Critical Mineral Initiatives

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All the Metals We Mined

In One Chart

Iron ore
3,040,000,000 tonnes

Iron ore made up roughly 96% of the 3.2 billion tonnes of metals mined in 2019.

Roughly 99% of iron ore goes into steelmaking. The remaining 1% is used in various other applications.

Industrial metals
207,478,486 tonnes

Aluminum is the world's second-most used metal after iron, found in everything from electronic devices to aircraft parts.

Copper production is one-third that of aluminum, though it has several uses ranging from wiring to construction.

Manganese is mainly used in iron and steel manufacturing and is a key ingredient in lithium-ion batteries.

Chromium enhances the hardenability and corrosion resistance of stainless steel.

Total Metals
3,248,814,336 tonnes

Metals are the building blocks of the global economy. From iron ore to rare earths, here are all the metals we mined in 2019.

Metals vs. Ores

Ores are naturally occurring rocks that contain metals or metal compounds.

Metals are the valuable parts of ores that can be extracted and sold.

Tech and precious metals
1,335,848 tonnes

Niobium is a rare metal used in superalloys for jet and rocket engines.

Lithium and cobalt are critical ingredients of lithium-ion batteries for electric vehicles.

Indium is used to make indium tin oxide, an important part of touch screens, TV, and solar panels.

The Earth’s natural resources power our everyday lives. Visual Elements breaks down the building blocks of the universe.


*Production does not reflect actual metal production as metals only make up a certain portion of ores. Graphic excludes semi-metals and metallates. Niobium is combined in Zircon.

We live in a material world.
Growing Global Demand

The Energy Transition

Tesla 100MW station, South Australia (30,000 homes for 1hr)
Our bottom-up assessment suggests that a concerted effort to reach the goals of the Paris Agreement (climate stabilisation at “well below 2°C global temperature rise”, as in the IEA Sustainable Development Scenario [SDS]) would mean a quadrupling of mineral requirements for clean energy technologies by 2040. An even faster transition, to hit net-zero globally by 2050, would require six times more mineral inputs in 2040 than today.
International Initiative

Earth MRI Project Phase
Critical Minerals

Phase 2
Aluminum
Cobalt
Graphite (natural)
Lithium
Niobium
Platinum group elements
Rare earth element group
Tantalum
Tin
Titanium
Tungsten

Phase 3
Antimony
Barite
Beryllium
Chromium
Fluorspar
Hafnium
Helium
Magnesium
Manganese
Potash
Uranium
Vanadium
Zirconium

Sources:
Dicken and others, 2021, USGS data release, https://doi.org/10.5066/P9WATJZY
Dicken and Hammarstrom, 2020, USGS data release, https://doi.org/10.5066/P95CO8LR
HR 3684 – Infrastructure Bill

Law 11-15-2021

Added 10's of millions of $ for critical mineral and supply chain research and development

Distributed through DoD, DoE, USGS, National Labs...
Mining – a gradual process

To go electric, America needs more mines. Can it build them?

By Ernest Schneyer

• ~10 years from idea to breaking ground

• Investment in basic geological and geophysical datasets can lead to 6x investment from private sector to improve public datasets (ACIL Allen Consulting, 2015), demonstrated by Canada and Australia

Source: USGS, Nova Scotia
West Texas – USGS Arial Surveys

- Large magmatic province extending from NM, through West TX, into Mexico
- Newer proven resources of REE
  - Round Top, Sierra Blanca, TX
  - 303k tonnes rare earth oxides
Texas Coal – REE and CM Potential

DOE Carbon Ore, Rare Earth and Critical Minerals (CORE-CM) Initiative for U.S. Basins
Wastes from mining, refining, and manufacturing are being assessed for their critical mineral potentials across US.

Other "unconventional" sources of metals include heavy sands, lithium brines, black shales, and even seawater.

Red mud, an alumina refining by-product, constitutes millions of tons of waste house along the Texas coast, and is a potential new resource of REEs, Al, and other metals.
Holistic Life Cycle Analysis

Research Plan

Electricity Options Being Compared

1) Combined Cycle Gas Turbine (CCGT)
2) Wind Generation
3) Wind + Battery
4) Solar Generation
5) Solar + Battery

Base Case Functional Unit:
500 MW capacity CCGT, generating 3 TWh/yr of electricity

https://www.beg.utexas.edu/minerals
https://www.beg.utexas.edu/ceo
https://www.beg.utexas.edu/carbon-ore-rare-earth-and-critical-minerals