



# AN UPDATE ON EV BATTERY TRENDS, RECYCLING, AND ECONOMICS OF DSM - AND IMPLICATIONS FOR DSM POLICY

March 25, 2024

Highlights from recently published papers on demand shifts for the metals found in the deep sea, and the deep sea mining investment landscape.



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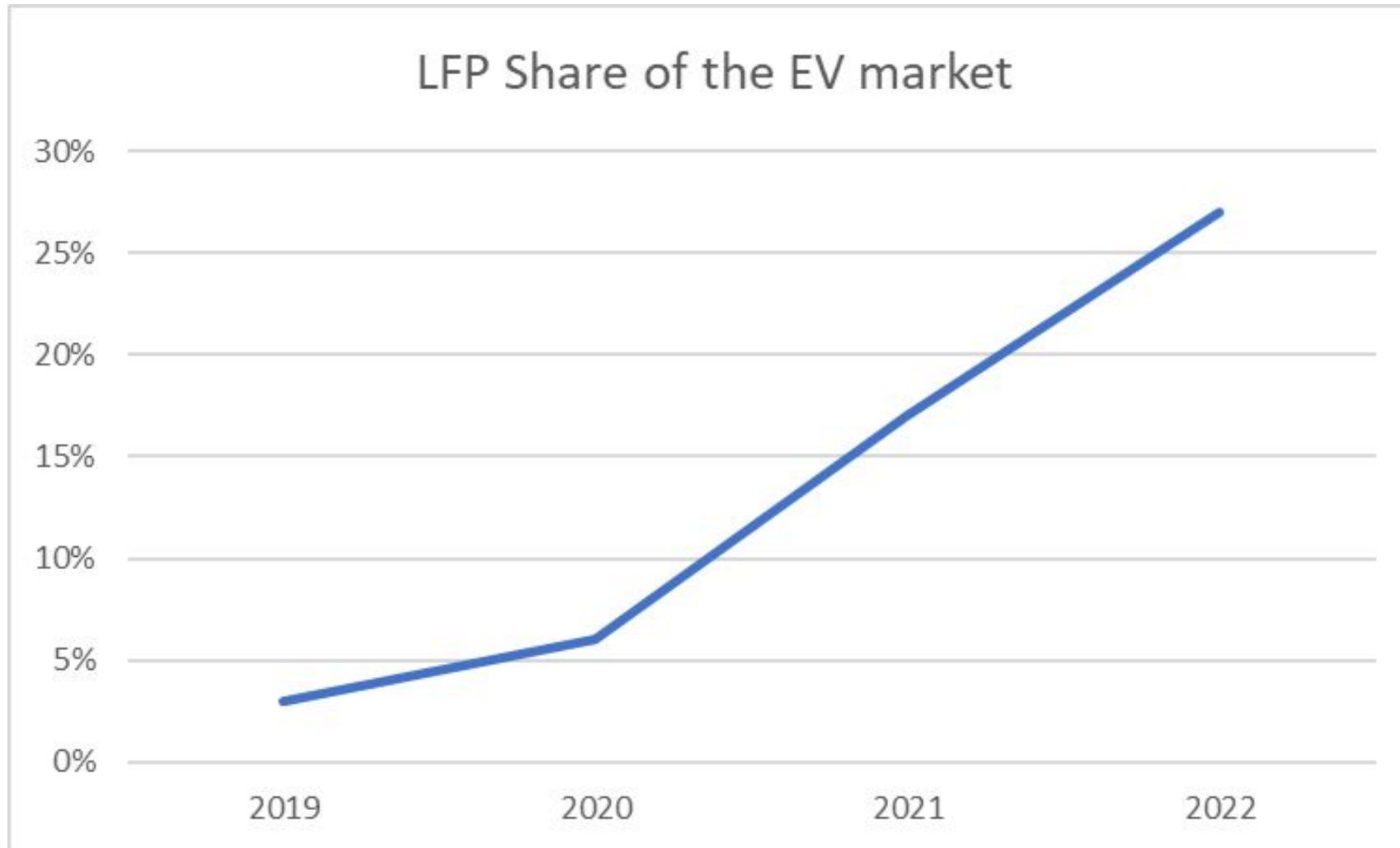
*Next Generation EV Batteries  
Eliminate the Need for  
Deep Sea Mining*



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## Yes, mining is problematic, and the demand will grow in the Just Transition



**LFP batteries (free of deep sea minerals) are rapidly replacing Lithium Ion (Li<sup>+</sup>) battery chemistry**

Source: [IEA Paris, 2023](#)

