



COMMODITIES AT A GLANCE

Special issue on strategic battery raw materials

No. 13



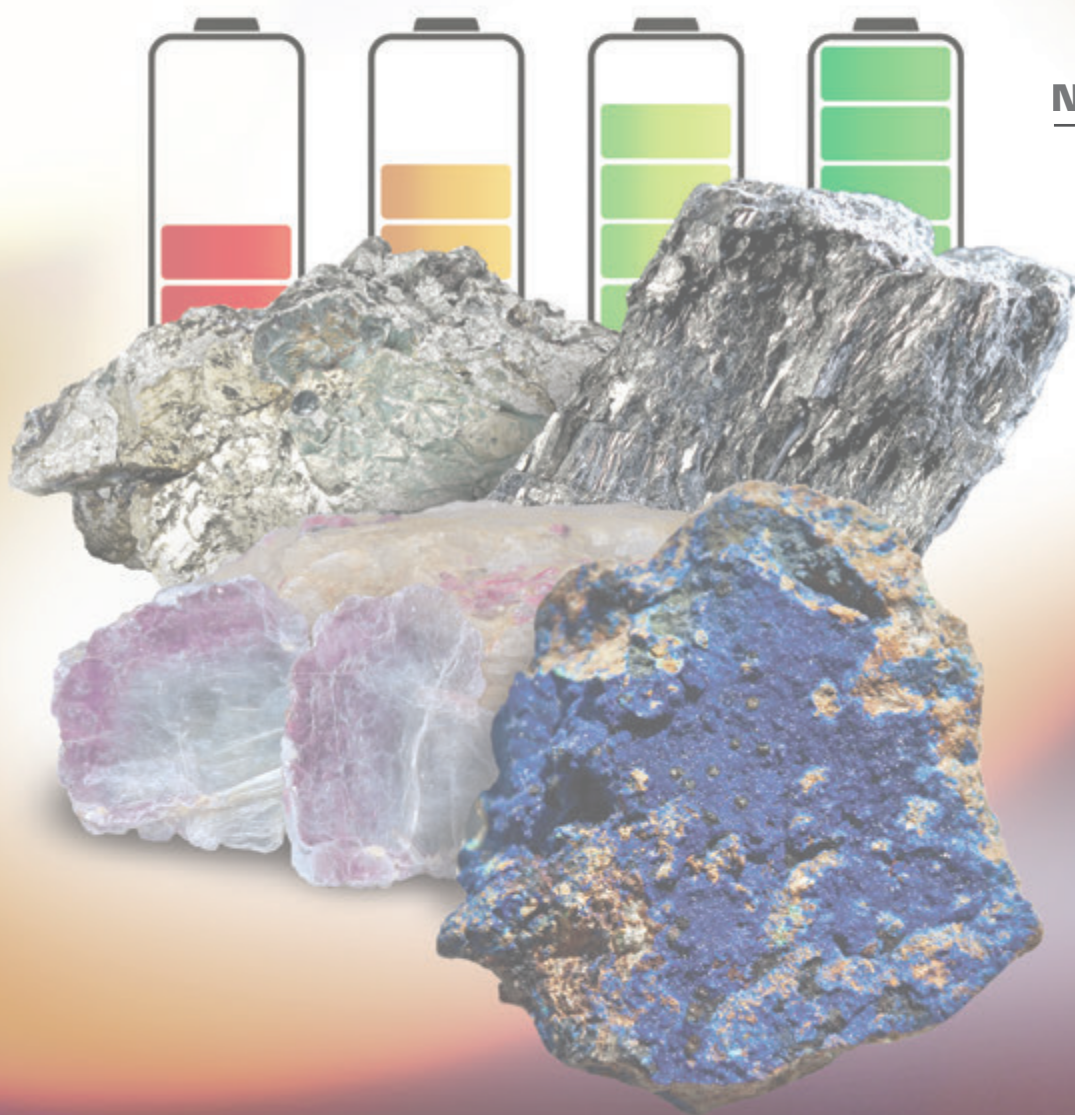
UNITED NATIONS



COMMODITIES AT A GLANCE

Special issue on strategic battery raw materials

No. 13



UNITED NATIONS
Geneva, 2020

© 2020, United Nations

This work is available open access by complying with the Creative Commons licence created for intergovernmental organizations, available at <http://creativecommons.org/licenses/by/3.0/igo/>.

The findings, interpretations and conclusions expressed herein are those of the authors and do not necessarily reflect the views of the United Nations or its officials or Member States.

