

The Rise of Cobalt Demand and the Perils of Its Supply



Cobalt has been mined for millennia and used for a variety of purposes – from blue pigment to green vehicles. Today, cobalt is critical in the chemistry of the ubiquitous lithium-ion battery, which powers cellular phones, laptops and electric vehicles. It is so critical, in fact, that the specter of a supply problem has investors on high alert. And for good reason. Much of the world’s supply of cobalt comes from the very unstable Democratic Republic of the Congo, and most of that supply is now controlled by China. Inside this piece we examine cobalt’s increasingly important place in the world and the challenges companies face in securing a supply of the blue mineral.

Charles Marlow, the steamer captain from Joseph Conrad's late 19th century novella *Heart of Darkness*, was drawn to the vast "blank places" on the map that surrounded the Congo River. Today, the Democratic Republic of Congo (DRC) is no longer a blank place on the map, and the Congolese are far from the one dimensional characters depicted by Conrad. But the DRC is still a land gripped by instability and danger. It also happens to be where half of the world's supply of cobalt is located. That poses a problem for manufacturers of electric vehicles (EV) and cellular phones, as well as anyone else who relies on cobalt for lithium-ion batteries.

With China just announcing it will join Great Britain and France in banning the combustion engine, the challenge of securing a supply of cobalt just got tougher. This piece will lay out a few of the critical issues surrounding cobalt and illustrate some of the challenges companies face in securing a sustainable supply of this critical and strategically important blue mineral.

While Tesla Eyes Mars, China's Mission to Africa Continues

China's plan to rely on the electric car to curb long-term pollution is predicated on its ability to tie up the world's supply of cobalt.¹ Some say they are already close to doing it.² Last year China made the biggest private investment in the Democratic Republic of Congo's history, when China Molybdenum announced it was buying U.S. based Freeport McMoRan's stake in the Tenke copper mine for \$2.65 billion.

Why is copper significant? Cobalt is produced primarily as a bi-product of nickel and copper mining, and the Tenke mine contains one of the world's largest known deposits of copper and cobalt. According to mineral analysts CRU Group, China now controls 62% of the world's cobalt supply, and over 90% of that comes from the DRC. This control of Congolese cobalt puts China in the "driver's seat" of electric car manufacturing and has other implications as well. While 40% of the world's supply of cobalt is used by lithium-ion battery makers, the remaining 60% is used for a diverse mix of industrial and military uses.³ The threat of Chinese hegemony over cobalt is serious enough that the American Defense Logistics Agency has started to acquire chemical compounds of cobalt as a "strategic material".⁴

Where There is Conflict, There are Conflict Minerals

Under the right circumstances, the combination of democracy and capitalism can lift humanity to a better version of itself. Unfortunately, those circumstances have never been present in the DRC. Since the

1 <https://www.bloomberg.com/news/articles/2017-09-10/china-s-fossil-fuel-deadline-shifts-focus-to-electric-car-race-j7fktx9z>

2 <https://www.wallstreetdaily.com/2016/06/06/china-cobalt-electric-cars/>

3 <https://www.cobaltinstitute.org/>

4 <http://www.dla.mil/HQ/GeneralCounsel/FOIA/Freedom-of-Information/Index-Of-Information/DLA-Strategic-Materials/>



China now controls 62% of the world's cobalt supply, and over 90% of that comes from the DRC.



Erythrite, which is partially composed of cobalt-containing minerals.

arrival of King Leopold II of Belgium in the late 1800s, being born in the Congo has offered few blessings. In some ways, things haven't improved much since the days of rubber plantations and the ivory trade. Despite abundant natural resources, the United Nations ranked the DRC 177 out of 188 in their far-reaching 2016 Human Development Index.⁵

Since the 1960s, constant strife and corruption in the DRC has led to two civil wars and a total collapse of state-run mining. In the aftermath, the government encouraged independent small mining operations as a way to inject any economic activity in the region. As a result, few, if any, rules or regulations govern mining in the DRC and in the absence of any other opportunities, people are desperate to work the mines. These "artisanal" mines are usually small and poorly constructed. They are often dug by hand, in toxic and dangerous conditions, and far too often by children. In 2012, UNICEF estimated 40,000 children labored in the cobalt supply chain.⁶ In 2016, Amnesty International released a 92-page report on human rights issues in the DRC cobalt mines with a title that evoked King Leopold's ghost: "This is what we die for".⁷ Amnesty International now considers cobalt a conflict mineral.

