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Critical Minerals and Renewable Energy Value Chains in the Democratic Republic of Congo

A Study of Actors and Initiatives

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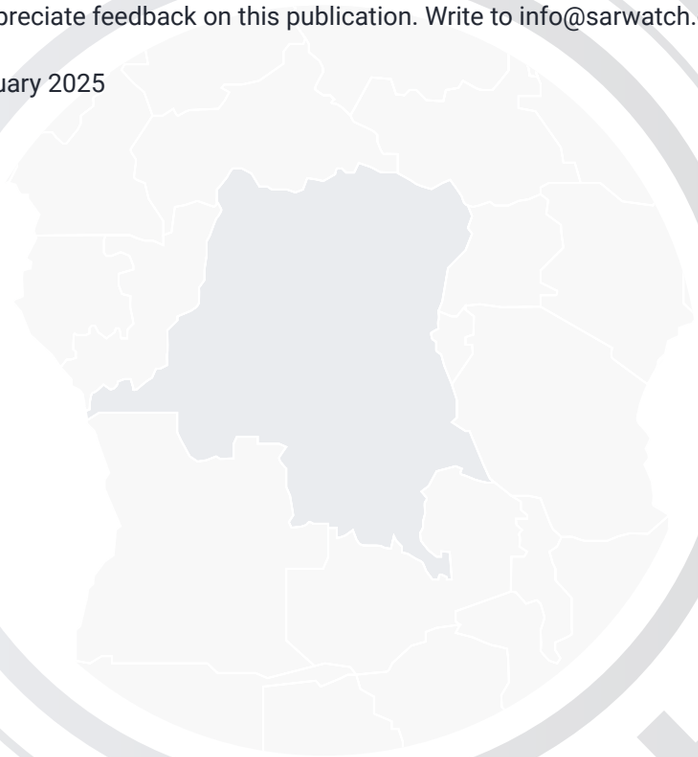

ACKNOWLEDGEMENTS

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LIST OF ACRONYMS

AfDB	African Development Bank
AMDC	African Minerals Development Centre
AMV	African Mining Vision
ASM	Artisanal small-scale mining
AU	African Union
CAEB	African Centre of Excellence for Batteries
CCB	Congolese Battery Council
CCS	Carbon capture and storage
CMOC	China Molybdenum Co.
CRM	Critical raw materials
CSO	Civil society organisation
CSP	Concentrated solar power
CTCPM	Technical Cell for Coordination of Mining Production
ECA	Economic Commission for Africa
ERG	Eurasian Resources Group
ESG	Environmental, social, and governance (principles)
EU	European Union
EV	Electric vehicle
IEA	International Energy Agency
JET	Just energy transition
MOU	Memorandum of understanding
MSP	Minerals Security Partnership
NDC	Nationally Determined Contribution
SADC	Southern African Development Community
SARW	Southern African Resources Watch
SEZ	Special economic zone
TFM	Tenke Fungurume Mining
UN	United Nations
UNDP	UN Development Program
UNECA	UN Economic Commission for Africa
US	United States

EXECUTIVE SUMMARY

The Democratic Republic of Congo (DRC), like many other African countries, has expressed its ambition to add value to critical minerals locally, aiming to position itself as a driving force in the global transition to renewable energy. The DRC has rich mineral resources essential for green technologies, such as electric vehicle batteries, solar and wind energy infrastructure. The country also boasts substantial renewable energy potential, including hydroelectric power, biogas, solar energy, biomass, and extensive forests, which make up the world's second-largest carbon sink (after the Amazon). This natural wealth underpins the DRC's self-designation as a "solution country" for combating climate change and promoting the energy transition.

A comprehensive review of literature and of specific government policy frameworks identified that known reserves of strategic minerals like copper and cobalt in the DRC are predominantly controlled by foreign mining companies, which oversee production and marketing. These minerals are typically exported after minimal processing. Chinese companies dominate industrial and artisanal copper and cobalt markets, focusing more on extraction and sale than on value addition. Congolese communities are facing serious human rights abuses triggered by mining activities, including child labour and forced evictions. DRC lacks strong policies and frameworks that guide mining projects and exports.

This research recommends that, for DRC to succeed in its energy transition, it must implement strategies that promote renewable energy and reduce reliance on fossil fuels. This requires developing the value chain for critical minerals to ensure a steady supply of the manufacturing equipment and infrastructure necessary for renewable energy adoption. This study aimed to identify local initiatives related to critical minerals for renewable energy production in the DRC and the actors involved in these mineral value chains. Achieving local value addition for minerals means that DRC must secure its mineral deposits and attract investors who are interested in local processing. Despite ambitions to manufacture batteries for electric vehicles (EVs), the DRC government lacks a coherent policy or plan to execute this strategy effectively. Nevertheless, the DRC has received pledges for technical and financial support from organisations such as the Economic Commission for Africa (ECA) and the African Union (AU).

Geopolitical dynamics surrounding these minerals present both opportunities and threats for the DRC. Major economic and military powers, including the US, China, and the European Union (EU), have shown interest in supporting the DRC's ambitions to produce EV battery components, but the specifics of this support remain unclear. The Congolese government continues to pursue initiatives to reduce fossil fuel use in favour of renewable energies, with significant efforts like the DRC-Zambia collaboration for EV battery production. But the Congolese government plans to drill for oil and gas across the country, including in the sensitive areas of the Congo Basin – a major carbon sink.

The energy transition offers the DRC substantial opportunities to integrate into global supply and value chains for clean energy technologies. The DRC can enhance its economic development and play a crucial role in the global shift towards sustainable energy by moving beyond mere extraction to exporting value-added products.

1. INTRODUCTION

The DRC is the second largest country in Africa, with an area of 2 345 510 km², divided into 26 provinces, including 145 territories. The DRC shares 9165 km of its borders with nine other countries: Rwanda, Burundi, Uganda, Tanzania, Congo Brazzaville, Central African Republic, Angola, Zambia, and Sudan. The country has immense and diversified natural resources, including minerals, forests, agricultural, and hydrological resources. The manufacturing of green energies locally should be the start of the country's industrialisation and investment in a new economic model to reverse the country's reliance on the export of cheap raw materials and the import of finished products at much higher prices. At this time of energy transition, the DRC has a great opportunity to use its natural resources to position itself as a country that produces renewable energy. The DRC has shown interest in participating in the lithium battery value chain. This is aligned with the African Union's African Mining Vision (AMV), the African Continental Free Trade Area (AfCFTA), and the SADC industrialisation strategy, which aims to promote regional minerals value chains. The DRC wants to be a leader in green industrialisation.

