

# MINERALS DEMAND AND THE RENEWABLE ENERGY TRANSITION



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EARTHWORKS

Protecting communities and the environment from the adverse impacts of mineral & energy development while promoting sustainable solutions  
[www.earthworks.org](http://www.earthworks.org)

# ABOUT EARTHWORKS

- Non-profit organization dedicated to protecting communities and the environment from the adverse impacts of mineral and energy development while promoting sustainable solutions.
- Earthworks has 35 years experience supporting communities on the frontlines of extractive industries in the US, and around the world.
- “Making Clean Energy Clean Just & Equitable” Initiative aims to ensure that the transition to renewable energy sources is powered by responsibly and equitably sourced minerals that minimizes the need for new extraction and moves the mining industry toward more responsible practices.



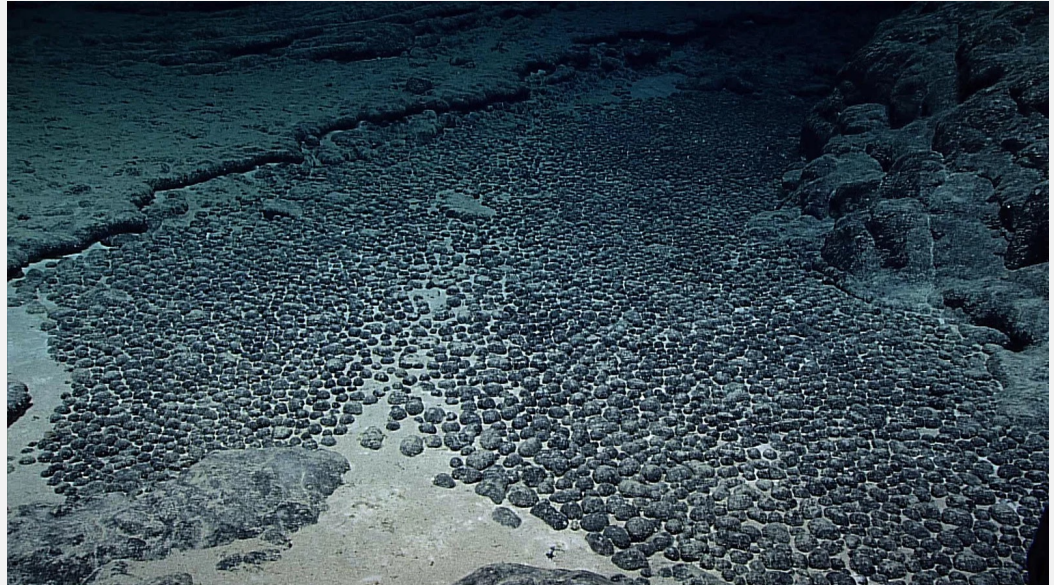
*Bristol Bay watershed, Alaska – threatened by the proposed Pebble copper/gold mine*





# DEEP SEABED MINING

- It's asserted that we need to mine the deep seabed for copper, nickel, manganese cobalt and other minerals used in EV batteries and other technologies
- ISA has issued 29 exploratory permits, 16 of these in the Clarion Clipperton Zone



Source:  
NOAA



# OPPORTUNITY FOR A JUST & EQUITABLE TRANSITION

- Earthworks supports the transition to a renewables-powered future – one that is just and equitable, and doesn't harm communities and the environment through increased mining impacts – whether terrestrial or marine
- This must be an *opportunity moment* – to not only transition to a low-carbon economy but also reduce our dependence on irresponsible mining that harms people and marine/terrestrial ecosystems.
- Can't build a clean energy future by replicating the mistakes of the dirty fossil fuel based energy system we are seeking to replace.
- Early interventions and political will needed to ensure this doesn't happen.