With reports like this and with major media outlets like *The New York Times*, *The Washington Post* and the *Financial Times* beginning to focus on the problems with the cobalt supply chain, the stakes are being raised for the iconic brands that rely on cobalt. Apple now considers cobalt a conflict mineral, bringing with it a higher level of scrutiny on its supply.⁸ Intel has even taken steps to educate the public on the issue.⁹ Tesla has pledged to source its cobalt exclusively from North America (more on that challenge below).

Ultimately, the scrutiny may lead to cobalt being added to the list of conflict minerals regulated in the U.S.A. by the Dodd-Frank Act. Section 1502 of the Act currently requires publically traded companies to disclose whether they receive tantalum, tungsten, tin and gold from the DRC.¹⁰ It is important to note that some critics claim Dodd-Frank doesn't really address the economic pressures on the ground when mining jobs are lost or have a realistic grasp on the causality of violence and radicalization of Africa.¹¹ Nevertheless, the intergovernmental Organization for Economic Co-Operation Development (OECD) is working to educate purchasers on the risks in cobalt production and

5 <http://hdr.undp.org/en/content/human-development-index-hdi>

6 <http://data.unicef.org/topic/child-protection/child-labour/>

7 https://www.amnestyusa.org/files/this_what_we_die_for_-_report.pdf

8 https://www.washingtonpost.com/news/the-switch/wp/2017/03/03/apple-cracks-down-further-on-cobalt-supplier-in-congo-as-child-labor-persists/?utm_term=.6e5e16cf4fa8

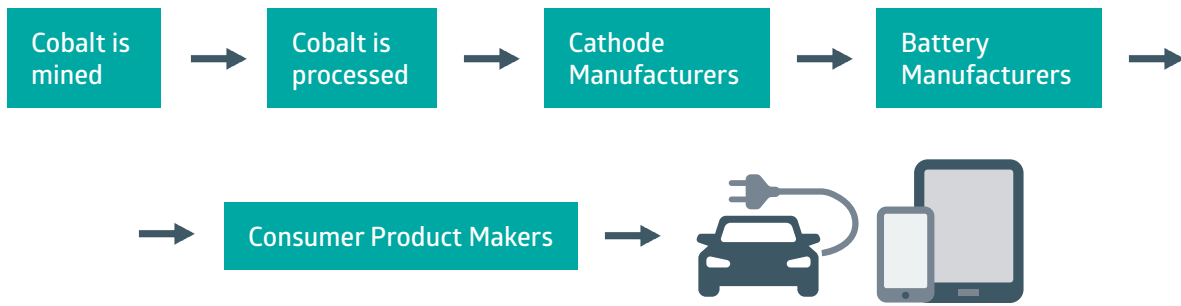
9 http://download.intel.com/newsroom/kits/ces/2016/pdfs/Intel2016_Conflict-Free_Milestone_FactSheet.pdf

10 <https://www.sec.gov/opa/Article/2012-2012-163htm---related-materials.html>

11 <http://foreignpolicy.com/2015/02/02/how-dodd-frank-is-failing-congo-mining-conflict-minerals/>

Apple now considers cobalt a conflict mineral, bringing with it a higher level of scrutiny on its supply. Intel has even taken steps to educate the public on the issue. Tesla has pledged to source its cobalt exclusively from North America.

LITHIUM-ION BATTERY SUPPLY CHAIN



Source: *Washington Post*¹³, *Bailard*

mining and has come up with a due diligence framework.¹² Several organizations including the World Economic Forum, The Clean Battery Alliance and the Cobalt Institute are working to create a framework to help companies secure a source of conflict-free cobalt.