The designation employed and the presentation of material on any map in this work do not imply the expression of any opinion whatsoever on the part of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Photocopies and reproductions of excerpts are allowed with proper credits.

This publication has not been formally edited.

United Nations publication issued by the United Nations Conference on Trade and Development.

UNCTAD/DITC/COM/2019/5

eISSN: 2522-7866

eISBN 978-92-1-004829-3

ACKNOWLEDGMENTS

The series *Commodities at a Glance* aims to collect, present and disseminate accurate and relevant statistical information linked to international primary commodity markets in a clear, concise and reader-friendly format.

This edition of *Commodities at a Glance* was prepared by Rachid Amui, Economic Affairs Officer at the Commodities Branch, Division on International Trade and Commodities, UNCTAD, under the overall guidance of Janvier Nkurunziza, Chief, Commodity Research and Analysis Section, Commodities Branch.

The cover of this publication was created by Magali Studer, UNCTAD. Photo credit © Adobe Photo Stock.

CONTACTS

For further information about this publication, please contact the Division on International Trade and Commodities, Commodities Branch, UNCTAD, Palais des Nations, CH-1211 Geneva 10, Switzerland, email: commodities@unctad.org, tel. +4122 917 6286/1648

NOTE

Reference to “dollars”, or use of the dollar symbol (\$), signifies United States dollars, unless otherwise specified.

The term “tons” refers to metric tons.

Unless otherwise stated, all prices in this report are in nominal terms.

Data sources are indicated under each table and figure.

ACRONYMS AND ABBREVIATIONS

BC	before Christ
C	carbon
CAGR	Compound Annual Growth Rate
CE	circular economy
CH₄	methane
Co	cobalt
CO₂	carbon dioxide
CTL	coal-to liquid
GHG	greenhouse gas
GTL	gas-to liquid
EV	electric vehicle
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
LCE	lithium carbonate equivalent
LCO	lithium cobalt oxide
LED	light-emitting diode
LFP	lithium Iron Phosphate
Li	lithium
LiAlSi₄O₁₀	Lithium silicate (petalite)
LIB	lithium-ion battery
LiBF₄	lithium tetrafluoroborate
LiClO₄	lithium perchlorate
Li-ion	Lithium-ion
LiPF₆	lithium hexafluorophosphate
LMO	Lithium Manganese Oxide
m	million
Mn	manganese
N₂O	nitrous oxide
NCA	Lithium Nickel Cobalt Aluminum Oxide
NiCd	Nickel-Cadmium
NiMH	Nickel-Metal Hydride
NMC	Lithium Nickel Manganese Cobalt
UNEP	United Nations Environmental Programme
UNFCC	United Nations Framework Convention on Climate Change
USGS	United States Geological Survey

CONTENTS

Acronyms and Abbreviations.....	iv
Introduction.....	viii
CHAPTER 1 RECHARGEABLE BATTERIES.....	1
1.1. Rechargeable batteries and climate change.....	2
1.2. Types of rechargeable batteries and performance	2
1.3. Battery components and battery chemistries.....	2
CHAPTER 2 OVERVIEW OF LITHIUM ION BATTERY RAW MATERIALS.....	5
2.1. Historical Background	6
Cobalt.....	6
Lithium.....	8
Natural graphite	10
Manganese.....	11
CHAPTER 3 THE VALUE CHAIN.....	15
3.1. The mining value chain.....	16
Cobalt value chain	16
Lithium value chain	19
Graphite value chain	19
Manganese value chain.....	20
3.2. Recycling of raw materials used in lithium ion batteries	20
3.3. Advantages and disadvantages of recycling	21
3.4. The Lithium ion battery manufacturing chain.....	21
3.5. Economic implications of the lithium ion battery value chains	22
CHAPTER 4 SUPPLY, DEMAND AND PRICES	25
4.1. Production of raw materials used in lithium ion batteries	26
4.2. Drivers of production.....	31
4.3. Demand for raw materials used in lithium ion batteries	31
4.4. International trade	32
International trade in cobalt.....	32
International trade in lithium	35
International trade in natural graphite	39
International trade in manganese	40
4.5. Price evolution of raw materials used in lithium ion batteries.....	41
CHAPTER 5 SOCIAL AND ENVIRONMENTAL CHALLENGES	45
5.1. Challenges related to exploitation of battery metals and minerals.....	46
CONCLUSION.....	47
Annex - Statistical data: Exports, Imports, Production, Reserves	49