Families protesting impacts of Ramu nickel mine, Papua New Guinea

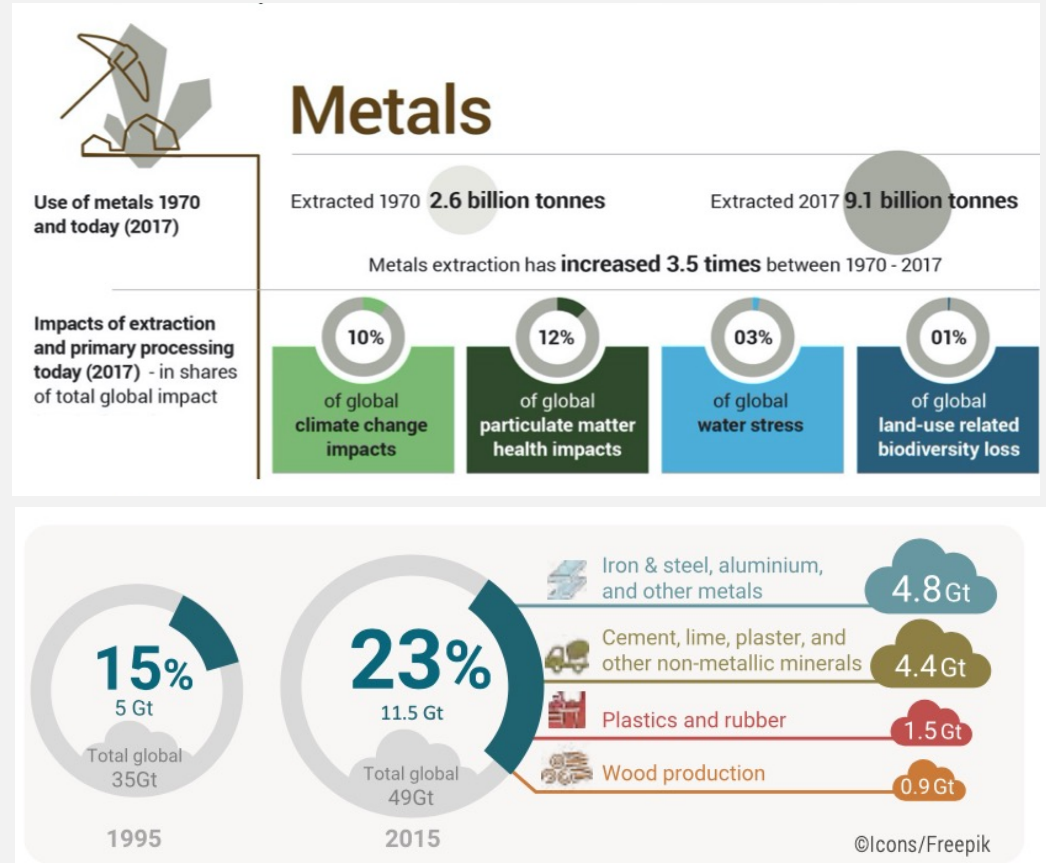


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# WHY MINING IS A THREAT TO COMMUNITIES, CLIMATE AND ECOSYSTEMS

- Human rights abuses: forced displacement, conflict, and pollution for workers and communities
- Disproportionate threats to indigenous rights and livelihoods
- Massive amounts of mine waste generated and deadly tailings disasters
- Freshwater pollution & use reduces water access and quality for ecosystems and communities
- Carbon-intensive – terrestrial metals mining and processing responsible for 10% of global carbon emissions
- Risks to marine environment from deep seabed mining and tailings disposal



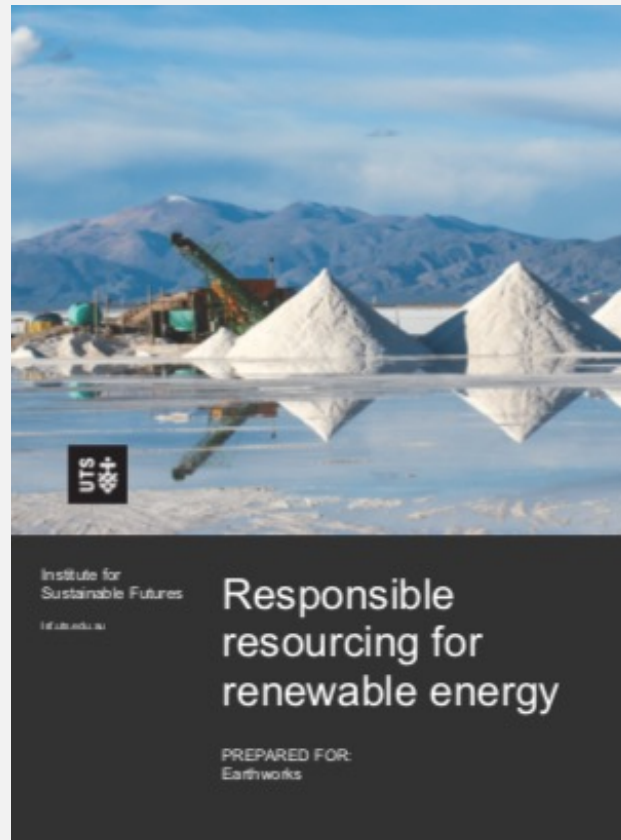
Graphics from UNEP International Resource Panel's Resource Outlook (2019), and Resource Efficiency and Climate Change (2020) Factsheets