This study provides information on initiatives to improve critical minerals value chains in the DRC. Specifically, it aims to map actors in the value chain and explores salient initiatives to produce renewable energy. The report presents a context of the DRC, a summary of critical minerals, some renewable initiatives, and just energy transition considerations. In the final analysis, some recommendations are made.

2. AN OVERVIEW OF DRC'S MINING SECTOR

The DRC's rich mineral resources have been described as a "geological scandal." It has over ten precious metals – notably silver, gold, and diamonds. In the context of climate change, the DRC has an abundance of energy transition minerals, including chrome, manganese, cobalt, copper, and rare earth elements. Its subsoil has all the minerals essential to the energy transition, especially for manufacturing electric vehicles: copper, cobalt, lithium, manganese, nickel, phosphate, and graphite. The rapidly evolving critical minerals and energy transition landscape can provide opportunities for industrial transformation and achieving a just energy transition in the DRC.

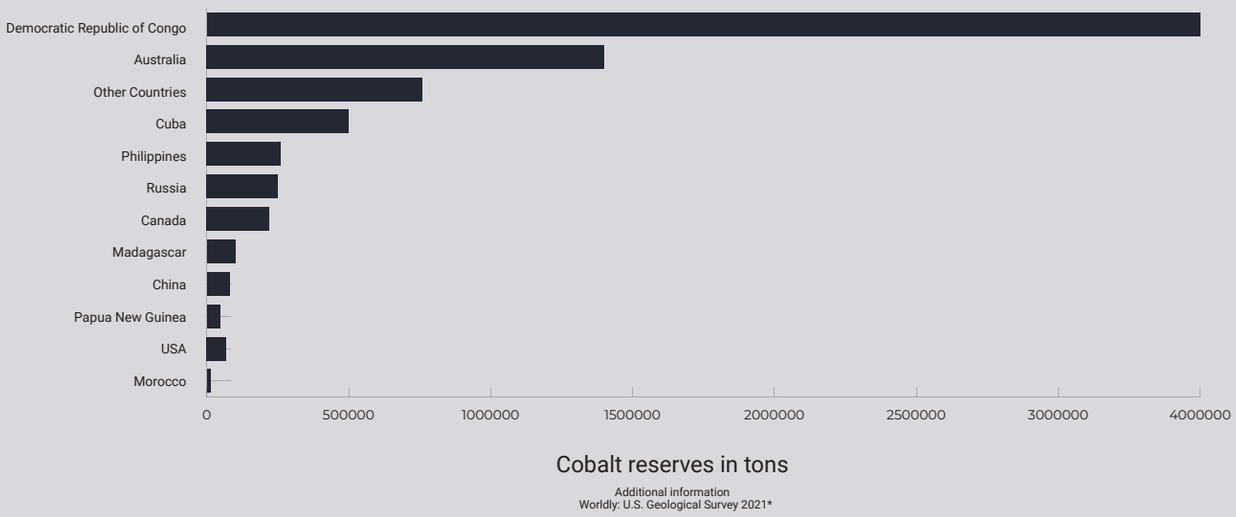
Table 1: Estimated Deposits

Ores	Reserve in millions of tonnes	Use
Brass (copper and zinc)	75 000 000	Biomass, concentrated solar power (CSP), electrical storage, EVs, geothermal, grid networks, hydro, nuclear, PV, wind
Cobalt	4 500 000	Biomass, carbon capture and storage (CCS), electrical storage, EVs
Niobium	30 000 000	Catalysts, magnets, superconductors, capacitors
Manganese	7 000 000	CCS, electrical storage, EVs, geothermal, hydro, nuclear
Nickel	7 000 000	Biomass, CCS, electrical storage, EVs, geothermal, hydro, nuclear, wind
Lithium		Electrical storage, EVs

Source: EITI Report, 2023

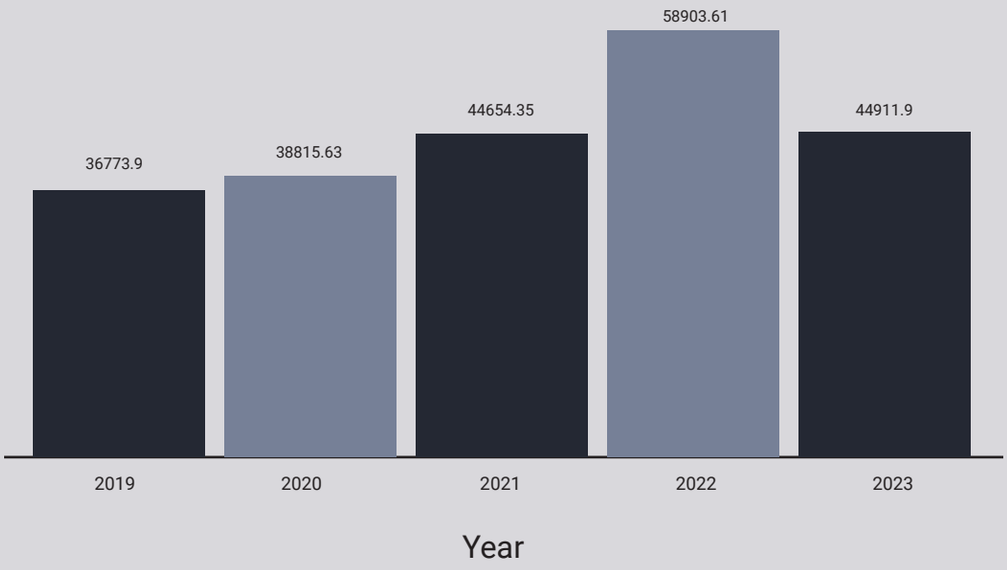
Currently, exploitation is focused on copper and cobalt in Haut-Katanga and Luanlaba. The DRC currently produces 70 per cent of the world's cobalt. Cobalt, copper, and nickel are vital inputs for renewable energy technologies. The International Energy Agency (IEA) estimates that there will be a four- to six-fold increase in demand for minerals critical to the energy transition between 2020 and 2030 (IEA, 2021). Globally, the DRC is the largest producer of cobalt and the second largest producer of copper. In the DRC, cobalt is mined as a byproduct of copper.

Figure 1: World Reserves of Cobalt in 2021



Source: US Geological Survey (2024)

Figure 2: Cobalt production in the DRC over the past five years.