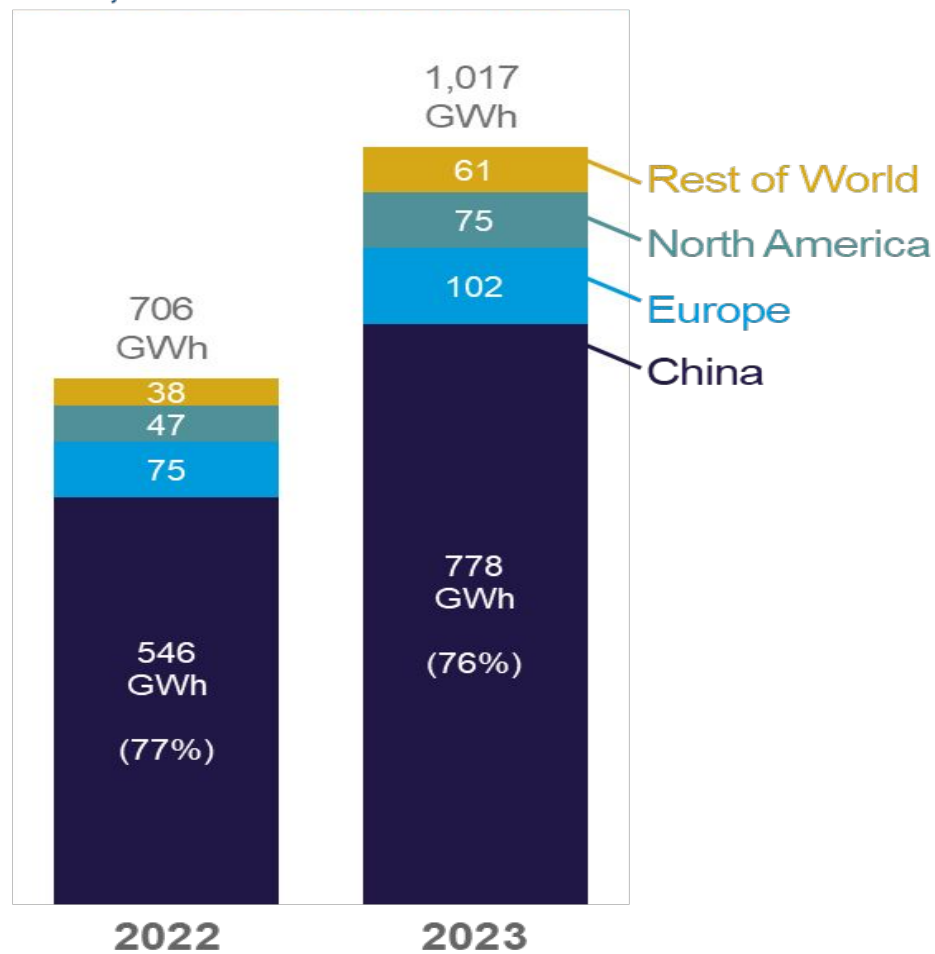


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**“LFP has reached almost 60% of BEVs produced in China and 36% of battery production globally.”**

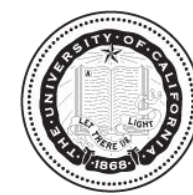
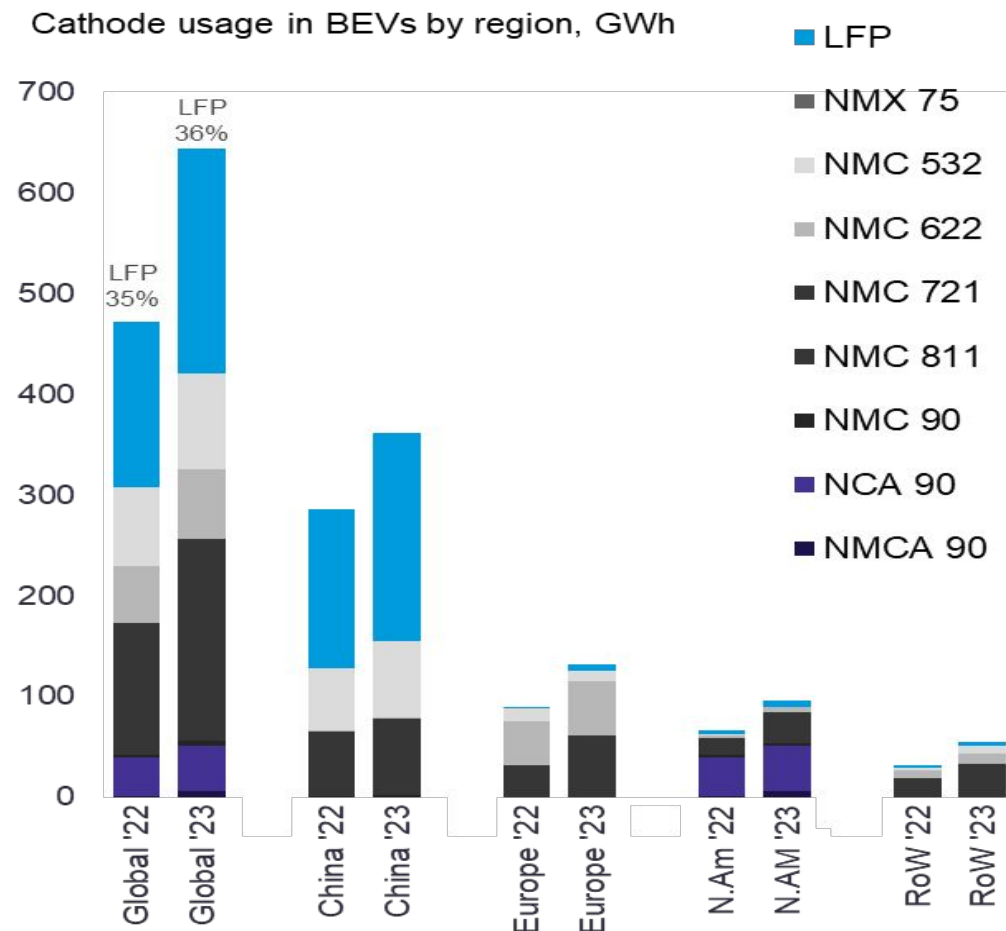
Sam Adham,  
Head of  
Battery  
Materials, CRU

Battery production reaches 1 TWh/y in 2023, 52% of which was LFP



DATA: CRU Battery Value Chain Service. LHS showing total Li-ion production. RHS showing battery installations in vehicle production.