The Rub

Unfortunately, a verifiable “chain of custody” from beneath the earth to beneath the hood will be no easy task. Cobalt from artisanal mines and large scale operations are too easily mixed together and then sold to a variety of small distributors in the southern DRC. The cobalt is then sold to larger distributors who mix it with cobalt purchased from large scale mines. These larger distributors in turn sell the cobalt to Chinese buyers.¹³ The cobalt then typically ends up with smelters and processors in China and is sold downstream to battery manufacturers. The processors and smelters are no help and have historically been very reluctant to show any transparency about their cobalt supply.

As a result, it is difficult for any company to ensure its purchase of cobalt from the DRC is free of child labor and conflict. That is the position held by natural resources audit and training company RCS Global, which helps companies verify supply chains. RCS, which has offices in New York, London, Shenzhen and Johannesburg, says the chance of having child labor somewhere in a

company’s supply chain of cobalt is a virtual certainty.¹⁴

Of course, the first challenge for companies dependent on cobalt is securing a supply of cobalt at all. In the future, that supply may be much less certain.

Supply and Demand Imbalance May Leave Investors Feeling Blue

Two things are clear:

1. As long as the lithium-ion battery remains the default battery for EV and hand-held devices, the demand for cobalt will grow exponentially
2. As long as the economics make direct mining of cobalt unfeasible, the supply can be choked off for various reasons.

There are about six grams of the cobalt in a typical smartphone. Even with the growth of cellular phones slowing, an estimated 1.84 billion phones will be shipped annually by 2020.¹⁵ EV batteries of course require much larger amounts of cobalt than a cell phone. The rapid growth of the EV market combined with the constraints of cobalt supply could easily put a squeeze on companies dependent on the mineral.

Tesla provides a good illustration of the potential shortfall in cobalt that could hit the market.

Cobalt currently represents about 15% of the mineral composition of the typical Tesla/Panaso-

¹² <http://www.oecd.org/corporate/mne/mining.htm>

¹³ <https://www.washingtonpost.com/graphics/business/batteries/congo-cobalt-mining-for-lithium-ion-battery/>

¹⁴ <http://www.rcsglobal.com/the-battery-revolution-balancing-progress-with-supply-chain-risks/>

¹⁵ <https://www.idc.com/getdoc.jsp?containerId=prUS41425416>

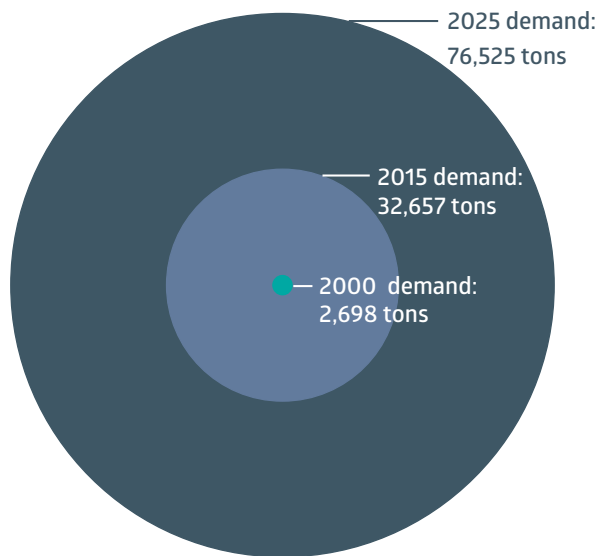
nic EV battery – and Tesla plans to increase production to 500,000 cars per year.¹⁶ Tesla plans to make the battery packs for the Model 3 in their \$5 billion “Gigafactory” being built in the Nevada desert. The company claims one Gigafactory will produce more batteries than the company produced worldwide in 2013.¹⁷ Tesla estimates that the Gigafactory production will create a 30% reduction in the cost of the battery pack. This brings the question back to cobalt.