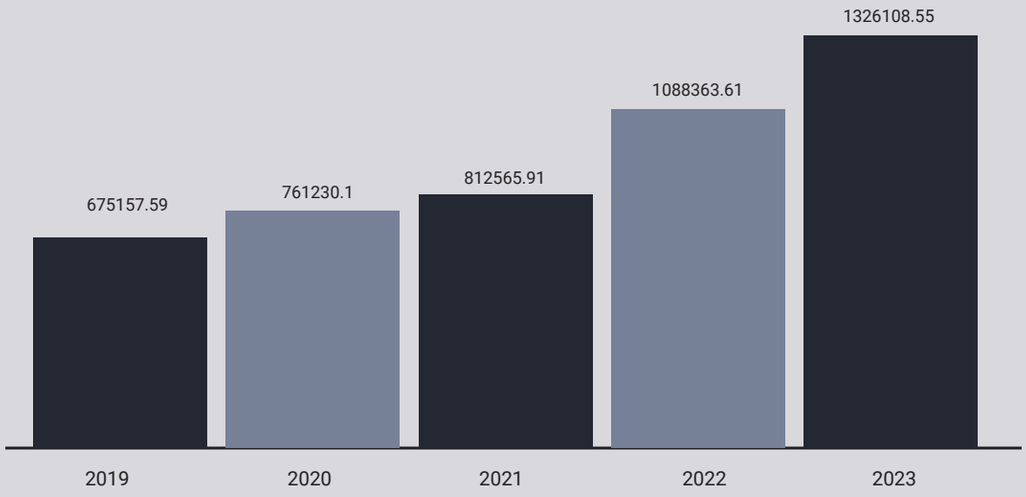


Source: CTCPM, 2024

In 2023, the DRC produced almost 44 912 tonnes of cobalt (CTCPM, 2024).

Copper is the raw material par excellence used in transporting electricity. The demand for copper will increase by 2040, which presents an opportunity for countries to develop their own value and supply chains (Mo Ibrahim Foundation, 2022). The DRC is the leading copper-producing country in Africa, with 2 394 629.67 tonnes per year (2022 estimate).

Figure 3: Copper production in the DRC over the past five years

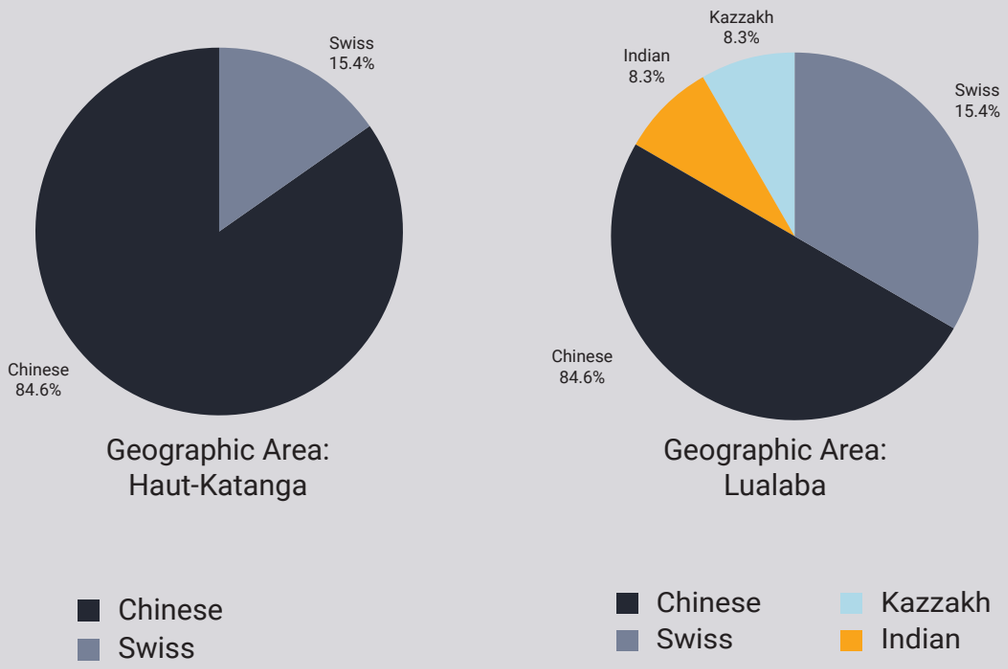


Source: CTCPM, 2024

2.1. CHINESE DOMINANCE IN DRC ENERGY TRANSITION MINERALS

Chinese companies extract copper and cobalt in the two producing regions of Haut Katanga and Lualaba.

Figure 4: Breakdown of Mines by Shareholder in Different Areas



Source: CTCPM (https://e-mines.ctcpm.cd/listprojet)

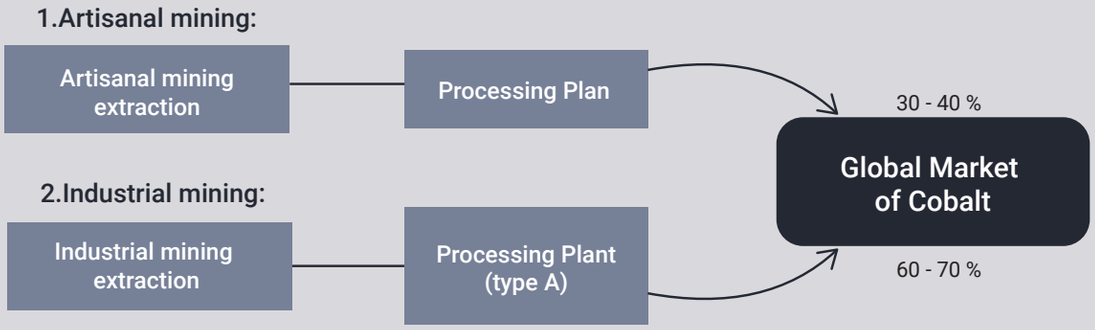
Chinese domination also extends to artisanal small-scale mining (ASM) and processing entities. Indeed, in the artisanal sector, Chinese companies have signed technical assistance partnerships with mining cooperatives. This consists of the provision of technical support in the discovery of mining sites. In return, all the extracted minerals are sold to Chinese partners. In addition, the Chinese also own most processing entities to which ores extracted by ASM are transported. Ultimately, critical minerals from the DRC are shipped to China for refining, whether mined industrially or artisanally.

China controls DRC's critical minerals value chain from end to end, except for the transport sector. Operated by China Molybdenum Co., Ltd. (CMOC), a major player in the global mining industry, companies such as Tenke Fungurume Mining (TFM) own some of the largest cobalt and copper mines in Katanga Province. CMOC is the majority shareholder (80 per cent), with the state-owned Gécamines owning the rest. TFM produces about 16 000 to 20 000 metric tons of cobalt annually and exceeds 200 000 metric tons in copper output. Due to this dominance, China's investment behaviour influences host countries' development decisions and practices. The companies contribute to the DRC's economy, from revenue generation through mining royalties, taxes, and export earnings to job creation. All these are key to infrastructure and economic development. These investments influence local communities' livelihoods as several thousands of local direct and indirect jobs support households and local economic development.