LFP overtakes NMC in China



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“And when you take into account other uses like energy storage, the share is even higher.”

LFP represented 52% of 2023 global battery production all applications combined.”

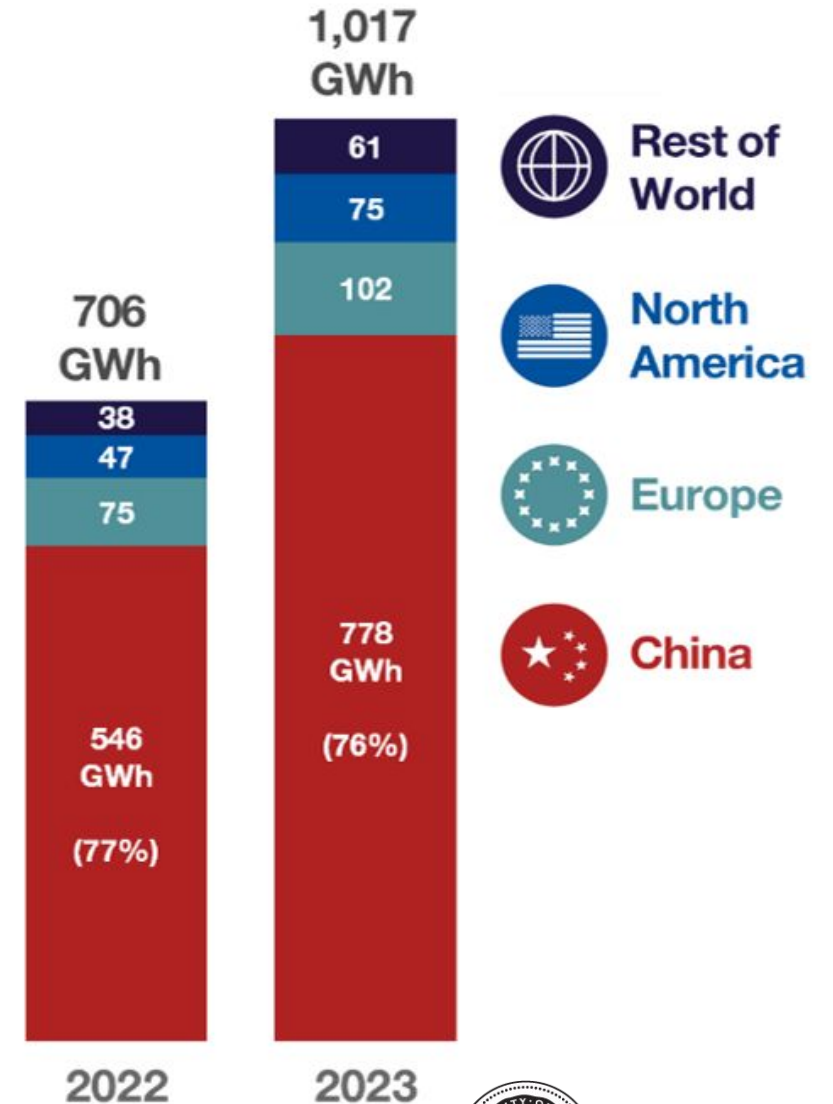
Sam Adham, CRU

In 2023, global lithium-ion battery cell production exceeded

1 TWh

52% were LFP batteries

