U.S. and Global Cobalt Statistics and Information from the USGS National Minerals Information Center

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Overview

- USGS National Minerals Information Center
- U.S. cobalt supply & consumption
- Global cobalt resources & reserves
- Where to find more information
Mission: to collect, analyze, and disseminate information on the domestic and international supply of and demand for minerals and mineral materials essential to the U.S. economy and national security.

Goal: to provide decisionmakers with the information required to ensure that the Nation has an adequate and dependable supply of minerals and materials to meet its defense and economic needs at acceptable costs related to environment, energy, and economics.
USGS National Minerals Information Center—Cobalt Statistics and Information

**Domestic Statistics**
- Production
- Consumption
- Imports & exports
- Government, LME, and industry stocks
- Prices

**Examples of additional information**
- Legislation & Government programs
- Status of U.S. operations and planned projects
- Special reports on topics of interest

**Global Statistics**
- Mine production
- Refinery production
- Refinery capacity
- LME stocks
- Reserves
- Resources
- Prices

**Examples of additional information**
- Country-by-country reviews of industry developments
- Status of planned projects
- Special reports on topics of interest
United States is 75–80% import reliant for cobalt.

- About one-quarter of reported cobalt consumption is derived from scrap.
- Prior to 2010, cobalt shipments from the National Defense Stockpile (NDS) contributed to supply.
- Some U.S. cobalt mine production in Michigan and Montana; potential future production in Minnesota and Idaho.
Recent imports have been about 11,000 metric tons per year of cobalt.

- China, Finland, Norway, and Russia are leading suppliers.
- Sudden decrease in imports following global financial crisis and rapid return to pre-crisis levels.
- China’s share increased during past decade.
- Increase in imports from “Other” countries.
Cobalt sales began in 1993; the authorization expired in 2011.

Inventory as of December 31, 2014, was 301 metric tons of cobalt metal.

Acquisition of lithium ion battery precursors during FY 2015–19
- 750 kilograms of lithium cobalt oxide (LCO)
- 2,700 kilograms of lithium nickel cobalt aluminum oxide (NCA)

Source: Defense Logistics Agency Strategic Materials
## U.S. Cobalt Supply—Mine Production

<table>
<thead>
<tr>
<th>First year of production</th>
<th>Company Project Location</th>
<th>Scope</th>
<th>Cobalt capacity, metric tons per year contained cobalt</th>
<th>Cobalt-containing product</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996*</td>
<td>Stillwater Mining Co.</td>
<td>PGE mines, mills, smelter, and refinery</td>
<td>Minimal</td>
<td>Nickel sulfate</td>
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<tr>
<td></td>
<td>Stillwater operation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Montana</td>
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<tr>
<td>2014</td>
<td>Lundin Mining Corp.</td>
<td>Nickel-copper mine and mill</td>
<td>900&lt;sup&gt;e&lt;/sup&gt;</td>
<td>Nickel concentrate</td>
</tr>
<tr>
<td></td>
<td>Eagle Mine</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Michigan</td>
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<tr>
<td>2016&lt;sup&gt;e&lt;/sup&gt;</td>
<td>PolyMet Mining Corp.</td>
<td>Copper-nickel-PGE mine and mill</td>
<td>360</td>
<td>Nickel-PGE concentrate</td>
</tr>
<tr>
<td></td>
<td>NorthMet Phase 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minnesota</td>
<td></td>
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</tr>
<tr>
<td>NA</td>
<td>Formation Metals Inc.</td>
<td>Cobalt mine and mill and refinery</td>
<td>1,500&lt;sup&gt;e&lt;/sup&gt;</td>
<td>Cobalt sulfate or cobalt cathode</td>
</tr>
<tr>
<td></td>
<td>Idaho Cobalt Idaho</td>
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</tbody>
</table>

*Base Metals Refinery was commissioned in 1996.
<sup>e</sup> Estimated. NA Not available. PGE platinum-group element.
U.S. Cobalt Consumption

Reported consumption
- Based on voluntary surveys of U.S. cobalt processors and consumers
- Data include estimates for nonrespondents
- Data collected by material and end use

Apparent consumption
- Calculated
Imports - Exports + Secondary Production ± Changes in Government and Industry Stocks
- Can be used to evaluate total reported consumption
Resources & Reserves—Definitions

Resource
A concentration of naturally occurring solid, liquid, or gaseous material in or on the Earth’s crust in such form and amount that economic extraction of a commodity from the concentration is currently or potentially feasible.