# RESEARCH BY THE UNIVERSITY OF TECHNOLOGY, SYDNEY FOR EARTHWORKS

<https://earthworks.org/mcec>



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# KEY METALS FOR CLEAN ENERGY TECHNOLOGIES

## Batteries & electric vehicles (EVs)




- Lithium-ion (Li-ion) – current tech
- Lithium-Sulfur (Li-S) – new tech
- Lifetime: 10 years (battery) 15 years (vehicle)

## Solar PV

- Silicon (c-Si) – 95% of market
- Copper Indium Gallium Selenium (CIGS)
- Cadmium Telluride (CdTe)
- Lifetime: 30 years

## Wind Power

- Permanent magnet (PMG) – 20% of market
- Without permanent magnet (non-PMG)
- Lifetime: 30 years

	 Batteries			 Solar PV			 Wind Power	
	Li-ion	Li-S	EV	c-Si	CIGS	CdTe	PMG	Non-PMG
Aluminium	X			X	X	X	X	X
Cadmium						X		
Cobalt	X							
Copper	X			X	X	X	X	X
Dysprosium			X				X	
Gallium					X			
Indium					X			
Lithium	X	X						
Manganese	X							
Neodymium			X				X	
Nickel	X							
Silver				X				
Selenium					X			
Tellurium						X		



# Minerals Demand Projections for Battery and Renewables Technologies Under 100% Scenarios

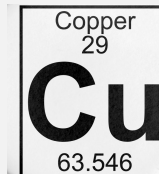
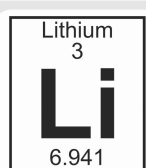
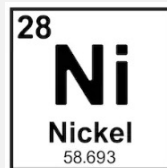
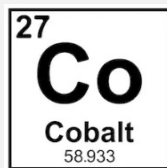
	Peak annual demand (tonnes)		% of demand compared to current production	
	Maximum scenario	Minimum scenario	Maximum scenario	Minimum scenario
Aluminium	18,852,177	17,822,832	3%	3%
Cadmium	700	479	3%	2%
Cobalt	1,966,469	747,427	1788%	679%
Copper	5,626,579	4,493,216	29%	23%
Dysprosium	11,524	7,299	640%	406%
Gallium	89	57	28%	18%
Indium	276	181	38%	25%
Lithium	4,112,867	727,682	8845%	1565%
Manganese	6,438,599	2,447,220	40%	15%
Neodymium	94,687	59,118	592%	369%
Nickel	6,581,326	2,501,469	313%	119%
Selenium	404	289	12%	9%
Silver	9,926	6,646	40%	27%
Tellurium	834	555	199%	132%



