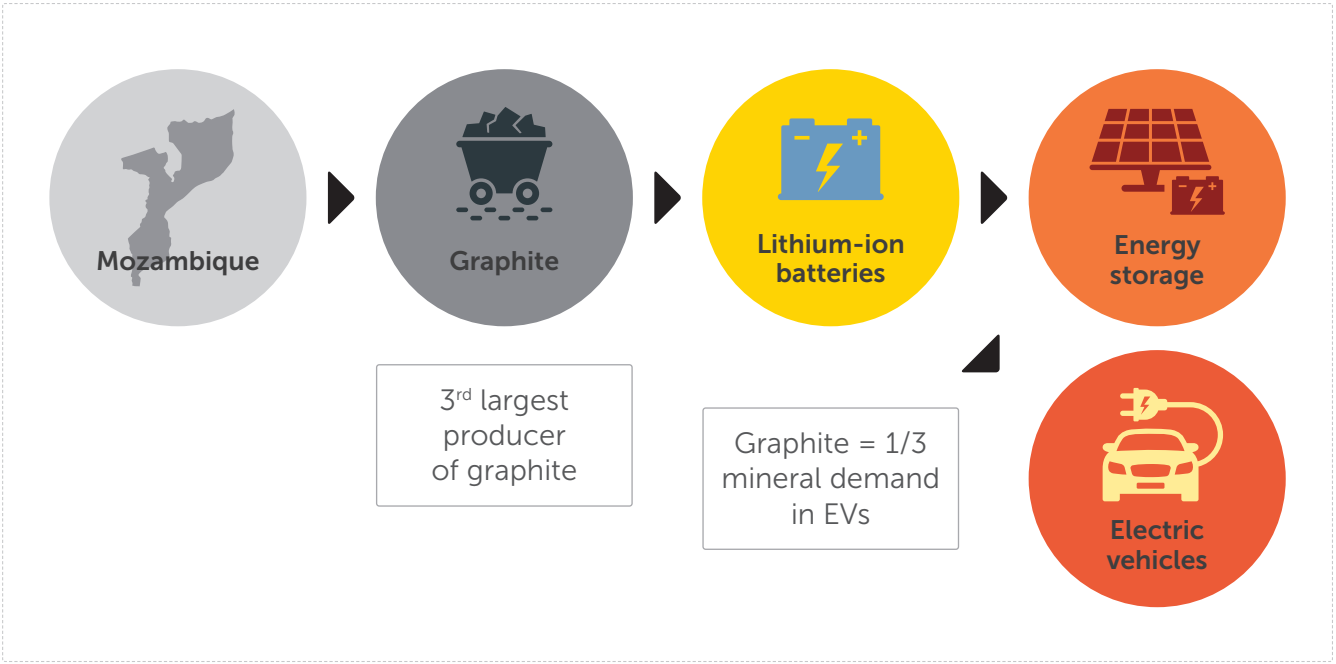


Manganese (Mn): concentrated solar needs African manganese

Manganese will be a key mineral for many green technologies such as concentrated solar power, wind, hydro, and geothermal while also being used in electric vehicles and for energy storage.

- Manganese accounts for over one quarter of the mineral demand from concentrated solar power.

Manganese has no satisfactory substitute in its major applications.

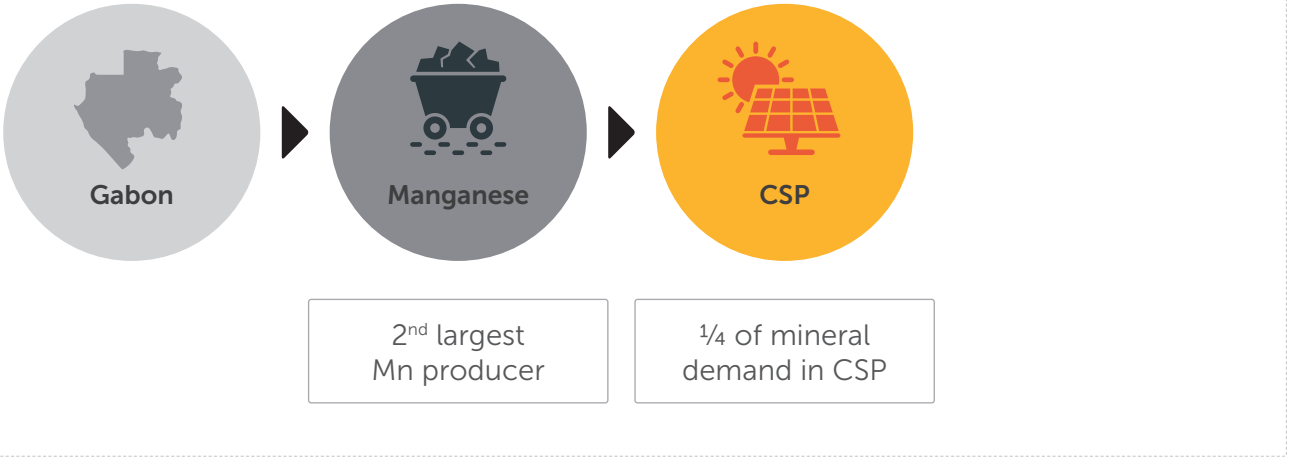
Over 60% of global mine production for Manganese occurs in Africa, with several countries on the continent hosting manganese resources.