FIGURES

Figure 1.	Schematic of a lithium ion battery	4
Figure 2.	Cobalt reserves, 2018 (Percentage)	7
Figure 3.	Lithium reserves, 2018 (Percentage)	9
Figure 4.	Graphite reserves, 2018 (Percentage)	11
Figure 5.	Manganese reserves, 2018 (Percentage)	12
Figure 6.	Refined cobalt - chemicals, 2017 (Tons)	17
Figure 7.	Refined cobalt - powder, 2017 (Tons)	18
Figure 8.	Refined cobalt - metal, 2017 (Tons)	18
Figure 9.	Cobalt production, 2010 to 2018* (Tons)	26
Figure 10.	Cobalt production, 2018* (Percentage)	27
Figure 11.	Lithium production, 2010 to 2018* (Tons)	27
Figure 12.	Lithium production, 2018* (Percentage)	28
Figure 13.	Global manganese production, 2010 to 2018* (Tons)	29
Figure 14.	Manganese production, 2018* (Percentage)	29
Figure 15.	Natural graphite production, 2010 to 2018* (Tons)	30
Figure 16.	Natural graphite production, 2018* (Percentage)	30
Figure 17.	Top 5 importers of cobalt ores and concentrates, 2018 (Percentage)	33
Figure 18.	Top 5 exporters of cobalt ores and concentrates, 2018* (Percentage)	33
Figure 19.	Top 5 importers of cobalt oxides and hydroxides, 2018 (Percentage)	34
Figure 20.	Top 5 exporters of cobalt oxides and hydroxides, 2018 (Percentage)	35
Figure 21.	Top 5 importers of lithium oxides and hydroxides, 2018 (Percentage)	36
Figure 22.	Top 5 exporters of lithium oxide and hydroxide, 2018 (Percentage)	37
Figure 23.	Top 5 importers of lithium carbonate, 2018 (Percentage)	37
Figure 24.	Top 5 exporters of lithium carbonate, 2018 (Percentage)	38
Figure 25.	Top 5 importers of Natural Graphite in powder or flakes, 2018 (Percentage)	39
Figure 26.	Top 5 exporters of Natural Graphite, 2018 (Percentage)	40
Figure 27.	Top 5 importers of manganese ores and concentrates, 2018 (Percentage)	41
Figure 28.	Top 5 exporters of manganese ores and concentrates, 2018 (Percentage)	42
Figure 29.	Battery raw materials prices, 2010 to 2019 (Dollars)	43

Table 1.	Types of lithium-ion battery chemistries	3
Table 2.	Components of a lithium ion battery, functions and materials	4
Table 3.	Summary of main cobalt deposit types.....	7
Table 4.	Major trading partners of leading importers of cobalt ores and concentrates, 2018 (Millions of dollars)	33
Table 5.	Major trading partners of leading exporters of cobalt ores and concentrates, 2018 (Millions of dollars)	34
Table 6.	Major trading partners of leading importers of cobalt oxides and hydroxides, 2018 (Millions of dollars)	34
Table 7.	Major trading partners of leading exporters of cobalt oxides and hydroxides, 2018 (Millions of dollars)	35
Table 8.	Major trading partners of leading importers of lithium oxides and hydroxides, 2018 (Millions of dollars)	36
Table 9.	Major trading partners of leading exporters of lithium oxides and hydroxides, 2018 (Millions of dollars)	37
Table 10.	Major trading partners of leading importers of lithium carbonate, 2018 (Millions of dollars)	38
Table 11.	Major trading partners of leading exporters of lithium carbonate, 2018 (Millions of dollars)	38
Table 12.	Major trading partners of leading importers of natural graphite, 2018 (Millions of dollars).....	39
Table 13.	Major trading partners of leading exporters of natural graphite, 2018 (Millions of dollars).....	40
Table 14.	Major trading partners of leading importers of manganese ores and concentrates, 2018 (Millions of dollars)	41
Table 15.	Major trading partners of leading exporters of manganese ores and concentrates, 2018 (Millions of dollars)	42
Table 16.	Leading importers of cobalt ores and concentrates by value (Dollars)	49
Table 17.	Leading exporters of cobalt ores and concentrates by value (Dollars)	50
Table 18.	Leading exporters of lithium oxide and Hydroxide by value (Dollars).....	51
Table 19.	Leading importers of lithium oxide and Hydroxide by value (Dollars).....	52
Table 20.	Leading Importers of Natural Graphite by value (Dollars)	53
Table 21.	Leading Exporters of Natural Graphite by value (Dollars)	54
Table 22.	Leading importers of manganese ores and concentrates by value (Dollars).....	55

预览已结束，完整报告链接和二维码

<https://www.yunbaogao.cn/report/index/report?re>