2.2. PROCESSING CAPACITY FOR COPPER AND COBALT

The production of cobalt and copper has two origins in the DRC – artisanal and industrial miners – and artisanal mining is critical for meeting projected cobalt demand. The law does not allow the export of minerals from artisanal mining or industry without added value, but the adding of value of these minerals is still embryonic (see Figure 5). Each mining company has a processing plant that processes copper and cobalt to some extent.

Figure 5: Extraction Methods and Value Added to Cobalt and Copper



Source: Joh Shall, 2023.

Thirty companies mine copper and cobalt in the DRC, each with a copper and cobalt processing plant. Processing entities for artisanal products are also installed in Haut Katanga and Lualaba provinces. Currently, both copper and cobalt are sold at the level of beneficiation. Copper beneficiation only reaches the level of metal (copper cathodes), and cobalt beneficiation is at the level of hydroxide or cobalt oxide. The Eurasian Resources Group (ERG), in partnership with China's BGRIMM Technology Group, is constructing a cobalt beneficiation plant in the DRC which will be commissioned in 2024. This significant investment in cobalt beneficiation will supply feedstock for EV batteries. The ERG project is strategic since the DRC has taken steps to set up institutions directly linked to EV battery production.

2.3. LITHIUM

Lithium is used in the form of lithium carbonate in the manufacture of rechargeable and batteries accumulators. Lithium is critical in the global energy transition because it is used in batteries for electric vehicles and energy storage systems. As the world shifts towards cleaner energy sources, the demand for lithium is expected to soar. This presents a unique opportunity for the DRC to contribute to global sustainability goals while achieving economic growth. Chinese companies have invested in lithium projects in DRC, with known projects including the Manono Lithium Project and the Kamoya Lithium Project. According to Nigel Ferguson, Managing Director of AVZ Minerals, it is an important source not yet exploited globally. DRC's lithium reserve of 6 million tonnes can compete with those of Australia, Chile, Argentina, or China (VOA, 2022). With these discoveries, the DRC is positioned in the top 10 projects in Africa with AVZ Minerals, an Australian company, which carries the Manono Lithium Project, for an estimated production of 700 000 tonnes of high-quality lithium over 20 years, and with another unidentified company, a production of 100 000 tonnes of concentrates per year, planned for 2025 as part of the Manono Tailing project (Lithium Africa Summit 2024).

The exploitation of Manono caused a legal dispute between the Congolese government and AVZ Minerals. AVZ contested the granting of a part of its mining permit to a Chinese company, Zijin Mining Group. In June 2023, AVZ Minerals filed a complaint against the DRC at the International Centre for Settlement of Investment Disputes in Washington in which it sought remedies from the DRC government for an alleged failure to comply with the country's mining code[1].

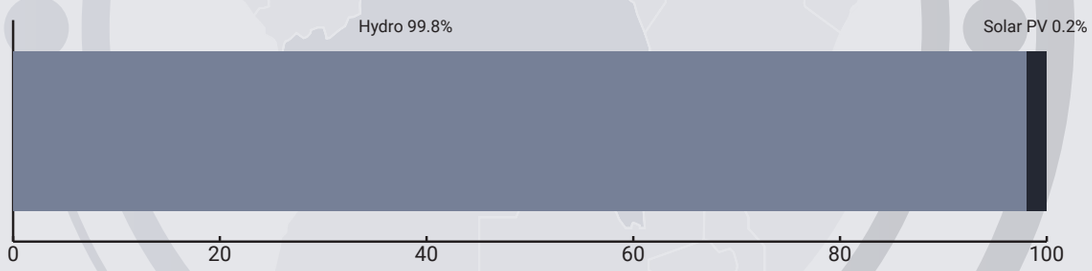
[1] See Tom Richardson, "AVZ takes Congo to Washington court over mine licence", (Financial Review, Jun 12, 2023) <https://www.afr.com/markets/equity-markets/avz-akes-congo-to-washington-court-over-mine-licence-20230612-p5dfsg> accessed 5 February 2024.

3. DRC'S ENERGY MIX

DRC's energy sources consist of both renewable and non-renewable resources. The non-renewables are fossil fuels (oil and natural gas), and renewable energy sources are hydroelectric, biomass, solar, and geothermal. Biomass is used mainly in the form of burning wood, agricultural byproducts or dung for household cooking or heating. The use of biomass is associated with adverse effects on health and the environment. Millions of Congolese die from respiratory diseases caused by air pollution, and biomass use is targeted for elimination in the net zero scenario provided by the International Energy Agency (IEA).

DRC's renewable share of electricity generation is 100 per cent, with almost all coming from hydropower. The Grand Inga Hydropower project has the potential to provide a surplus, and the DRC could become an electricity exporter (IEA, 2019).

Figure 6: Renewable electricity generation by source (non-combustible), DRC 2021



Source: IEA[2]

The DRC has not tapped its wind energy potential. Wind speeds average between 6 and 6.6 meters per second throughout the country, translating to a total potential of 15GW. Wind turbines could also be valuable in powering small-scale lighting or water-pumping applications. The viability of this approach hinges on overcoming technical and logistical challenges, including the availability of necessary skills for installing and supporting wind turbines in outlying regions.

The DRC's mining industry consumes significant energy with a requirement of about 1267MW. With only 725MW currently available for the mining sector, a gap exists to meet current needs. This may restrict the growth expected with mining expansion to meet the demand for energy transition minerals.

[2] See IEA, "Democratic Republic of the Congo: Renewable Energy" (IEA n.d.)<https://www.iea.org/countries/democratic-republic-of-the-congo/renewables#what-are-the-main-sources-of-renewable-heat-in-democratic-republic-of-the-congo>; accessed 5 April 2024.

4.RENEWABLE ENERGY INITIATIVES IN THE DRC

The DRC has a large renewable energy potential, particularly solar and hydroelectric. The Congolese government is pursuing two paths for renewable energy production. First, a strong focus is on processing critical minerals locally to produce EV batteries. Second, the DRC intends to optimise its renewable energy sources such as hydro-power, solar, and wind. Local processing of ores will allow the development of renewable energy storage equipment produced by solar energy, without which this energy source will only be partially used. The potential of solar energy is considerable (between 3.5 and 5.5KWh/m/d). Given the intermittency of solar energy, the development of battery storage systems offers a great opportunity for the DRC to develop the value chain of minerals useful for battery manufacturing.