Top 3 manufacturers made up 2/3 of output



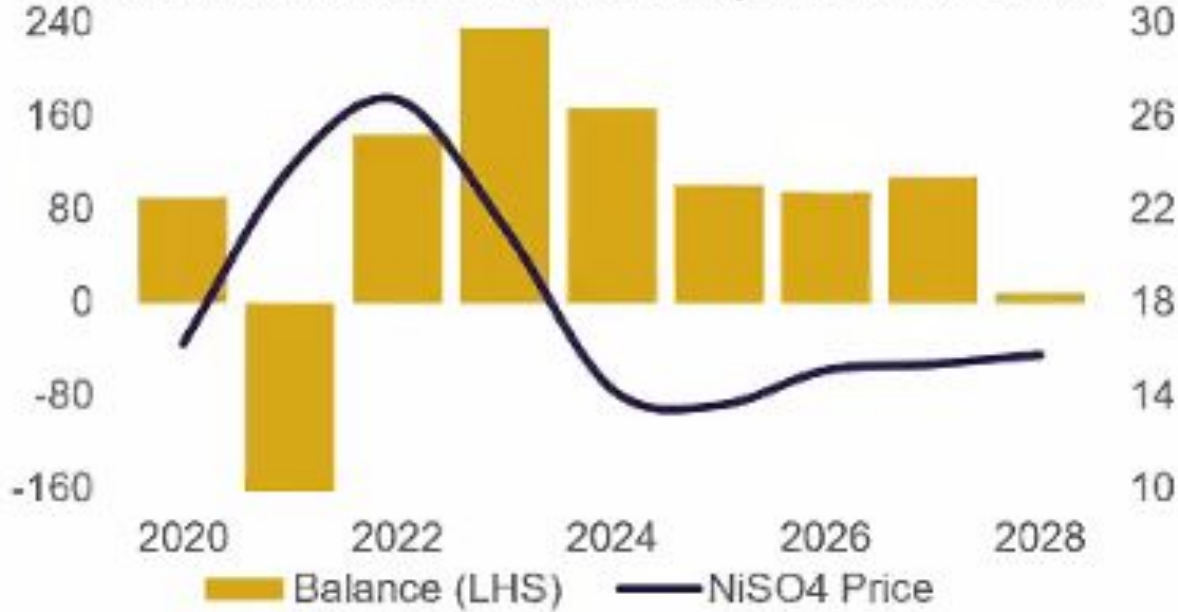


# Ni & Co prices are falling as result of shifting demand and oversupply

## Ni sulphate struggles as LFP rises



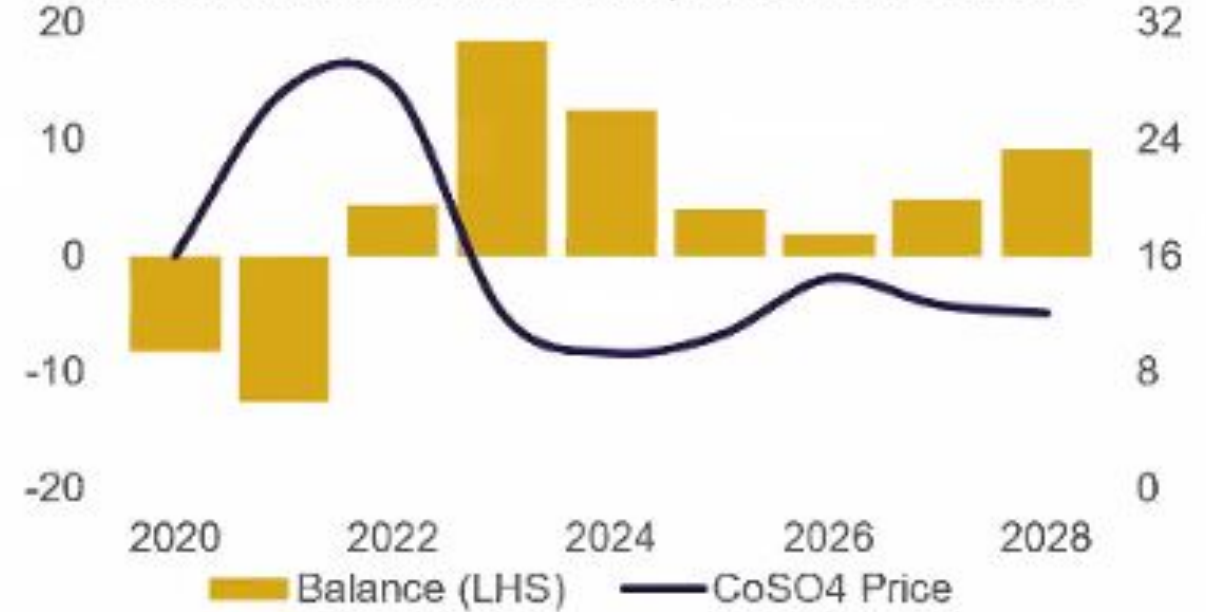
Refined nickel market balance and price, kt and \$/t Ni



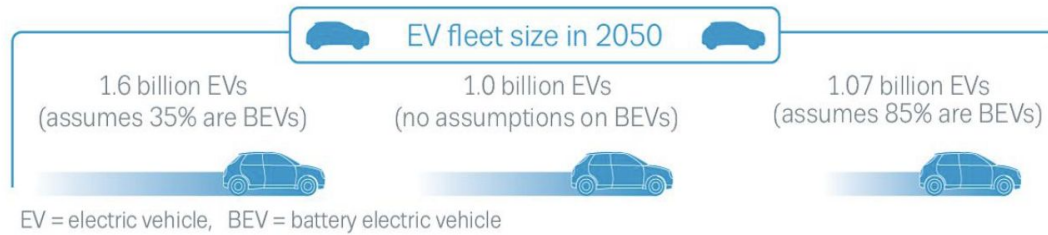
## Substantial short-term surpluses, support in mid-term