- Côte d'Ivoire, Gabon, Ghana, and South Africa all produce manganese.
- South Africa is the world's largest manganese producer, followed by Gabon.

The IEA project that demand for manganese will increase three-fold by 2040 based on current policies but will need to increase more than 8-fold in a 'Sustainable Development Scenario'. African manganese will be essential to meeting this demand.

Over 60% of global mine production for Manganese occurs in Africa

South Africa is the world's largest manganese producer, followed by Gabon.



Platinum Group Metals (PGMs): South African minerals key to decarbonising heavy transport and industry

Platinum group metals, including metals such as iridium, palladium, and platinum, will be key to the adoption of green hydrogen, and for decarbonising difficult sectors such as heavy transport, heating, and industry.

- Platinum and Iridium are the ideal metals for catalysts in Proton Exchange Membrane (PEM) technology, the process which produces hydrogen fuel.

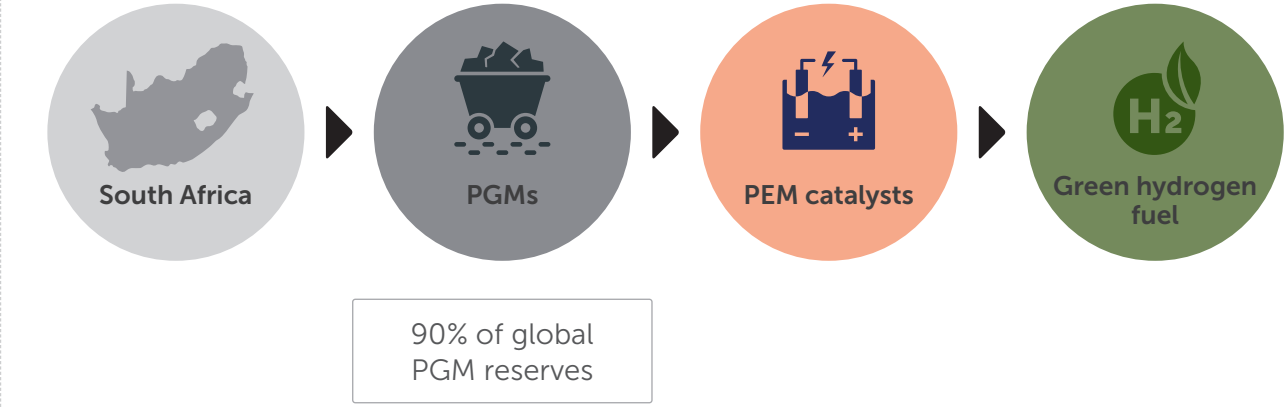
Africa accounts for over 90% of global PGM reserves, with South Africa accounting for the large majority of that.

- Between 2016 and 2020, South Africa accounted for over 70% of global platinum production, and over 80% of global iridium production.

- Between 2016 and 2020, Zimbabwe was the world's third largest producer of platinum and second largest producer of iridium.

The IEA projects a 150-fold increase in demand for PGMs by 2040 if a 'Sustainable Development Scenario' is to be achieved. Comprehensive decarbonisation of the transport system and industry will not be possible without African minerals.

South Africa holds 90% of world platinum group metal reserves, key for green hydrogen technology.



Strong resource governance will be key

For local populations to truly benefit from the continent's mineral wealth lessons must be learned from decades of jobless growth, spurred by the export of unprocessed extractives such as crude oil. For the continent's oil producing nations, oil extraction has generated government revenues and foreign exchange, but extraction has been capital intensive, creating few associated jobs. In Nigeria, the continent's largest crude oil producer, only 0.5% of the population work in extractives. In several cases, natural resource wealth has even had an adverse impact on industrialisation and development. Most oil, gas, and mineral rich countries have failed to reach their full potential because of the so-called 'resource curse'. There is a tendency for resource dependent countries to become more authoritarian, more prone to conflict and less economically stable than similar countries without resources.

- Democracy: Natural resource wealth, particularly oil wealth, has made it more likely for governments to become or remain authoritarian over the past 30 years with governments less dependent on citizens for revenues.
- Conflict: Natural resources can, and often do, provoke and sustain internal conflicts as different groups fight for control of the resources or use

natural resources to finance their fighting.

- Unstable public revenues: The amount that governments collect in resource revenues can change drastically from year to year because of changes in commodity prices and production.
- "Dutch disease": A large increase in natural resource revenues can hurt other sectors of the economy by causing inflation or exchange rate appreciation and diverting human and financial resources from non-resource sectors.
- Environmental problems: Resource extraction can create a host of problems for local communities and environments in the vicinity of operations, such as pollution, environmental scarring, use of local water supply, and seismic disturbances.
- Weaker institutional development: Some researchers argue that institutions are weaker in resource-rich countries because it is easy for elites to capture or take large sums of cash.

