MAKING CLEAN ENERGY CLEAN, JUST & EQUITABLE

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MAKING CLEAN ENERGY CLEAN, JUST & EQUITABLE

- Earthworks is a non-profit organization dedicated to protecting communities and the environment from the adverse impacts of mineral development.
- In recent years seeing uptick in copper, nickel, and other new mining projects described as "critical" for the energy transition
- Used as justification for investing in problematic new proposals in places where communities don't want mining, and ecosystems cannot bear the burden – places like Bristol Bay, Alaska and Basamuk Bay, PNG,even the deep ocean

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

MAKING CLEAN ENERGY CLEAN, JUST & EQUITABLE

- 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
- This must be be an ***opportunity moment*** – to not only transition to a low-carbon economy but also reduce our dependence on dirty mining.
- To better understand the data, we commissioned research from Institute for Sustainable Futures at the University of Technology, Sydney

Families protesting impacts of Ramu nickel mine, Papua New Guinea

MAKING CLEAN ENERGY CLEAN, JUST & EQUITABLE

- Potential impacts of increased minerals demand on frontline communities and ecosystems:
  - threats to indigenous rights and risk to livelihoods
  - human rights abuses
  - worker health & safety
  - **toxic waste**
  - freshwater pollution & use
  - threats to ocean health: marine mine waste dumping and deep-sea mining
  - **metals mining contributes10% of greenhouse gas emissions**

Brumadinho mine waste disaster, Brazil, January 2019: an estimated 250 people killed

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		

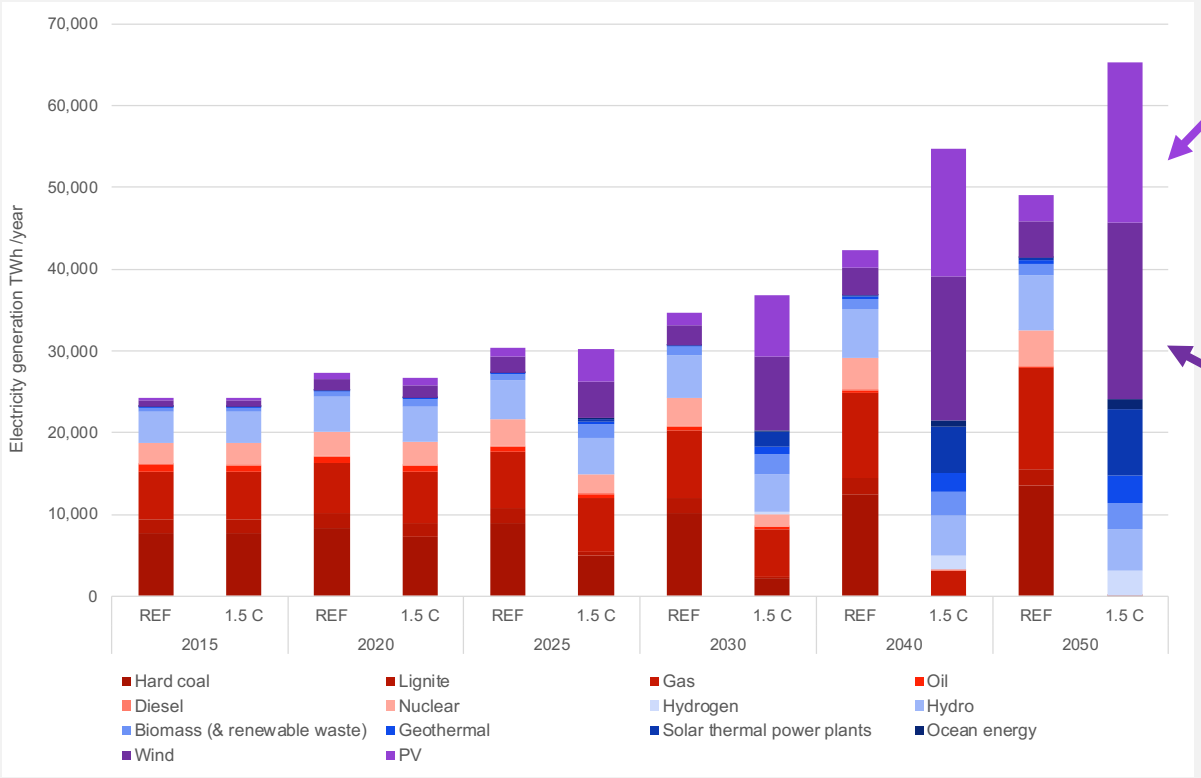
1.5°C ENERGY SCENARIO

One Earth Climate model

100% renewable electricity 2050

100% renewable transport 2050 (>50% electric)

