The Question of the Impact of Cobalt Mining

Ecology and Environment 2 (EEII)

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Background

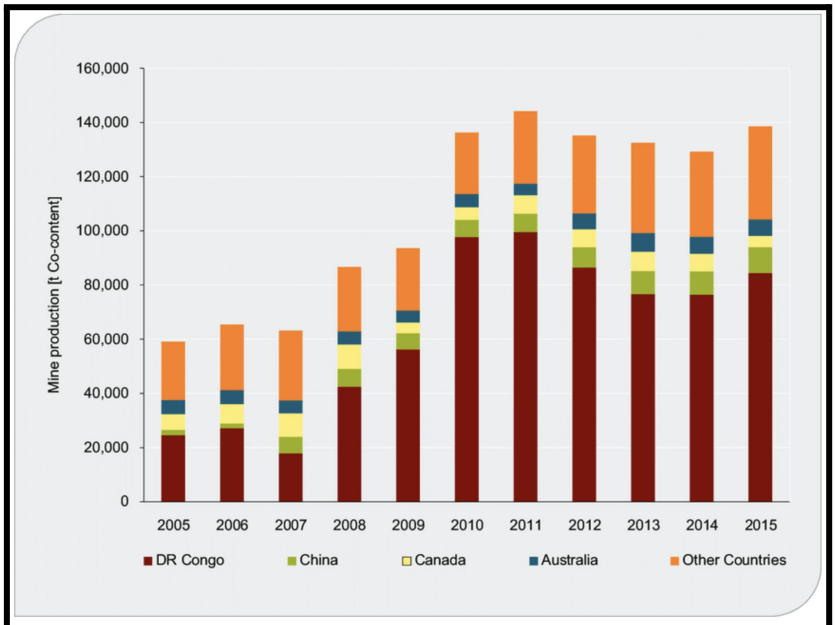
Cobalt is used in the manufacturing of rechargeable batteries, and to power smart phones and electric vehicles. There is currently a surge in cobalt mining which has resulted from glocal decarbonisation efforts. Increased demand is linked to the use of cobalt in the cathodes of electric vehicle (EV) batteries.

There is a limited amount of cobalt available, and geo-political difficulties in the countries where it is available. Most cobalt is mined as a by-product of copper mining, in the Democratic Republic of Congo (DRC). Efforts to increase production of this cobalt are currently stalled by the low price of copper. The DRC has also been plagued by political and social instability. Russia is the second largest producer of cobalt, raising issues of supply line instability and geo-political rivalry. Other countries such as Cuba and Madagascar are also emerging. China dominates the market in electric vehicle production, so many countries are looking further afield to increase their supply of cobalt to use in EV batteries.

There are also social costs of meeting increased demand. 'Artisanal' mining provides cobalt outside of copper mining. Artisanal mines are small, dangerous and polluting, involving hand digging of higher grade ores than those extracted by mechanised processes in copper mines. Mining and refining processes are therefore labour intensive and associated with frequent accidents, health problems from noxious gases and chemical exposure, deaths from overexertion and violence, and the use of child labour. Human rights abuses have been documented, linked to the expansion of multinational mining operations on community land.

left = interior of an artisanal mine in South Africa

There are also significant environmental costs of meeting increased demand, from both copper and artisanal mines. Contamination of soil and water with cobalt and radioactivity have been documented in the main mining region of the DRC.



Cobalt mine production from 2005 to 2015 (BGR 2017).

Overview of Current Issues:

Increased Cobalt demand: international environmental efforts have increased the global demand for Cobalt. The drive to reduce the roughly 75% of greenhouse gas emissions currently produced by the energy sector (IEA Report, 'Net Zero by 2050'), have led to a higher demand for the minerals used in batteries for electric vehicles. EV batteries are charged and discharged through the flow of lithium ions between the anode (positively charged) and the cathode (negatively charged). The cathodes contain nickel, and play a role in allowing the vehicle to travel further. Cobalt in the cathodes ensures they do not easily overheat or catch fire and helps to extend the life of batteries, acting as a stabiliser. An International Monetary Fund (IMF) Report in 2021 noted that a typical EV battery needs 8 kg of lithium, 35 kg of manganese and 6-12 kg of cobalt. The DRC is expected to account for 180,000 tonnes of cobalt supply this year, up more than 30% from 2022, and around 225,000 tonnes in 2024 (Reuters, March 2023). However, this increased demand for cobalt has worsened key problems associated with cobalt mining, such as grave human rights abuses, and environmental issues linked to radioactivity and the disposal of the minerals.

Environmental and public health problems: according to the US Centre for Disease Control and Prevention, the threshold for the level of cobalt toxicity in the environment is under 300 µg/l (100 µg/l respecting a safety factor of 3.) This kind of level will cause no damage to healthy people. However, levels over 700 µg/l can lead to heart problems, impaired eyesight and hearing, diarrhoea, headaches, blood pressure changes and damage to the immune system. Chronic levels of exposure to cobalt dust (particularly in children) can cause severe lung disease.