In the absence of good governance and effective management of natural resources, the continent's climate minerals could become a burden rather than a boon. However, the 'resource curse' is not inevitable. Botswana have been able to leverage their vast diamond wealth to generate economic opportunity largely due to good governance. Developing a sound governance environment – transparency of contracts, strong labour rights, environmental sustainability - will be key to maximising this opportunity for the continent, as will targeted industrial policies that focus on processing minerals in-country for consumption in domestic or regional markets. When African countries trade among themselves, they exchange more manufactured and processed goods, have more knowledge transfer, and create more value, leading to good local jobs. The African Continental Free Trade Area (AfCFTA), which came into force in January 2021, can facilitate intra-African trade and will undoubtedly be key to developing green supply chains.

References

The African Climate Foundation (2022). Geopolitics of critical minerals in renewable energy supply chains. https://africanclimatefoundation.org/wp-content/uploads/2022/09/800644-ACF-03_Geopolitics-of-critical-minerals-R_WEB.pdf. Accessed 14 October 2022.

Atlas of Economic Complexity (2020). Variables used: Product: Exports by product https://atlas.cid.harvard.edu/explore. Accessed 14 October 2022.

CEIMIG (2022). Hydrogen Economy – Why Platinum Group Metals have such an important role in helping to decarbonise the energy sector. https://www.ceimig.co.uk/hydrogen-economy. Accessed 14 October 2022.

Cobalt Institute (2021). Batteries and electric vehicles. https://www.cobaltinstitute.org/essential-cobalt-2/powering-the-green-economy/batteries-electric-vehicles/. Accessed 14 October 2022.

Cobalt Institute (2021). Batteries and energy storage. https://www.cobaltinstitute.org/essential-cobalt-2/powering-the-green-economy/batteries-energy-storage/. Accessed 14 October 2022.

Cobalt Institute (2021). Renewable energy. https://www.cobaltinstitute.org/essential-cobalt-2/powering-the-green-economy/renewable-energy/#:~:text=Cobalt%20plays%20an%20important%20role,renewable%20replacement%20for%20natural%20gas. Accessed 14 October 2022.

Conversation (2021). Is the resource curse hard-baked into African economies? China's approach hints that it may not be. https://theconversation.com/is-the-resource-curse-hard-baked-into-africaneconomies-chinas-approach-hints-that-it-may-not-be-167397 Accessed 20 June 2022

Copper Alliance (2022). Renewable energy. https://copperalliance.org/policy-focus/climate-environment/renewable-energy/. Accessed 14 October 2022.

Glimpse from the Globe (2018). Avoiding the Resource Curse: Why Botswana Succeeded Where Others Failed. https://www. glimpsefromtheglobe.com/regions/sub-saharanafrica/avoiding-theresource-curse-why-botswana-succeeded-where-others-failed/. Accessed 20 June 2022

Graphite One (2022). Surging graphite demand. https://www.graphiteoneinc.com/surging-graphite-demand/. Accessed 14 October 2022.

International Energy Agency (IEA) (2021). The Role of Critical Minerals in Clean Energy Transitions. https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions. Accessed 14 October 2022.

International Energy Agency (IEA) (2021). World Energy Outlook 2021. https://iea.blob.core.windows.net/assets/4ed140c1-c3f3-4fd9-acae-789a4e14a23c/WorldEnergyOutlook2021.pdf. Accessed 14 October 2022.

International Energy Agency (IEA) (2022). Mineral requirements for clean energy transitions. https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/mineral-requirements-for-clean-energy-transitions. Accessed 14 October 2022.

Mo Ibrahim Foundation (MIF) (2021). Research Spotlights: COVID-19 and Africa's governance https://mo.ibrahim.foundation/research-spotlight-9-covid-19-and-africas-governance Accessed 20 June 2022

Mo Ibrahim Foundation (MIF) (2022). 2022 Forum Report: The Road to COP27: Making Africa's Case in the Global Climate Debate. https://mo.ibrahim.foundation/sites/default/files/2022-07/2022-forum-report.pdf. Accessed 14 October 2022.

Natural Resource Governance Institute (NRGI) (2015). The Resource Curse. The Political and Economic Challenges of Natural Resource Wealth https:// resourcegovernance.org/sites/default/files/nrgi_Resource-Curse.pdf Accessed 20 June 2022

Science Direct (2004). Aluminum Ore. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/aluminum-ore. Accessed 14 October 2022.

U.S. Geological Survey (2022). Commodity Statistics and Information. Mineral Commodities Summaries. https://www.usgs.gov/centers/national-minerals-information-center/commodity-statistics-and-information. Accessed 14 October 2022.

World Bank (2020). Minerals for Climate Action: The Mineral Intensity of the Energy Transition. https://pubdocs.worldbank.org/en/961711588875536384/Minerals-for-Climate-Action-The-Mineral-Intensity-of-the-Clean-Energy-Transition.pdf. Accessed 14 October 2022.

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