4.1. ELECTRIC BATTERIES VALUE CHAIN

The electric batteries manufacturing project is DRC's major renewable energy initiative. It is central to the country's industrial policy, which focuses on value chain development and processing minerals into finished products. The mega project was mooted at the first edition of the DRC-Africa Business Forum in November 2021. A Bloomberg report[3] proved that the production of battery precursors in the DRC, valued at US$39 million, would be much cheaper compared to production in the US, China, or Poland, which respectively offset US$117 million, US$112 million in China, and US$65 million in Poland (Muamba, 2021). In 2022, the DRC and Zambia concluded a historic cooperation agreement to produce components of EV batteries. The battery initiative has become strategic from a regional and continental perspective, with possible cooperation involving critical minerals-producing countries, notably Gabon, Zimbabwe, Namibia, South Africa, Madagascar, and Morocco.

4.1.1. Progressing to Special Economic Zones

As part of their aim to transition from exporters of unprocessed critical minerals to manufacturing hubs for electric batteries, the Congolese and Zambian governments are setting up dedicated special economic zones (SEZs). The SEZs aim to generate local and national economic development, create jobs, and preserve the environment. Located in Kipushi, Katanga (DRC) and Ndola (Zambia), the main SEZ will cover about 2000 ha of land. The African Export-Import Bank (Afreximbank) and the UN Economic Commission for Africa (UNECA) sponsor the SEZ based on their framework agreement and commissioned a pre-feasibility study in 2023. Plans include the building of a 10 00-metric-ton precursor facility in the DRC. It is deemed more cost-effective and environmentally friendly to produce the batteries in the DRC and Zambia than in the United States, China, or Poland, given the proximity of the raw materials and a relatively clean electricity network (BNEF 2021).

4.1.2. The Congolese Battery Council and Multi-University Collaborations

On 6 December 2022, the DRC set up the Congolese Battery Council (CCB) through a decree by the Prime Minister, Sama Lukonde. The CCB aims to manage the value chain of batteries and electric vehicles and has several missions relating to partnership, investment in favour of innovation, and the transformation of strategic minerals, including the supply of raw materials necessary to produce batteries locally. The CCB has signed a collaboration agreement with its Zambian counterpart to manage the battery manufacturing project jointly. The CCB will produce studies, statistical data, and information on the value chain of batteries and clean energy.

[3] The study was carried out at the request of the United Nations Economic Commission for Africa (UNECA), Afreximbank, African Finance Corporation (AFC), the African Development Bank (AfDB), and the Arab Bank for Economic Development in Africa (BADEA).

A related institution is the African Centre of Excellence for Batteries (CAEB), created by ministerial decree in 2022.[4] The CAEB is hosted by the University of Lubumbashi (UNILU). It collaborates with the Steinbeis Global Institute (SGIT), part of Steinbeis University in Germany, with the support of UNECA. Specially set up for advanced battery research, the CAEB is a multidisciplinary centre with ambitions to obtain a significant share of the global market for electric cars valued at more than US$8000 billion. The national target is to propel the DRC to become the leading producer of the components of electric batteries between 2030-2040. The centre will provide skills development training to meet the labour requirements of the EV industry and green energy. The CAEB has other collaborating institutions, including the Copperbelt University of Zambia, the University of Johannesburg, the University of the Witwatersrand, Mangosuthu University of Technology, and the Cape Peninsula University of Technology in South Africa, Namibia's University of Technology, and the Mohamed VI Polytechnic University in Morrocco. However, as it is still in its formative stages, the centre lacks adequate funding to conduct its mission.

4.2. SOLAR ENERGY INITIATIVES

The DRC has a significant solar energy capacity of 3500 to 6000Wp/m²/d, representing an opportunity to develop a photovoltaic accessories industry using energy transition minerals. The DRC can promote domestic production of batteries and complex solar energy storage systems for mini-solar power plants, particularly in areas without grid access. Building on its potential, the DRC can build mini-solar power plants for each of its 145 territories as part of the renewable energy strategy. With a population of over 95 million, the DRC is a significant market for solar technology. Creating a manufacturing plant for solar technology could benefit the country itself and neighbouring countries in southern, eastern, and central Africa.

In the Haut-Katanga province, Kipay Energy is developing Sombwe Hydropower Project (HPP), a 160 megawatt hybrid solar-hydroelectricity initiative. The power plant is on the Lufira River. Combining a photovoltaic solar plant (expected to generate 46MWp) and hydropower is an innovative solution for seasonal shifts. Solar energy will supplement power demand during dry seasons or low water levels. The cost of the investment is estimated at more than US$500 million. The equity comprises 30 per cent shares of businessman Eric Monga and 70 per cent of PowerChina. Connecting the power plant to the existing electricity network will require a 205km high-voltage power line from Sombwe to the Fungurume substation, connecting to the national grid. A local electrification project will empower local communities within the project's vicinity, a key step in using renewable energy to fight energy poverty among Congolese communities.

Other solar initiatives are in the pipeline. These include the Tshipuka Photovoltaic Solar Park, a 10MW solar energy project planned for Kasaï-Oriental. The project is currently in the permitting stage. It will be developed in a single phase, with construction expected to begin in 2024 and entering commercial operation in 2025.

4.2.1. Hydroelectric and Solar Power Generation from Kibali Gold

The energy regulatory market in the DRC has been liberalised and permits companies to produce their own energy. Several mining companies are investing in renewable energy, including hydropower and solar power. The Kibali Gold Mine, in the Haut-Uélé province in northeast DRC, directly produces its electricity from hydropower. Kibali is also investing in solar energy. It is implementing a 16MW solar farm project that will increase its renewable energy supply from 79 to 88 per cent with the ability to run on 100 per cent renewable energy during the rainy season. The solar installation will be commissioned in 2025. The mine is completely independent of the national grid and is an example of how independent power production can play a positive role in the decarbonisation of the mining sector.

Other solar initiatives are in the pipeline. These include the Tshipuka Photovoltaic Solar Park, a 10MW solar energy project planned for Kasaï-Oriental. The project is currently in the permitting stage.

[4] Ministerial Decree No. 14/MIN. RSIT/CAB. MIN/JMK/2022 of 04/19/2022

4.3. HYDROELECTRICITY

On water resources, the DRC has considerable potential in surface water and groundwater. Indeed, the DRC is characterised by a vast hydrographic network that occupies 50 per cent of the Congo Basin (77 810 km2 of its surface area) with an average flow of the Congo River of 41 000m3/s. In this regard, hydroelectricity is the most reliable source of green energy in the DRC. However, the DRC's hydropower potential is largely untapped. In the energy transition, several opportunities exist to increase renewable energy generation through small and large-scale hydropower initiatives.