A 2018 study by the US National Institute of Health in the area of Kolwezi in the Katanga Copperbelt area of DRC, ('*Sustainability of artisanal mining of cobalt in DR Congo*') found, that people living in a neighbourhood that had been transformed into an artisanal cobalt mine, had much higher levels of cobalt in urine and blood than people living in a nearby control area. These levels were well above the accepted environmental threshold for cobalt toxicity. The differences were most extreme in children; the study also found evidence of exposure-related oxidative DNA damage.

Radioactivity levels are high in cobalt mining regions due to the presence of uranium deposits alongside cobalt and copper. Increased copper and cobalt mining increases levels of radioactivity in the local environment, as well as increasing exposure to humans. Cobalt mining is also associated with high concentration of cobalt in water sources and rivers close to mines, and contamination of soil leading to the death of crops and worms vital for soil fertility. The dumping of cobalt devastates landscapes and can severely affect the people living in nearby communities.

Social Problems: in several countries, artisanal cobalt mining is virtually unregulated, posing serious humanitarian concerns. The increased global demand for cobalt has led to the rapid expansion of mines in countries such as the DRC; this has led to human rights abuses as multinational companies scramble to extend mining projects on local land. Amnesty International's 2023 report details forced evictions of those living in areas turned into mines (with limited compensation), threats and intimidation, violence and damage to land and property. Alongside incredibly poor working standards, safety and rights, a 2016 report by Amnesty International ('This is What We Die For') discovered the prevalence of child labour in the mining of cobalt. The report details children as young as seven working in dangerous conditions for long hours, often to pay off family debts. The US Department of Labour estimates that over 25,000 children in the DRC are working in cobalt mines today; this figure threatens to expand as the electric car industry continues to grow.

Relevant Countries

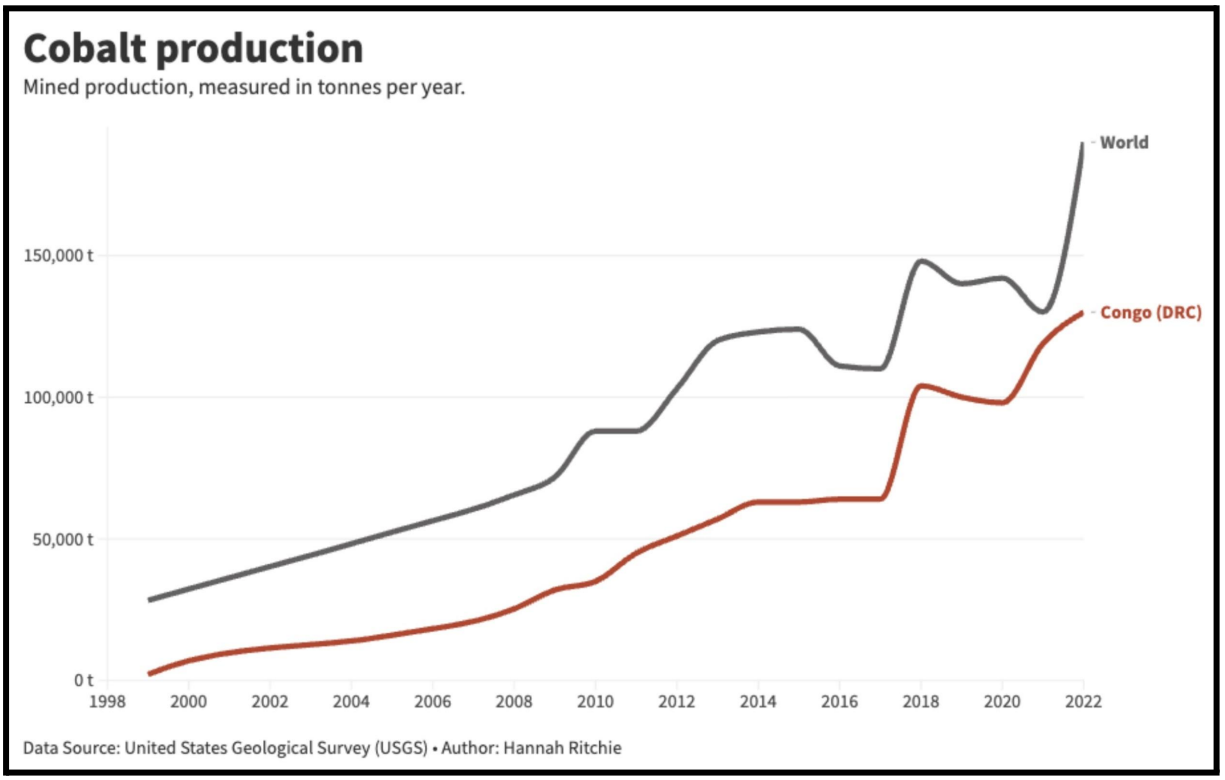
The US Geological Society reported in 2021 that roughly 70% of the world's cobalt was produced in the DRC. Of that, around 60% came from industrial mines and roughly 20% came from artisanal mines in one main region, the Katanga Copperbelt. (Russia produced about 10 % and Australia 8%.) The focus in studies has therefore been on the DRC as the major producer.