Battery demand calculated for cars, buses, commercial vehicles & storage



Solar PV 30% of electricity generation by 2050

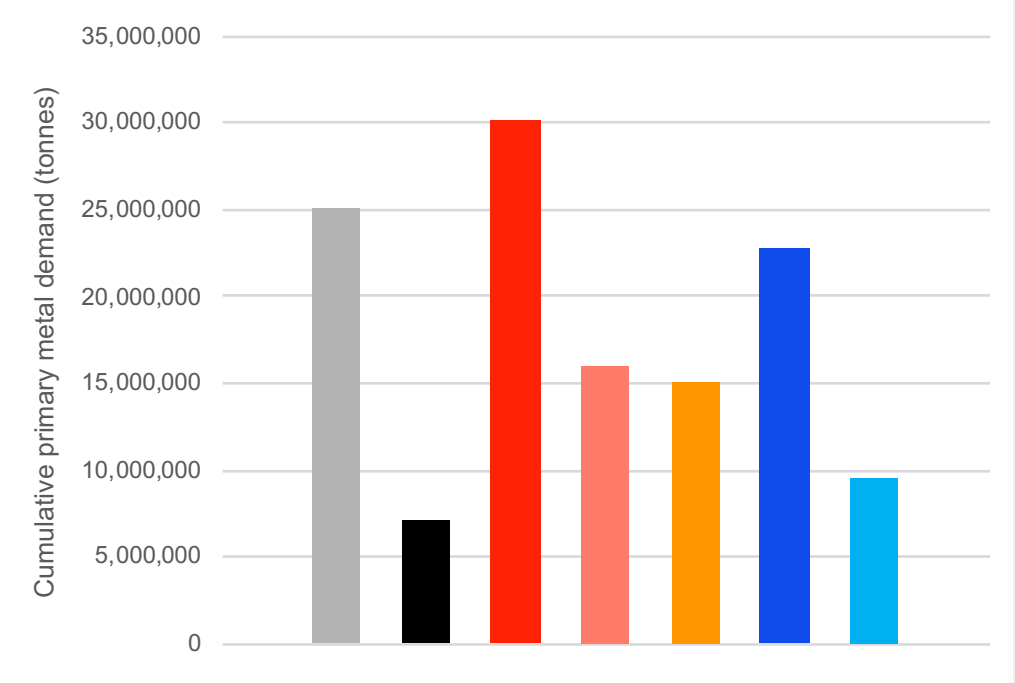
Wind 28% of electricity generation by 2050

Cumulative Demand

	Cumulative demand in 2050 compared to reserves		Cumulative demand in 2050 compared to resources	
	Maximum scenario	Minimum scenario	Maximum scenario	Minimum scenario
Aluminium	2%	1%	1%	1%
Cadmium	4%	2%	0%	0%
Cobalt	423%	135%	120%	38%
Copper	18%	13%	4%	3%
Dysprosium	19%	12%	11%	7%
Gallium	2%	1%	0%	0%
Indium	51%	28%	16%	9%
Lithium	280%	86%	85%	26%
Manganese	14%	5%	0%	0%
Neodymium	13%	8%	7%	5%
Nickel	136%	43%	77%	25%
Selenium	11%	7%	7%	4%
Silver	52%	29%	21%	12%
Tellurium	75%	42%	48%	27%

Cumulative primary demand in 2050: cobalt

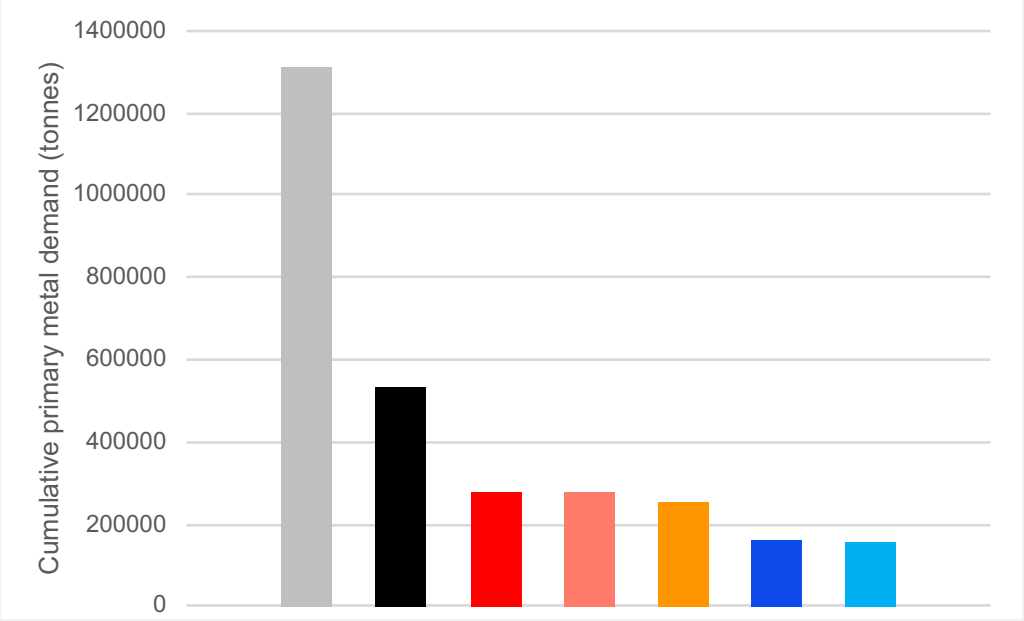
Cumulative primary demand for cobalt for EVs and storage by 2050