4.3.1. The Grand Inga Project

The Grand Inga Project is Africa's most ambitious power generation project at Inga Falls. Once fully developed, it could generate about 44 000MW, compared to its current installed capacity of only 1.8MW. It will require approximately $80 billion in investment (Warner et al., 2019), and the lack of financing has delayed the project's take-off. The Congolese government has struggled to provide the necessary leadership to attract capital. Several public and corporate initiatives have failed to reach project finance closure. Partnerships such as Western Power Corridor, Southern African Power Pool (SAPP), and BHP Billiton Company for constructing Inga III have not materialised. The World Bank (which committed to financing the construction of Inga III) has not come on board. South Africa (which should buy 2500 MW of the 4800 MW that would be produced) signed a bilateral treaty to construct the Grand Inga Project in 2023. To date, this agreement has not been operationalised. Discussions with China's Three Gorges, which has expressed interest in participating in the Grand Inga project, have also been fruitless. Australian mining company Fortescue Future Industries has not been successful and joins the lengthy list of unsuccessful bidders to construct the Grand Inga Project.

The Grand Inga Project has shown difficulties in promoting renewable energy using foreign resources. Even efforts to collaborate at a pan-African level have not yielded the desired results. In the short term, perhaps, real progress lies with the small hydropower projects such as the Busanga Power Plant and independent power producers (IPPs).

4.3.2. Independent Hydroelectric Power Producers

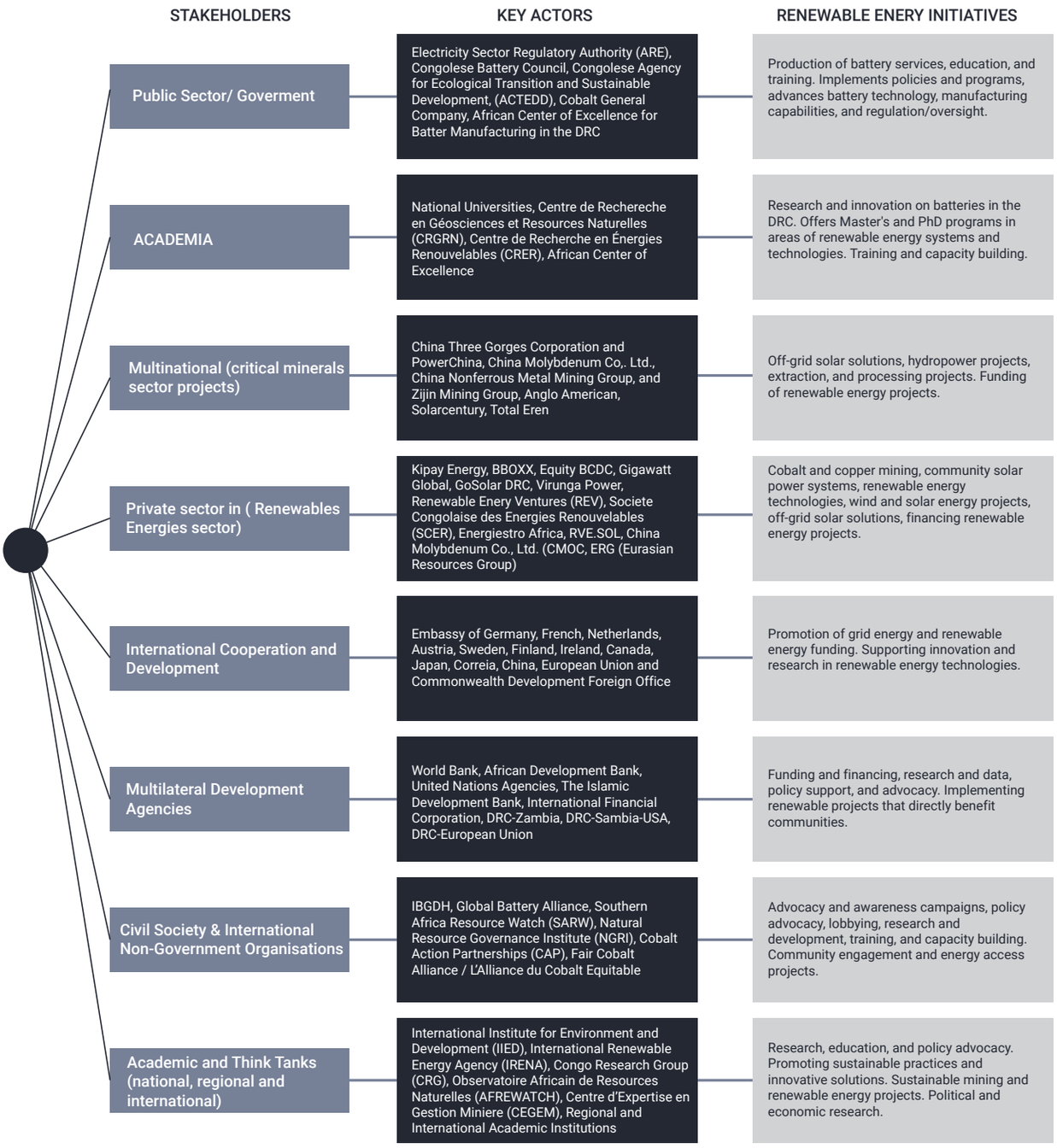
In 2013, the Virunga Foundation created Virunga Energies SAU, which manages the Virunga National Park (PNV). It produces, distributes, and markets clean and renewable hydroelectric energy, promoting the socio-economic development of the park's periphery. The amounts invested since 2013 exceed $120 million. Virunga Energies serves the Beni, Lubero, Rutshuru, Nyiragongo, and Goma territories. It has received financial support from the EU, the Schmidt Family Foundation, the World We Want, and British International Investment. It will expand its production capacity to 100MW by 2040.

Gécamines (a state-owned enterprise of the DRC) and a group of Chinese companies, including China Railway Resources Group and Sinohydro, produce electricity for the joint venture's Sicomines. Busanga hydroelectric plant will address the mine's electricity shortage and promote local industrial and socio-economic development. It will also improve the country's mining production and metal processing capabilities. Furthermore, electricity will be reserved for supply to residents with the expected improvement of access to affordable and clean electricity for all.

Regarding critical minerals and renewable energy, DRC, like many other African countries with these minerals, has several stakeholders and key actors who play a significant role in the mining and renewable energy sectors. While the table below is not exhaustive, it includes key examples of stakeholder groups and various stakeholders in DRC's day-to-day operations that directly impact the mining sector, the environment, and the general communities.

Figure 8 below shows a stakeholder mapping that briefly overviews various stakeholders and initiatives.