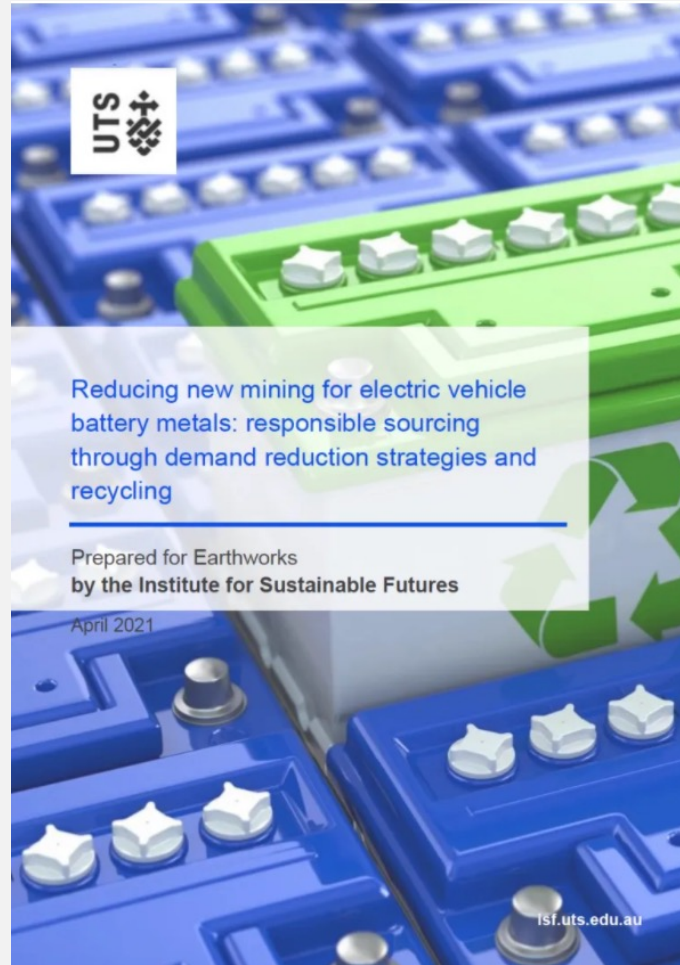


## KEY FINDINGS

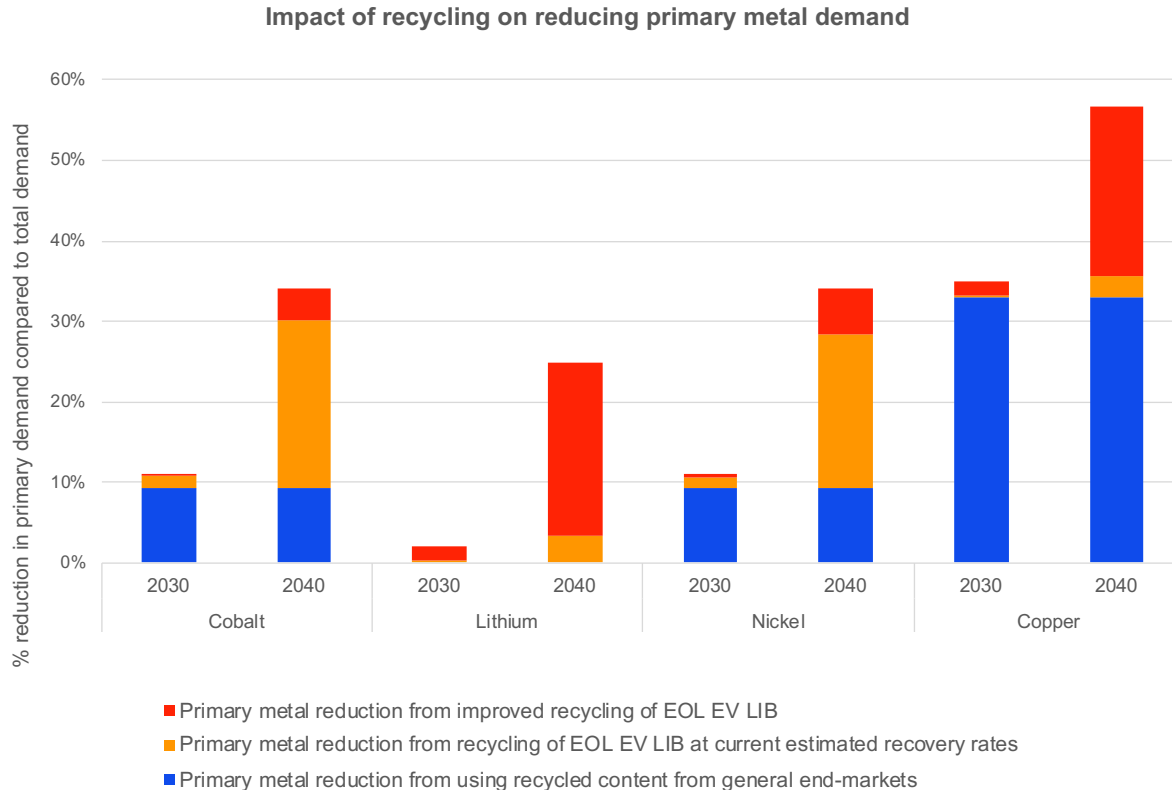
- **Potential large increases in demand for metals** that have only been mined in small amounts previously and where renewable energy, especially batteries, is a large share of demand (lithium, cobalt, rare earths)
- These metals are **most likely to see largest increases in production and new mines** as they are harder to substitute from other uses
- **Electric vehicles** are the main driver of demand for key metals
- A combination of **technological shifts, recycling and increased efficiency** has the most potential to reduce demand
- Impact of private EVs vs. public transit – **opportunity for a shift in transportation**



