

# Strategic Metals & Rare Earths Letter

## INTERNATIONAL

*the independent information and advisory publication on investing in Strategic Metals & Rare Earths*

### SPECIAL REPORT - May 2017

## COBALT to benefit from excessive surging rise of lithium (Li-ion) batteries



Compared to lithium, **cobalt** is a shiny, grey, brittle metal that is best known for creating an intense blue colour in glass and paints. It is not a rare element even though pure cobalt is not found in nature.

**Cobalt** occurs in conjunction with other elements in such metals as carrollite, a copper-cobalt-(nickel) sulphide; skutterudite, a cobalt-nickel arsenide and asbolane, a nickel-cobalt-manganese oxide.

**Cobalt** is obtained from the following three main types of ore deposits: (1) Sediment-hosted stratiform copper deposits such as those in the Central African copper belt in the Democratic Republic of Congo (DRC) and Zambia, (2) magmatic nickel sulphide deposits, such as those found at Sudbury Canada and at Norilsk, Russia; and (3) nickel laterite deposits, which are found in such tropical regions as New Caledonia (overseas territory of France).

**Cobalt** is frequently used in the manufacture of rechargeable batteries and to create alloys that maintain their strength at high temperatures. It is also one of the essential trade elements (or “micro-nutrients”) that humans and many other living creatures require for good health.

**Cobalt** is an important component in many aerospace, defence and medical applications and is a key element in many clean energy technologies.

Globally, the leading use of cobalt as in rechargeable batteries to help increase battery life and stability and to reduce corrosion. Mobile phones, portable computers and hybrid and electric vehicles all depend on the energy produced by chemical reactions in these rechargeable batteries.

**Cobalt** also plays a vital role in human and animal health; it is an essential element in vitamin B2, which helps ensure proper brain function and aids in the formation of red blood cells.



**Congo (Kinshasa)** is the world’s leading source of mined cobalt, supplying more than one-half of world cobalt mine production. With the exemption of production in Morocco and artisanally mined cobalt in Congo (Kinshasa) most cobalt is mined as a by-product of copper and nickel.

In 2016, global cobalt mine production decreased from 126,000 tons to an estimated 123,000 tons, mainly owing to lower production from nickel operations.

Growth in world refined cobalt operations was forecast to increase at a lower rate than that of world cobalt consumption, which was driven mainly by strong growth in the rechargeable battery and aerospace industries.

As a result, the global cobalt market is expected to shift from surplus to deficit by next year.



**China** is the world's leading producer of refined cobalt and the leading supplier of cobalt imports to the United States. Much of China's production is from ore and partly refined cobalt imported from Congo (Kinshasa); scrap and stocks of cobalt materials also contributed to China's supply.

In 2015 and 2016, China's State Reserve Bureau purchased cobalt for its stockpile, increasing its grip on the global cobalt market..

China is the world's leading consumer of cobalt, with nearly 80% of its consumption being used by the rechargeable battery industry.

### Top-10 cobalt mine producers (in tons)

	2016E	2015	Reserves
Congo (Kinshasa)	66,000	63,000	3,400,000
China	7,700	7,700	80,000
Canada	7,300	6,900	270,000
Russia	6,200	6,200	250,000
Australia	5,100	6,000	1,000,000
Zambia	4,600	4,600	270,000
Cuba	4,200	4,300	500,000
Philippines	3,500	4,300	290,000
Madagascar	3,300	3,700	130,000
New Caledonia *	3,300	3,680	64,000
Other countries	11,800	15,620	746,000
<b>World total</b>	<b>123,000</b>	<b>126,000</b>	<b>7,000,000</b>