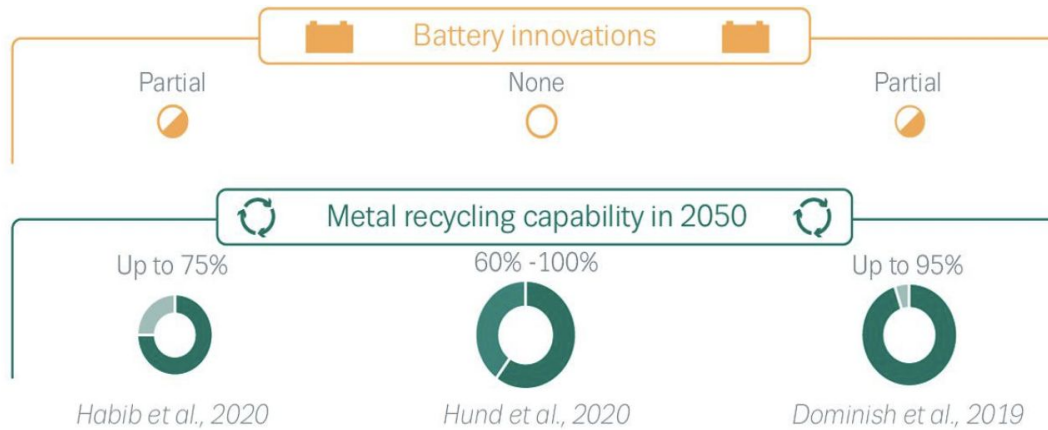
Ref. cobalt market balance and price, kt and \$/lb Co



# A Just Transition intelligently integrates smart materials choices, waste mining, and increased job production



Projections of the number of **EVs** that will be in circulation are variable. Some studies assume that plug-in hybrid EVs, which rely on fossil fuels, make up some of the 2050 fleet.



Studies often assume different **battery** technologies in their projections. As new innovations reach the market, mineral demand may diminish.

Studies assume different projected **recycling** capability for battery components. We focus on cobalt, lithium and nickel for simplicity.

## Setting the wheels in motion for a sustainable future

- Fewer private vehicles
- Global equitable access to green technology
- Investment in battery technology
- Improved public transport infrastructure
- Enhanced metal recycling capability
- Education to discourage use of fossil fuels
- Policy to encourage sustainable design and technology
- Behaviour change to achieve sustainable consumption

References: Dominish et al. (2019) Responsible Minerals Sourcing for Renewable Energy. Report prepared for Earthworks by the Institute for Sustainable Futures, Univ. Technol. Sydney. Habib et al. (2020). *Resour. Conserv. Recycl.* 154, 104603. Hund et al. (2020). Minerals for Climate Action: the Mineral Intensity of the Clean Energy Transition World Bank Group. Washington, D. C. USGS 2021 reports for individual minerals <https://www.usgs.gov/centers/nmic/commodity-statistics-and-information>. Graphic by Nigel Hawtin.

Miller, Bridgen, Santillo, Currie, Johnston, Thompson (2021) *Front. Mar. Sci.* doi: 10.3389/fmars.2021.706161



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BENJAMIN RUPERT

CHEMIST AND BATTERY STORAGE TECHNOLOGY  
EXPERT

(FORMERLY) BLUE CURRENT

SEE VIDEO AFTER  
OUR MAIN SESSION







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*Critical Minerals and the  
Green Transition:  
Do We Need to Mine the  
Deep Seas?*





- Future Demand for Critical Minerals
- Handling of Resources
- Impact of Circular Economy Strategies on Supply and Demand
- Is Deep-Sea Mining Needed?

**THE EXPANSION OF MINING ACTIVITIES INTO DEEP-SEA AREAS IS A FALSE SOLUTION.**



The International Energy Agency, the World Bank and other institutions estimate:  
***'Cobalt may see 6- to 30-times higher demand than today'***  
*24 - 100 million tonnes of nickel*  
*3 to 7 times of REEs*

These projections are unable to take into account innovations in technologies and are based on a 'take, make, waste' economic model



Linear Economy

E-waste produced



62 million tonnes / year

Unitar: Global e-waste Monitor 2024

1. relative contribution of different battery technologies over time,
2. assumed recycling capabilities,
3. the overall size of the EV fleet,
4. implications of policy shifts

Demand for relevant minerals can be reduced by

**58%**





“We are committed to not using minerals from the deep sea as a precautionary measure [...] We have integrated the issue of deep-sea mining as a building block in our biodiversity strategy and will not deviate from this commitment:

rather, we aim to utilise the potential of recycling to close material cycles and reduce the need for primary raw materials. We also communicate to our suppliers to exclude raw materials from the deep sea for our products.”



Manta Ray EV



RIVIAN



SCANIA



REDIVIVUS



generation



Katapult Ocean



ABN-AMRO



FARVATN



European Investment Bank



standard chartered



NatWest



TIFFANY & Co.



PHILIPS



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*Deep Sea Mining Isn't Worth the Risk:  
High Costs, Financial Developments  
Since 2021, and Externalities Stand to  
Diminish Theoretical Returns on  
Investment*



 THE OCEAN FOUNDATION



# Questions for Consideration

- We speak of dividing proceeds from DSM, but what level of confidence do we have that DSM will provide financial gains?
- What are the risks and liabilities that create the potential for financial losses related to DSM?
- In the face of much uncertainty, why the current rush to mine?