Figure 7: Stakeholder Map: DRC's REN Value Chain



4.4. MANUFACTURING OF ELECTRICAL CABLES AND ELECTRIFICATION OPPORTUNITIES

A key element of the just energy transition is providing access to energy for all through electrification. Copper is a fundamental mineral to electricity generation, distribution, and storage. It is a major element in the electrification of EVs. In the green energy transition, value addition to copper presents higher economic opportunities for the DRC. The country has private companies that are seizing the opportunity of the energy transition to manufacture electrical cables. In recent years, two companies have started local processing of copper into finished products. Mining Engineering Service (MES) Limited, whose activities were launched on 15 June 2023 in Lubumbashi, has a monthly production capacity estimated at one million kilometres of electrical cables. MES has received support from the Congolese government through the Industry Promotion Fund (FPI). Cabelec-Proton is the second electric cables manufacturing company. Based in Kinshasa, it plans to produce 3600 tonnes of cables annually. The impact of local cooper beneficiation is, among other things, a reduction in the import bill for electrical cables for national electrification initiatives. This contributes to lowering the electrification costs in rural and peri-urban areas.

The copper value chain integrates vertically and horizontally with renewable energy value chains. For instance, it will enable the local production of electrical conductors, particularly electrical wires and cables. More jobs will be created, and the potential to export finished electrical conductors will bring several fiscal benefits. Further value chain linkages include using raw materials such as cathode copper purchased from mining companies in Haut-Katanga and Lualaba.

5. JUST ENERGY TRANSITION: CHALLENGES AND OPPORTUNITIES

Due to its vast mineral resources, the DRC should theoretically experience economic prosperity. However, the DRC has experienced an extractive-driven resource curse since the colonial period. In the new race for energy transition minerals, the DRC is at the centre of a fierce battle for its resources. A green curse cannot be ruled out. The extraction of energy transition minerals could be accompanied by a serious loss of biodiversity and an adverse impact on social structures.

5.1. ARTISANAL AND SMALL-SCALE MINERS AND ENERGY TRANSITION MINERALS

Artisanal small-scale mining (ASM) is a vital factor in the supply of energy transition minerals. In the DRC, most ASM is informal, posing significant challenges to health and safety, environment, and governance. Incidences of child labour, inhuman conditions, and gender-based violence characterise this sector (Amnesty International, 2022). Artisanal miners get low mineral prices, as they lack bargaining power in mineral markets. For example, Chinese buyers have set stations to purchase ore from ASM miners in Lualaba and Katanga. Some ASM mines are organised as cooperatives. The concern for ASM is not only about poor productive conditions but also income. As price takers, the ASM lack bargaining power or quantities that they can sell. At Mutoshi, a miner stated: "At present, the price is imposed, you are not even able to discuss your own goods." (Dorothée Baumann-Pauly 2023). Correct incomes in the earnings of ASM can contribute to sustainable livelihoods and the ability of households to meet their basic needs.

In the DRC, much policy focus has been on supporting the ASM sector towards formalisation.

5.2. PARTNERSHIPS, GEOPOLITICS, AND REN VALUE CHAIN DEVELOPMENT

Many development partners have expressed interest in helping the DRC develop its value chain. These include the US, EU, Japan, and China. Two blocs are competing for collaboration with the DRC: the Western governments, mainly through the Minerals Security Partnership (MSP) and China, via the Belt and Road Initiative, (BRI).

5.2.1. US, DRC, and Zambia MOU Supporting the Development of a Value Chain in the EV Battery Sector

In December 2022, during a side event at the US-Africa Leaders' Summit in Washington, the United States signed a trilateral memorandum of understanding with the DRC and Zambia to develop an integrated value chain to produce EV batteries. The agreement seeks to facilitate the development of an integrated value chain for the production of EV batteries in the DRC and Zambia, covering raw materials extraction, processing, manufacturing, and assembly. The US commits to providing the two countries with technical assistance and co-financing investment opportunities to develop the battery value chain for EVs and the clean energy sector. This includes promoting the initiative within the US private and investment sector to reach commercial development for identified projects.

Notable is the US intention to support both DRC and Zambia in the prevention, detection, and prosecution of corruption consistent with the UN Convention Against Corruption. The agreement is framed in terms of the Paris Agreement and aims to respond to the threat of climate change and efforts to limit temperature increase to 1.5 degrees Celsius. The MOU has not been followed by demonstrable projects on the ground and "is not intended to be legally binding and is not an obligation of funds," and all activities under the MOU are subject to the availability of funds (See US-DRC-Zambia MOU, 13 December 2022).

5.2.2. US, EU, Angola, DRC, Zambia Agreements and the Lobito Transport Corridor

In October 2023, at the Global Gateway Forum in Brussels, the European Union (EU) Commission signed two strategic partnerships on critical raw materials (CRM) value chains, one with the DRC and the other with Zambia. The EU signed an MOU with the US, Angola, DRC, Zambia, the AfDB, and the African Finance Corporation to develop the Lobito transport corridor (Christian Géraud Neema, 2024). The MOU aims to develop a complete value chain around electric vehicle batteries in the DRC and Zambia, from mineral extraction to the assembly line. Again, not much has been made public at the project implementation level.

5.2.3. China-DRC Cooperation

As shown by China's dominant presence in DRC's mining sector, the two countries have cooperated significantly.

a) Trade and Investment Cooperation Agreements

Energy transition minerals involving China in the DRC are concrete and measurable. For example, the significant investments in Molybdenum Co., Ltd. (CMOC) and Zhejiang Huayou Cobalt are measured in billions of dollars. Unlike the non-binding MOU between the DRC and the US or the EU, Chinese projects are visible and based on binding contracts on the ground. Therefore, they are hypothetically open to legal challenge, review, and benchmarking against responsible mining and community impact standards. The Sino-Congolese minerals-for-infrastructure agreement is a case in point.

b) The Sino-Congolese Agreement: The Minerals-for-Infrastructure Deal

In 2008, President Kabila signed the Sino-Congolese Agreement with China, which was considered the "deal of the century," forming the Sicomines joint venture with the following shareholding: Group of Chinese Enterprises (68 per cent) and Gecamines (32 per cent). The latter is a DRC state-owned enterprise. The deal involved the construction of infrastructure development projects amounting to US$3 billion in the DRC in exchange for China gaining access to copper and cobalt deposits, whose estimated value was US$93 billion. However, the Chinese performance of US$3 billion was not met as an audit found that only $822 million had been invested. This prompted President Etienne Tshisekedi to reassess the Sicomines Agreement in May 2021 and approach Beijing to renegotiate the agreement in the interest of justice and fairness. The negotiations are ongoing, and the President of the DRC has indicated that as part of the renegotiation of the Sicomines project, a total amount of $7bn in infrastructure support is estimated.[5] The renegotiation should align with President Xi Jinping's 2023 commitment at the China-Africa Leaders' Roundtable to harness its resources and support Africa in growing its manufacturing sector and achieving industrialisation and economic diversification. This could be integral to China's Belt and Road cooperation and the Forum on China-Africa Cooperation (FOCAC).