As previously noted, Tesla has pledged to source 100% of its needs for the Gigafactory from North America, thus avoiding the moral hazard of the Congo. Easier said than done. Securing enough cobalt from North America for the mass production of Tesla may be a test on par with flying private citizens to the moon. The United States Geological Survey (USGS) estimates the worldwide production of cobalt was 123,000 metric tonnes in 2016. According to the USGS, Canada and the U.S. currently produce approximately 4% of the global supply.¹⁸ Assuming the same basic configuration of minerals in the battery, the new Model 3 projections alone would require 7,800 metric tonnes or 6% of the current worldwide supply.¹⁹ Tesla clearly has its work cut out for itself.

Of course, Tesla is acutely aware of this issue. In the latest quarterly 10-Q report, Tesla listed “an increase in the cost, or decrease in the available supply, or materials used” in their battery cells as a material risk. It also may be a motivating factor in Tesla’s plans to build a wholly owned factory in Shanghai’s free-trade zone.²⁰

Keep in mind, Tesla is just one player in the growing demand for EV batteries. Morgan Stanley estimates EVs will represent 15% of the global car market by 2025. By most estimates, China is growing the EV market three to four times faster than the U.S. and Europe.²¹ China currently rep-

COBALT DEMAND FOR LITHIUM-ION BATTERIES



Source: Christophe Pillot, Avicenne Energy; Washington Post²²; Bailard

resents 50% of the global EV market and is growing at 200% per year.²² As is the case with most mass markets, China matters. As previously stated, the lithium-ion batteries now consume 40% of the world’s cobalt supply. With China coming on fast with EV market share, that percentage will grow, fed by the cobalt supply they control.

Further complicating the supply side of the equation – much less a conflict-free supply – is the reliance on the price of copper and nickel. When copper and nickel prices collapse, mines shut down and cobalt supply contracts. The price of copper is currently trading in the middle of its average over the past 10 years. Nickel is toward the low end of its range. If inventory levels of copper and nickel rise, that slows down production too. There is also some evidence that hedge funds have begun stockpiling the physical supply.²³ This could be disruptive to prices.

16 <http://fortune.com/2015/05/18/tesla-grid-batteries-chemistry/>

17 <http://www.ecobalt.com/news/cobalt-news/tesla-to-use-north-american-material-amid-pollution-worry>

18 <https://minerals.usgs.gov/minerals/pubs/commodity/cobalt/mcs-2017-cobal.pdf>

19 <https://techcrunch.com/2017/01/01/no-cobalt-no-tesla/>

20 <https://www.wsj.com/articles/tesla-strikes-deal-with-shanghai-to-build-factory-in-china-1508670181?mod=djemalert-tech>

21 <http://www.marketwatch.com/story/china-leads-electric-vehicle-market-bev-phev-2020-forecasts-say-new-research-reports-2016-04-21-22203056>

22 https://www.unicef.org/childsurvival/drcongo_62627.html

23 <https://www.ft.com/content/4f88cb60-f8f7-11e6-bd4e-68d53499ed71>

Essentially, any dramatic movement down in price for copper and nickel for sustained periods of time would further constrain the global supply of cobalt. The other alternative is mining cobalt directly, which would dramatically increase the price of the lithium-ion battery pack. Only about 6% of the world's cobalt is mined in this fashion.²⁴

Rare Earth

There are great natural resources in the DRC. There are 80 million hectares of arable land that some estimate could feed a billion people.²⁵ Lake Tanganyika alone contains 20% of the world's potable water. But it's what lies beneath the fertile land that has the world closing in on the "Congo" as it once did for its rubber plants and elephant herds. That means even more pressure on the DRC.

In an era when large companies have shown leadership in America over issues of tolerance, inclusion and climate change, is there an opportunity for the sophisticated companies that rely on cobalt to improve conditions in the mines? Perhaps. Companies can join international efforts to improve the supply chain and make things better in the mining regions of the southern DRC. More cooperation is needed between civil groups, companies and governments on the ground, or else armed factions will just run illegal mining operations regardless of international laws. Technological improvements may also lessen the dependence on cobalt in the lithium-ion battery, and

perhaps other less brutal industries will develop and provide economic opportunities for the population in the southern DRC so dangerous mining jobs are not the best option available.