# REDUCING NEW MINING FOR EV BATTERY METALS – 2021



# IMPACT OF RECYCLING ON REDUCING PRIMARY METAL DEMAND



- **25% for lithium**
- **35% for cobalt and nickel, and**
- **55% for copper**

## KEY FINDINGS

- Recycling has the potential to reduce primary demand compared to total demand in 2040, by approximately 25% for lithium, 35% for cobalt and nickel and 55% for copper, creating an opportunity to significantly reduce the demand for new mining.
- For cobalt and nickel, most of the reduction in primary demand comes from the use of recycled metals from end-of-life electric vehicle lithium-ion batteries, assuming that recycling continues at current recovery rates, which are already relatively high.
- For lithium, almost all of the reduction in primary demand comes from the use of recycled metals from end-of-life electric vehicle lithium-ion batteries at an improved recovery rate. This is because current recovery rates are low, and lithium is very rarely recovered from other end-markets, and is unlikely to be in future.
- For copper, the use of recycled contents from general end-markets has the most impact on reducing primary demand, followed by the use of recycled metals from end-of-life electric vehicle lithium-ion batteries at an improved recovery rate



# Non-recycling options for reducing demand for lithium-ion batteries in electric vehicles

	Current situation	Potential	Limitations
<b>Extending battery lifetimes</b>	Current lifetimes estimated between 8 years (current warranties) and 15 years.	Some manufacturers proposing potential 20 year battery lifetimes.	Consumers are more likely to upgrade vehicles before end-of-battery life.
<b>Reuse</b>	'second-life' applications, include <b>stationary storage</b> , use in other types of <b>vehicles</b> and potentially <b>EV-to-EV applications</b> .	The most likely market is the use of EOL EVs in <b>grid storage applications</b> , with potential lifetimes of 12 years (second life).	The variation between battery design and chemistries limits refurbishment and reuse, unless initiated by manufactures.
<b>Shifts away from private car ownership</b>	Car sharing schemes have the potential to reduce the number of privately-owned cars, but there are very few applications in operation.	Vehicles used in sharing schemes may be used more intensively, however they may also allow for best practice battery management.	Consumer preferences and a lack of policy support remain major limitations to further expansion of car sharing.
<b>Improved public and bike transit</b>	Access to public and bike transit options could significantly reduce private car use, but remain limited in many contexts.	Well-connected and incentivised electric buses, trains and the improved provision of bike infrastructure could reduce demand for private cars.	Lack of policy actively promoting public and bike transit infrastructure.

## RENEWABLE ENERGY AND DEEP SEA MINING (UTS 2018 FOR DSCC)

A transition towards a 100% renewable energy supply can take place without deep-sea mining. Metal demand associated with the dominant renewable technologies evaluated in this report, even assuming very aggressive growth rates under the most ambitious future energy scenarios, do not require deep-sea mining activity. This is combined with the potential to increase recycling rates and sustained research and development into alternative technologies that reduce, or eliminate, the use of supply-constrained metals. The significant increase in production demands for neodymium and dysprosium, and the projected volumes of lithium and silver relative to current reserves suggests these metals require special attention.



# LEVERS FOR CHANGE

## **Boost Recycling and Minimize Toxicity**

- Policy interventions to encourage metals recovery and recycling and remove barriers that tilt the balance in favour of new extraction e.g. EU battery regulations
- Extending product life and repurposing
- Product take-back requirements, design for disassembly, and standardization of battery technologies
- Prioritize health and safety for workers and communities to ensure no new sacrifice zones, ecosystem harm or injustices
- R&D advances in battery technologies substituting and/or reducing mineral content



# LEVERS FOR CHANGE

- **Demand-side Shift in Consumption and Transportation:**
  - Rethink how we consume products and transport goods and people
  - Prioritize investments in electric-powered public transit
  - Circular economy strategies that reduce battery demand and ensure second-life uses
  - Equity in access to benefits of clean energy and transit – who has access?





# LEVERS FOR CHANGE

- **Ensure Responsible Minerals Sourcing**
  - Reform the rules: legally binding regulations to protect human rights and the environment at the state and international level. E.g. Reform the US General Mining Law of 1872
  - Where sourcing from new mining is necessary, operations must adhere to stringent environmental and human rights standards with independent, third-party assurance of compliance and civil society oversight, such as the multi-stakeholder Initiative for Responsible Mining Assurance ([www.responsiblemining.net](http://www.responsiblemining.net)).
  - IRMA members include: BMW, Ford Motor, GM, Daimler-Benz, Tiffany & Co, Microsoft, Anglo American, ArcelorMittal, IndustriALL Global Union, United Steelworkers, Earthworks, Human Rights Watch, Transport & Environment, First Nations Women Advocating Responsible Mining, Mining Affected Communities United in Action



# THANK YOU!

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*Alaskan wild salmon imperiled by Pebble mine*