The implementation and success of cooperation agreements and MoUs will depend on the ability of the DRC to align its national interest with the security and economic interests of its partners, the EU, the US, China, and others. In the context of the geopolitical rivalry between the West and China over the critical minerals supply chain, this can be both an opportunity and a threat to the DRC's ambition. The DRC must negotiate its relations with the two blocs with caution based on principles that benefit the country's industrial development and advance the welfare of citizens.

[5] Alfie Shaw, "China and DRC considering $7bn in financing: A deal was first struck in 2008 but the African nation wants this renegotiated." (Mining Technology. com, January 23, 2024)<https://www.mining-technology.com/news/drc-seek-mining-deal-renegotiation-with-china/?cf-view> accessed 5 March 2024

6.CONCLUSIONS AND RECOMMENDATIONS

6.1. BATTERY MANUFACTURING-LED INDUSTRIALISATION

Could a value chain be developed to manufacture batteries for EVs and other industrial applications in the DRC? This question must be asked, and the main actors (the government, the partners, the mining companies, and civil society) must respond through practical action. The answer is yes, but the DRC will need to invest a lot of thinking and finances and create adequate skills to create renewable energy value chains that are enduring, resilient, and sustainable. This study shows that the DRC has a processing capacity that is still at an embryonic stage but the same cannot be said for battery manufacturing at industrial and commercial scales. The DRC should bring extra ordinary capacity to take the EV and battery manufacturing route as anticipated in the DRC-Zambia EV and battery manufacturing initiative (which is supported by the AfDB, Afrexim bank and UNECA, among others). More capital and technological investments are needed to extend this processing capacity to an advanced level. In the meantime, the DRC must optimise revenues from its critical minerals exports as financing and installation of manufacturing capacity will take longer than policy intentions.

6.2. FINANCING CRITICAL MINERALS BENEFICIATION AND JET PARTNERSHIPS

There are several ways for the DRC to obtain financing from commercial banks, development partners, and public-private partnerships to increase processing capacity. China is a key partner with which the DRC should necessarily work to expand its capacity to process critical minerals locally. China has excess processing capacity for these minerals. Given that Chinese companies control 95 per cent of cobalt and copper in the DRC, the need to renegotiate contracts to include provisions for Chinese processing capacity to be relocated to the DRC is imperative This is the fastest way to promote localisation of value chains to manufacturing of finished products. Similar deals should be made with western countries with the USA-DRC-Zambia trilateral agreement being a building bloc. The positioning of the DRC as a climate solution country should be integral to the promotion of a trade and investment partnership on critical minerals equal to the model taken by just energy transition partnerships Just Energy Transition Partnerships (JETP). A financing mechanism followed in six countries and partnered by developed countries: South Africa, Indonesia, Vietnam, Philippines, Senegal, and India.

6.3. GOOD GOVERNANCE AND STATE CAPACITY

Although the DRC has a critical minerals advantage, it is difficult to establish an efficient and sustainable value chain at the current stage of its governance, security, and social situation. Demand for its minerals due to the global energy transition is not enough. The supply of critical minerals from the DRC has raised concerns over the security of supply due to political instability and conflict, as well as the concentration of Chinese interests in the mining sector. The DRC's democracy is fragile, and each electoral cycle is accompanied by disputes above the protracted armed conflict in the east. Corruption, illicit financial flows, and tax evasion remain omnipresent in the mining sector. This poses significant risks for businesses. There is a need to strengthen the capacity of state institutions to deal with multiple and intersecting factors and actors operating fighting to get a share of its abundant minerals.

6.4. DEVELOPING EFFECTIVE PUBLIC POLICIES AND CRITICAL MINERALS STRATEGY

The DRC government must quickly invest in implementing green policies. The success of DRC green manufacturing and clean energy technologies will depend on government policies to support new industries and the entrepreneurship of international investors such as the Chinese, EU, and US private sectors. The AU African Mining Vision (AMV) focuses on value addition, industrialisation, and comprehensive development within the mineral sector. The development of a DRC-specific critical minerals strategy should be aligned with the AMV and its tools, the Africa Green Mineral Strategy, and the African Minerals Governance Framework. The success of the country's strategy should integrate strong ESG credentials.

6.5. ESG FRAMEWORKS AND INCREASED CORPORATE ACCOUNTABILITY STANDARDS

6.5.1. Social License to Operate

DRC stakeholders must be guided by the need to build a social licence to operate and ensure that local communities benefit through inclusive project approaches to critical minerals supply chains and beneficiation.

6.5.2. Improved Use of ESG Standards and Laws Governing the Extractive Sector

There is a need to increase scrutiny of the environmental, social, and governance (ESG) implications of increasing the production of critical minerals in the DRC. Better ESG standards and norms for socially responsible critical minerals and energy transition investments can be achieved by strengthening the rule of law, especially concerning mining, environmental, and corporate governance laws. This is imperative in the DRC, where reported incidences of abuse in the cobalt sector abound. There should be a gradual shift from voluntary ESG standards to more compliance and regulation.

6.5.3. Philanthropies and CSOs to Support Community Involvement in Value Chains

Civil society organisations (CSOs) and philanthropies must support communities engaging in platforms and negotiations seeking consent on land, biodiversity, ecosystem services, and responsible mining closures. These standards are supported by initiatives such as the MSP's Principles for Responsible Critical Mineral Supply Chains, ESG-investing frameworks like the Equator Principles, and the general regime of international human rights, environmental and labour standards, which includes the UN Guiding Principles on Business and Human Rights, the Extractives Industry Transparency Initiative, Publish What You Pay, etc. To ensure consistency with international human rights norms and standards, CSOs and philanthropies must continue to provide evidence of irresponsible mining, and (particularly in the DRC) engagement with Chinese corporations and diplomatic channels within the Chinese international relations system is important. Platforms like the China-Africa Forum are the primary multi-lateral coordination mechanisms African countries to use for cooperation within the Belt and Road Initiative.

6.6. TECHNOLOGICAL ADVANCEMENT: INVESTMENT IN RESEARCH AND INNOVATION

6.6.1. Invest in Scientific REN Knowledge and Research

Investment is needed in scientific research in all energy transition sectors (manufacturing of batteries, energy accumulators and photovoltaic technology, solar panels, etc.) by supporting the CAEB. Mining companies must be incentivised to establish a DRC research fund to support the energy transition.

6.6.2. Investments in Training and Skills Development

The reform of higher and university education programmes in the technical sector (ISTA, Polytechnic Faculty) must be prioritised in developing human capital for critical minerals value addition in the energy transition context. This can be done by creating professional career centres in the renewable energy sectors to supply local skills to meet the requirements of the energy transition.

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