For now, history is repeating itself in resource rich central Africa. In the 1700s, European powers created vast colonial operations all over the continent while the Congo remained impenetrable – a vast blank place on the map. That is, until Leopold willed his way in with his particularly brutal brand of occupation. Today, light is being shed on the Congo because of the world's adoption of cell phones and electric cars. The picture the world is seeing is bleak. Even with his narrow, racially-distorted view of the world, Marlow made a succinct observation when he ventured up the Congo River in the *Heart of Darkness*: "The conquest of the earth, which mostly means the taking it away from those who have a different complexion.....is not a pretty thing when you look into it too much."

To be sure, looking into the cobalt supply chain in the DRC is "not a pretty thing". Whether conditions improve remains to be seen. It will take much more public pressure and scrutiny, and companies willing to work through complex supply chain issues. Ultimately, cooperation and pressure from China will be needed especially if western companies pull out of the DRC to avoid issues with child labor. That may be wishful thinking, but if a private company can land a person on the moon, anything is possible.

24 <https://seekingalpha.com/article/4027400-teslas-evolving-cobalt-nightmare>

25 <https://www.bloomberg.com/news/articles/2017-09-15/one-hundred-years-later-heart-of-congo-ships-oil-again>

DISCLOSURES

This communication is for informational purposes only and is not a recommendation of, or an offer to sell or solicitation of an offer to buy, any particular security, strategy or investment product. This communication does not take into account the particular investment objectives, financial situations or needs of individual clients. References to specific stocks are for illustrative purposes only and are not intended to represent any past, present or future investment recommendations. All investments have the risk of loss. There is no assurance that Bailard or any of its investment strategies can achieve their investment objectives. **Past performance is no**

guarantee of future results. This communication contains the current opinion of its author and such opinions are subject to change without notice. Information contained herein has been obtained from sources believed to be reliable, but is not guaranteed. Bailard cannot provide investment advice in any jurisdiction where it is prohibited from doing so. The application of various environmental, social and governance screens may result in the exclusion of securities that might otherwise merit investment, potentially adversely affecting performance.



ABOUT THE AUTHOR

Blaine Townsend, CIMA®, CIMC®

Senior Vice President

Director, Sustainable, Responsible and Impact Investing (SRII)

Bailard, Inc.

Blaine serves as a Senior Vice President and the Director of Bailard Wealth Management's Sustainable, Responsible and Impact Investing (SRII) group. Blaine is on both Bailard's fundamental and SRII investment committees, conducts social research, oversees corporate engagement efforts and maintains client relationships.

Blaine began researching and writing about corporate social responsibility in the late 1980s. He started his career in Socially Responsible Investing in 1991 at the Muir Investment Trust, the nation's first environmentally screened bond fund. In 1996, he opened the California office for Trillium Asset Management, which he led for thirteen years. While at Trillium, Blaine managed socially responsible and sustainably focused portfolios, served on the firm's investment committee and worked on corporate engagement efforts on a host of social and environmental issues from deforestation to media reform. Blaine also led the effort to create the "Joan Bavaria Awards for Building Sustainability in the Capital Markets",

which are presented each year at the Ceres annual conference and was part of the working group that created OpenMic to address net neutrality and media reform. In 2009, he joined Nelson Capital Management, where he was a partner and a senior portfolio manager. He also served on the firm's leadership team and investment committee. Blaine chaired the company's corporate engagement committee and was on the Extraction-Free and Animal-Welfare model teams. Blaine joined Bailard in 2016.

Blaine holds a BA from the University of California, Berkeley and CIMC® and CIMA® credentials. His writings on social investing have appeared in numerous publications including the *San Francisco Chronicle*, *Houston Chronicle*, *San Jose Mercury News* and London's *Environmental Finance* magazine. Blaine has three children in college and lives with his wife and two dogs in Mill Valley, California. He has an eclectic taste in music and is an avid sports fan.

Published October 2017

Bailard Wealth Management
950 Tower Lane, Suite 1900
Foster City, California 94404-2131
phone: (650) 571 5800

For more information, please visit
www.bailard.com.

*Bailard Wealth Management is a
division within Bailard, Inc.*

Bailard
Wealth Management