Disclaimer: this is not legal or financial advice; instead it is a request that we pursue answers to these questions until we are satisfied we have all relevant information



# Economic Viability of DSM Is Uncertain

Technical Readiness: 

Macro-Economics: 

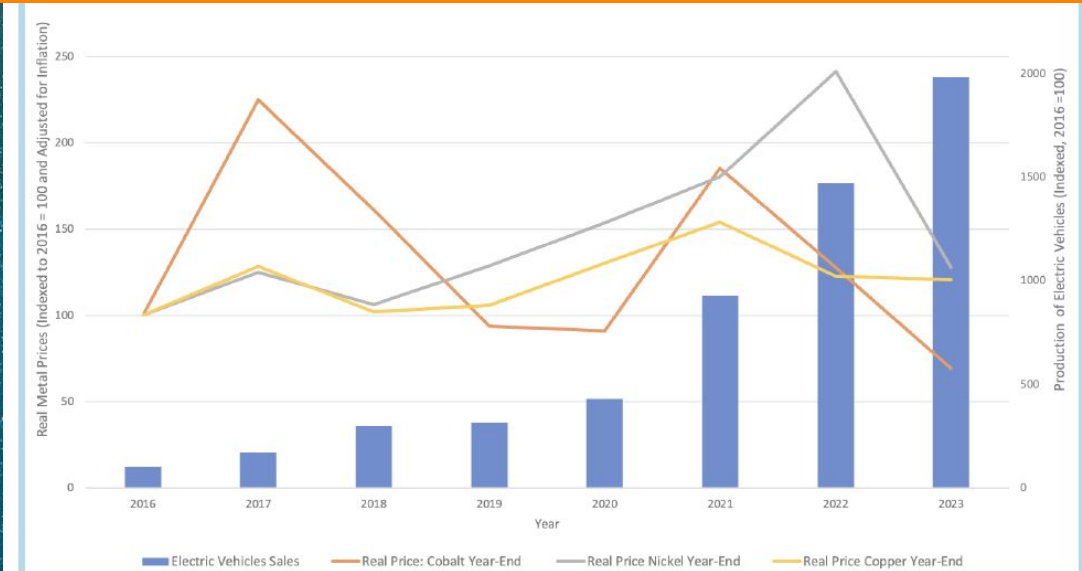
Market Prices: 

Nowhere near the technological readiness to operate an an economically profitable capacity (but could destroy the seabed).

Costs rising: drill ships, labor, equipment; access to finance.

EV production has risen consistently, prices of nickel and cobalt haven't.

***“ A decrease in prices for one or more of the four affected metals [copper, nickel, cobalt, and manganese], caused by any reason, automatically reduces the market value of polymetallic nodules as raw materials for the extraction of these metals. This decline may result in some or even all seabed mining projects becoming subeconomic or unprofitable. This transformation is possible both before and during seabed mining.” ISA Technical Study 32, p. 16***



**Figure 1:** Electric vehicle production compared to the prices of cobalt, nickel, and copper 2016-2023 (adjusted for inflation). Credit: Victor Vescovo. Sources: Commodity Prices from [TradingEconomics.com](https://www.tradingeconomics.com), Inflation Adjustment using US CPI found at Investopedia.

# Potential Risks & Liabilities of Investing in DSM

Regulatory Certainty:



Reputational Confidence:



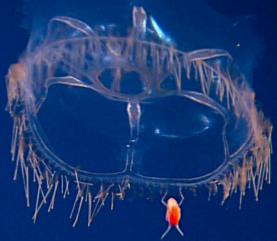
Social License:



To begin commercial DSM in the absence of regulations would be to play a game in which the rules are constantly changing.

- Reporting regarding potential ethical and conduct issues
- Multiple ongoing litigations which implicate truthfulness and good faith as well as an ongoing investigation by the U.S. Securities Exchange Commission
- ESG issues: questions regarding identity and status of investors & financial position in natural gas companies

TMC website (March 25, 2024): “Nodule exploitation also means no disruption to Indigenous communities”



Indigenous Voices Call For a Ban on Deep Sea Mining



## Deep Sea Mining Company Sues Greenpeace Amid Standoff at Sea

The Metals Company claims it's losing \$1 million a day as activists occupy a ship the firm is using to conduct research on seabed mining.



Greenpeace activists confront workers on a boat conducting deep sea mining research. The Metals Company, which is overseeing the research, has sued the activist organization. *Photographer: Martin Katz/Greenpeace*

By **Todd Woody**.

November 28, 2023 at 5:28 PM EST



# Why the Rush?

- **The world is moving away from cobalt and nickel**
  - This is true for EVs, and batteries broadly - despite new rhetoric around geopolitical issues and national security we are relying less and less on the minerals found on the seabed
- **Comparisons to terrestrial mining found to be misleading**
  - DSM could drive down prices; leading to a race to the bottom for human rights and environmental concerns
  - All of the research that says DSM would be better for the environment than terrestrial mining comes from industry; a PlanetTracker report just found that DSM could be worse for the climate than land ores

- **Seabed minerals, even at full production, may not put a dent in global minerals supply:**
  - TMC would produce only 2.34% of global nickel. (119,000 / 5,090,000 tons in 2031)
  - Using numbers from ISA Technical Paper 32, if twelve contractors were operating at full capacity, they would produce 8.7% of global nickel.
- **Scientists say we need at least decades to gather the information we need to make decisions.**
- **Despite diligent efforts by ISA Council Members, the Exploitation Regulations are not finalized nor are the Standards & Guidelines.**

Major corporations in the EV, battery, tech, investment and manufacturing sector stand opposed to deep sea mining



FIND OUT MORE





An aerial photograph of a beach. The ocean is a deep, vibrant blue, with white, frothy waves crashing onto the golden sand. The waves are breaking in a series of parallel lines, creating a rhythmic pattern of white foam against the dark blue water. The sand is a warm, light brown color, and the overall scene is bright and clear.