\* Overseas territory of France

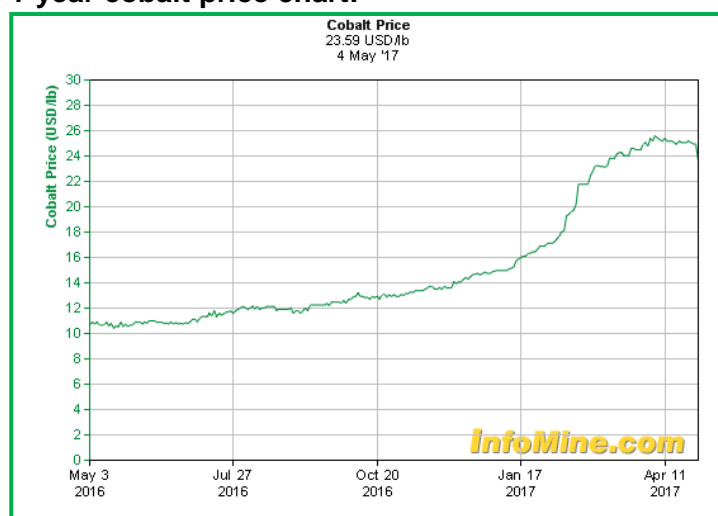
### ► Cobalt market price

In 2016, the cobalt price started to rise responding to increased demand and reduced supply. It was rising from its lows around US\$ 10/lb to around US\$ 15/lb by year-end, for about a 50% rise and is expected to more than double to US\$ 30/lb by year-end 2017. The current cobalt price is US\$ 23.50.

**Cobalt** is currently surging with the rise of lithium-ion (Li-ion) batteries (approximately 75% of these batteries use cobalt), as cobalt offers the highest energy density of the various Li-ion battery formulas, and is therefore very popular in electric vehicles.

The International Energy Agency estimates a global increase to 40 million hybrid cars by 2024, with the batteries of all these cars requiring 7 kilos of cobalt. This alone would push the demand for cobalt to 280,000 tonnes by that time, which represents two times today's global cobalt production.

### 1-year cobalt price chart:



Tesla, the world's largest electric car producer, uses NCA (nickel-cobalt-aluminium) lithium batteries in their electric vehicles (EVs). The raw material by cost for NCA batteries is higher for cobalt than for lithium and are usually a combination of 80% nickel, 15% cobalt sulphides and 5% aluminium. NCA has the highest specific energy or power per kilogram.

Many traditional nickel manganese cobalt oxide (NMC) batteries, which are typically used in power tools and many electric cars, are in energy storage use one-third equal parts nickel, manganese and cobalt.

## Overview of listed COBALT companies (by market capitalization)

26 May 2017	Trading symbol		Share price		Change in %	12 months prices		Total shares issued million	Market cap. million	
			Current 2017	Year-end 2016		H	L		local	US\$
			C\$	C\$		C\$	C\$		C\$	
eCobalt Solutions	TSX.V	ECS	0.970	0.540	80	1.46	0.37	129.7	125.8	93.1
Fortune Minerals	TSX.V	FT	0.205	0.125	64	0.34	0.09	300.1	61.5	45.5
US Cobalt *	TSX.V	USCO	0.800	0.200	300	1.19	0.16	50.4	40.3	29.8
First Cobalt	TSX.V	FCC	0.470	0.390	21	0.92	0.06	49.1	23.1	17.1
Lico Energy Metals	TSX.V	LIC	0.125	0.135	-7	0.24	0.07	106.7	13.3	9.9
Cruz Cobalt	TSX.V	CUZ	0.180	0.130	38	0.31	0.04	58.3	10.5	7.8
Castle Silver Resource	TSX.V	CSR	0.260	0.070	271	0.30	0.02	39.1	10.2	7.5
Cobaltech Mining	TSX.V	CSK	0.110	0.240	-54	0.45	0.02	85.6	9.4	7.0
Global Energy Metals	TSX.V	GEMC	0.150	0.160	-6	0.67	0.14	24.6	3.7	2.7
			A\$	A\$		A\$	A\$		A\$	
Cobalt One **	ASX	CO1	0.100	0.050	100	0.20	0.02	546.4	54.6	41.0

\* name change from Scientific Metals to US Cobalt - effective May 25, 2017

\*\* name change from Equator Resource to Cobalt One - effective May 26, 2017