Despite claims by international firms that they have 'cleaned up' their cobalt supply chain, there remains considerable crossover between the supply of cobalt from industrial and artisanal mines in the DRC. Artisanal mining provides approximately 140,000-200,000 people with work in the DRC and most earn less than US$10 per day. Whilst this is low globally, that is considerably more than the earnings of most other citizens in the country, where the average person lives on an estimated US$1.90 a day (Earth.org). Therefore, there is little incentive to tighten environmental and labour regulation of artisanal mining in the country.

Australia is the world's second biggest producer of cobalt, most of which is a byproduct of copper and nickel mining. Although mining in Australia is highly regulated, issues with environmental damage persist. 2019 flooding around Whim Creek mine in Pilbara, Australia, caused levels of cobalt, copper and other metals to enter the water supply significantly above water quality guidelines. Other issues associated with cobalt mining in Australia include greenhouse gas emissions generated by fossil fuels used in the process; for example, mining equipment, heavy machinery used to operate open pit mines, and the energy required for the blasting process.

Cuba has the world's third biggest cobalt reserves and was the 6th largest producer of cobalt in 2022. A 2021 study (Pollution Monitoring in Two Urban Areas of Cuba, Gomez/Morales) showed pollution plumes contaminating 8 km of coastline and 10km of the Cabañas River. Despite these environmental problems, cobalt production is seen as the key to re-establishing relations with the US, which needs cobalt for its electric car industry and wants to ease Chinese influence over the global supply chain in electric vehicles.

In Zambia, studies of soil and mango fruit grown near copper and cobalt mines have revealed metals above the safety limit. NGOs say miners in the country are also prone to silicosis and tuberculosis. Similarly, Madagascar's largest foreign investment project ($8bn nickel and cobalt mining complex near Toamasina) has been blamed for air and water pollution, as well as health problems among the local population.



Graph: cobalt production is increasing at a faster rate

Relevant Organisations

- Amnesty International
- Human Rights Watch
- US Institute for Public Health
- International Monetary Fund
- Cobalt Institute

Possible Solutions

1) Cobalt mining regulations

In many cobalt-mining countries (notably the DRC), cobalt mining (especially in regards to artisanal mining) is left largely unregulated. The adoption of common standards and metrics, the establishment of monitoring/assessment processes and knowledge-sharing is

crucial to controlling the process of cobalt mining. Similar recommendations are outlined in a 2020 World Economic Forum (WEF) report, which outlined the current state of artisanal cobalt mining in the DRC and offered potential solutions to make the industry fairer and safer. With standardised, universally-recognised limitations, the human rights and abuses and environmental problems associated with the cobalt mining industry could be eliminated. Examples of this could be hiring guards to safeguard active mining areas and exclude children from work sites, and the distribution of personal protective equipment like boots and gloves.

2) Promotion of ethical cobalt mining

By increasing public awareness of the severe problems associated with cobalt mining, a larger public voice will call for the improving of working conditions in cobalt mines and ensuring safe, guaranteed standards for workers. Additionally, educational campaigns by Electric Vehicle companies will ensure the cobalt used in EVs is ethically sourced. Furthermore, by developing and implementing new energy-efficient technologies, the environmental costs of cobalt mining can be reduced, as the process will be less energy-intensive.

3) Reduce global cobalt demand

Recent research has found several materials to be viable alternatives to cobalt. The widespread use of such materials would reduce the global cobalt demand, lessening the strain on workers and the environmental costs of cobalt mining. Nickel, manganese and iron are able to replace cobalt in batteries; however, they need to be combined in varying quantities with other metals. Tesla reported that half the vehicles manufactured in the first quarter of 2022 were produced using cobalt-free lithium iron phosphate (also known as LFP) batteries – proposed to be a more sustainable alternative to cobalt. However, unfortunately these also face environmental concerns from critics.

4) Reduce global dependence on power-requiring vehicles

The best way (with the least other negative consequences) to improve transport sustainably, away from EVs containing cobalt or fuel-powered vehicles, is to favour a shift from individual vehicles. Mass encouragement of electric mass transit, bicycle lanes and

broad walking pavements in cities is crucial. Public education campaigns could help this aim by incentivising the public to limit their use of individual power-requiring vehicles.