# Thank you

**Bobbi-Jo Dobush**  
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**25 March 2024**





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SEE VIDEO AFTER  
OUR MAIN SESSION

*How to Lose Half a Trillion  
Deep sea mining to destroy  
at least half a trillion dollars  
in corporate value and  
natural capital*







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*Deep-Sea Mining: Assessing  
Evidence on Future Needs and  
Environmental Impacts*



European Academies



Science Advisory Council

is the voice of ALL of Europe's science academies on science-based issues

Report May 2023 (Deep Sea Mining: assessing the evidence on need and environmental impact)

Summarizes the science and how that relates to key policy questions such as:

- Need
- Environmental impact?
- Sea vs Land
- Compatibility with other trends globally?

# statement

European Academies'  
Science Advisory Council

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## Deep-Sea Mining: assessing evidence on future needs and environmental impacts

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# Deep sea minerals and the green transition

**SUPPLY RISK** for green energies, robotics and ICTs:

Manganese, Nickel, Copper- VERY LOW

Cobalt - MODERATE

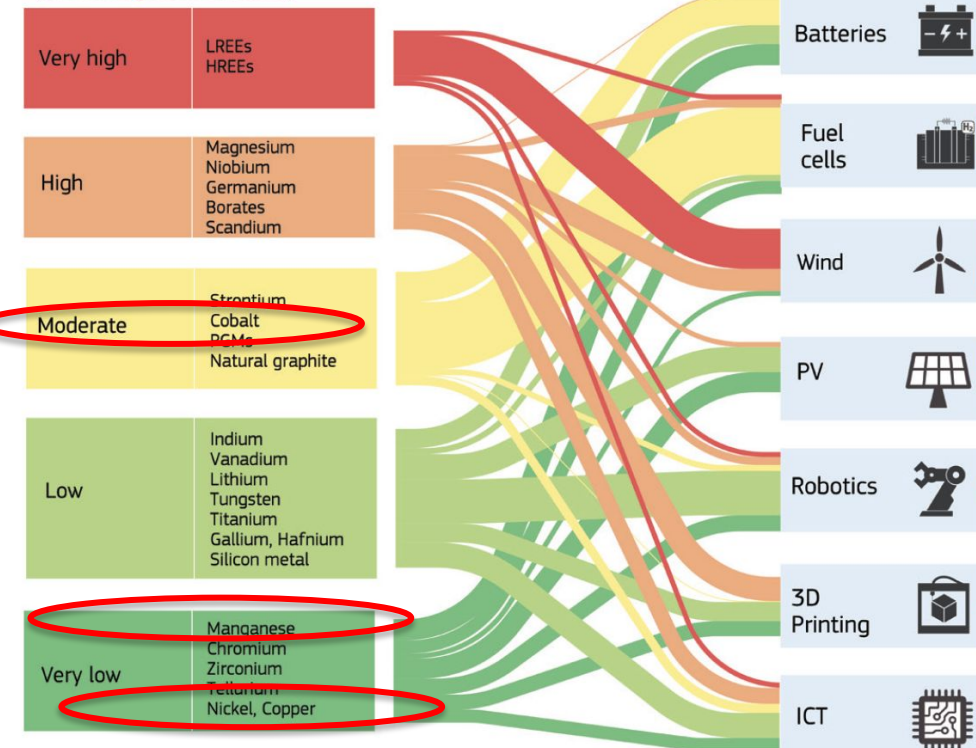
## OTHER FACTORS

- Forecasts of massive demand multiples tend to ignore innovation and substitution- just projecting past trends.
- Circular Economy can moderate demand IF PRIORITISED. (Equally a new source reducing prices would undermine measures such as recycling)

**IN SHORT:** Policy choice is between continuing LINEAR ECONOMY or supporting CIRCULAR ECONOMY (Boulding (1966)'s choice between COWBOY and SPACEMAN economies)

## EC Critical Materials Foresight Study

Supply Risk  
(sorted largest to smallest)