Reserve
Demonstrated resource from which minerals can be extracted profitably with existing technology and under present economic conditions.

Sources:
USGS Mineral Commodity Summaries, Appendix C
Principles of a resource/reserve classification for minerals, USGS Circular 831, 1980
Global Cobalt Reserves—By Country

Global Cobalt Reserves in 2014

- Congo (Kinshasa): 47%
- Australia: 14%
- Cuba: 15%
- Philippines: 7%
- Zambia: 4%
- Canada: 3%
- Russia: 3%
- New Caledonia: 3%
- Other countries: 7%

7.2 Mt
Sourced mainly from company and Government reports

Mt = Million metric tons

Published annually

MINERAL COMMODITY SUMMARIES 2015

USGS - US Department of the Interior - U.S. Geological Survey
Global Cobalt Resources


- Data for 215 individual deposits or districts
- Compiled from industry, government, and academic sources
- Data for conventional identified resources
- Resources categorized by deposit type
- Total terrestrial identified cobalt resources were 25.5 Mt, very similar to 26.1 Mt independently derived by Mudd, G.M., Weng, Z., Jowitt, S.M., Turnbull, I.D., and Graedel, T.E., 2013, Quantifying the recoverable resources of by-product metals—The case of cobalt: Ore Geology Reviews, v. 55, p. 87–98.
Global Cobalt Resources—Deposit Types

Principal terrestrial deposits

- Sediment-hosted stratiform copper-cobalt
- Magmatic nickel-copper(-cobalt-platinum-group element) sulfide
- Nickel-cobalt laterite

Other terrestrial deposits

- Black-shale-hosted nickel-copper-zinc-cobalt
- Iron oxide-copper-gold(-silver-uranium-rare earth element-cobalt-nickel)
- Metasedimentary rock-hosted cobalt-copper-gold
- Volcanogenic copper(-zinc-cobalt-silver-gold) massive sulfide
- Mississippi Valley-Type zinc-lead(-cobalt-nickel) sulfide
- Iron-copper-cobalt skarn and replacement
- Polymetallic (silver-nickel-cobalt-arsenic-bismuth) and other cobalt-rich vein

Seafloor deposits

- Iron-manganese(-nickel-copper-cobalt-molybdenum) nodules
- Iron-manganese(-cobalt-molybdenum-rare earth element) crusts
- Copper(-zinc-cobalt-silver-gold) volcanogenic massive sulfide
Global Cobalt Resources—By Deposit Type

Terrestrial and Ocean Floor Deposits

147 Mt cobalt

- Sediment-hosted stratiform Cu-Co: 38%
- Magmatic Ni-Cu(-Co-PGE) sulfide: 7%
- Ni-Co laterite: 6%
- Other terrestrial: 3%
- Seafloor Fe-Mn(-Ni-Cu-Co-Mo) nodules: 1%
- Seafloor Fe-Mn(-Co-Mo-REE) crusts: 1%

Terrestrial Deposits

25.5 Mt cobalt

- Sediment-hosted stratiform Cu-Co: 41%
- Magmatic Ni-Cu(-Co-PGE) sulfide: 8%
- Ni-Co laterite: 36%
- Other terrestrial: 15%

Mt = million metric tons
Global Cobalt Resources, Reserves, and Mine Production—By Deposit Type

Resources
- 25.5 Mt cobalt

Reserves (2011)
- 7.5 Mt cobalt

Mine Production (2011)
- 0.109 Mt cobalt

- Sediment-hosted stratiform Cu-Co
- Magmatic Ni-Cu(-Co-PGE) sulfide
- Ni-Co laterite
- Other terrestrial

Mt = million metric tons
Additional Cobalt Information from the National Minerals Information Center

URL for Cobalt Statistics and Information
http://minerals.usgs.gov/minerals/pubs/commodity/cobalt/

URL for List Services
http://minerals.usgs.gov/minerals/pubs/listservices.html

URL for RSS feed
http://feeds.feedburner.com/usgs_mpubs

Annual reports
- Mineral Commodity Summaries
- Minerals Yearbook

Monthly reports
- Mineral Industry Surveys

Special reports and products
- Data Series 140—Database of key statistics (1900–2012)
- Reports on materials flow and recycling
- Reports on mineral resources