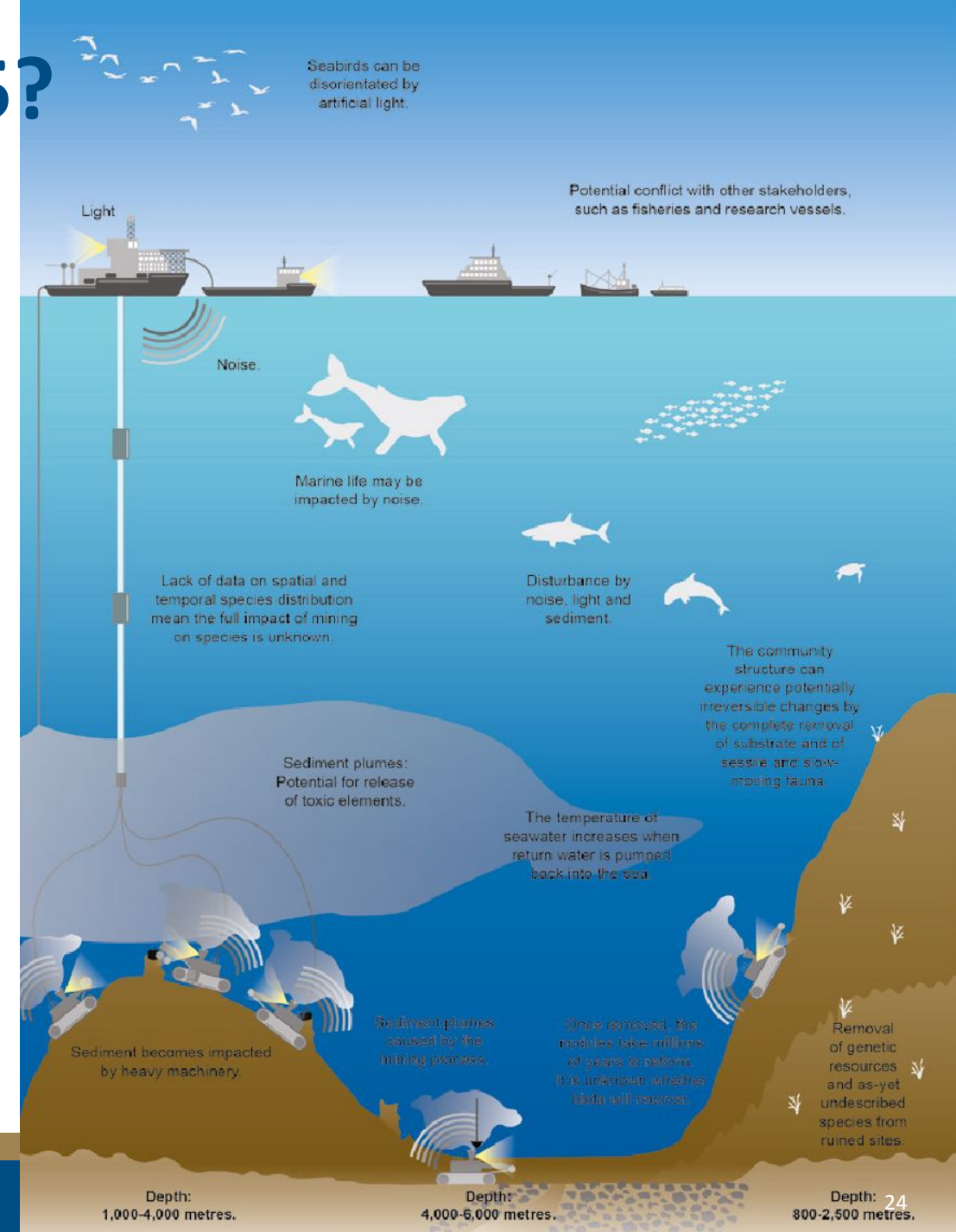




# Complying with UNCLOS Art. 145?

Difficult because:

- Impossible to avoid destruction in mined areas.
- Loss of hard substrates and the structure of habitats mined.
- Collateral ecological damage through sediment plumes to adjoining seabed and water column.
- Remaining sediment inhospitable to recovery.
- Recovery impossible (removal of anchoring substrates) or very slow (decades to millennia).
- Disrupting microbiological processes- effects uncertain on carbon flows.





# Deep Sea the lesser of two evils?

- Huge difference in areas (e.g. a Ni/Co mine of 70km<sup>2</sup> /20 m depth; 17,000km<sup>2</sup> of sea bed required to deliver the same quantity from nodule extraction.)
- Applying the mitigation strategies of terrestrial mining??
  - Not possible to avoid **biodiversity loss**,
  - **Mitigation** measures unclear and unproven – likely limited to plume effects or noise/light
  - **Remediation** would rely on natural recolonisation; limited experience shows slow or lacking where hard substrates removed
  - **Biodiversity offsets**- not possible like-for-like.
- Political response to terrestrial failures possible
- DSM Out of sight out of mind?

Exclusive: Indonesian president pledges nickel mining clean up amid EV-led boom

By Gayatri Suroyo

March 31, 2023 8:47 AM GMT+9 · Updated a year ago



# Recent trends compatible with DSM?

- Convention on Biological Diversity to protect 10% of land and sea areas
- Agreement on the new high seas area of marine biodiversity in the high seas (BBNJ).
- Global Resource Institute transform to reduce demand to sustainable levels.
- All trending in the opposite direction to exploiting the deep sea

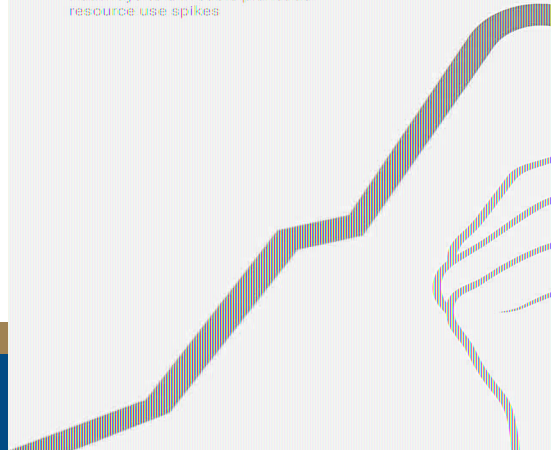
**Conclusion of the EASAC analysis is that the science supports those countries that call for a moratorium.**

Convention on  
Biological Diversity



**Bend the trend**

Pathways to a liveable planet as  
resource use spikes





# Blue Climate Initiative

Solutions for People, Ocean, Planet

# THANK YOU

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