Recycling has greatest potential to reduce primary demand for battery metals

Cumulative primary demand in 2050: silver

Cumulative primary demand for silver for solar PV (c-Si) by 2050



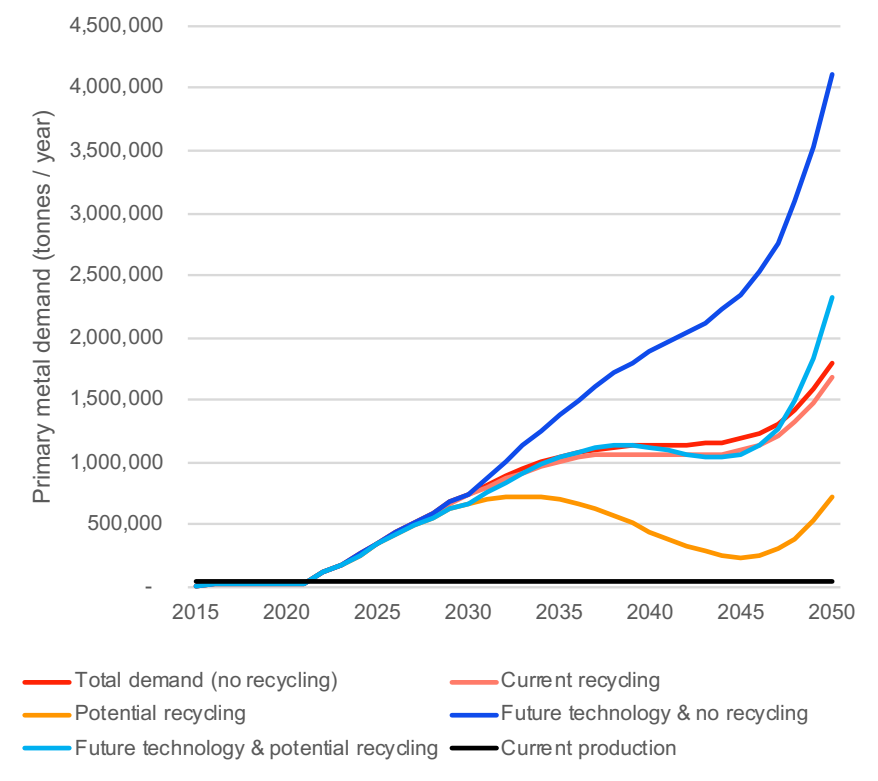
Efficiency has greatest potential to reduce primary demand for Solar PV metals

Increases in Production

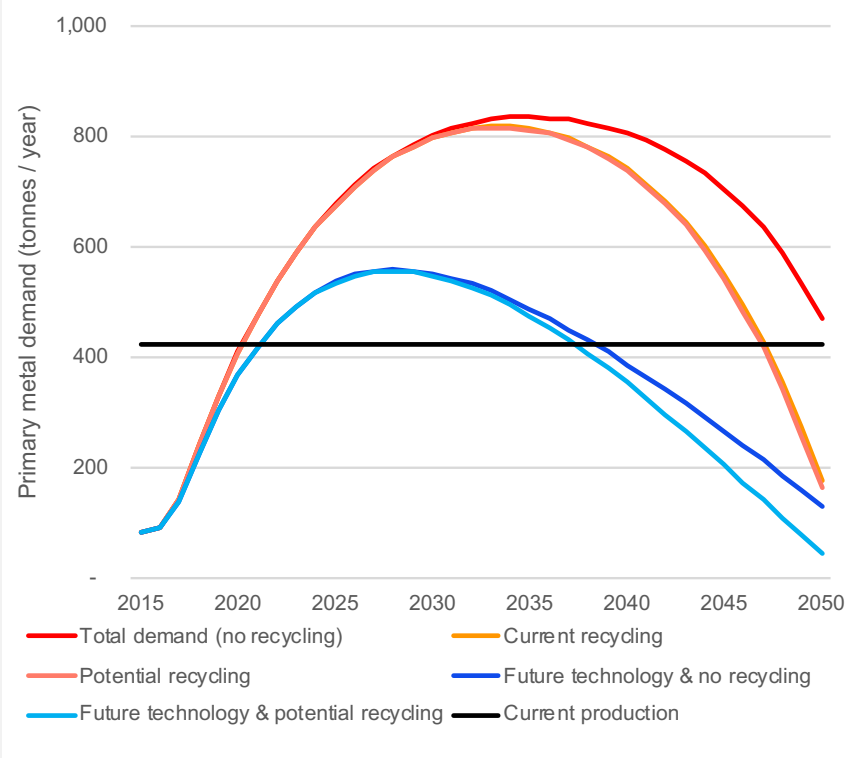
	Peak annual demand (tonnes)		% of demand compared to current production	
	Maximum scenario	Minimum scenario	Maximum scenario	Minimum scenario
Aluminium	18,852,177	17,822,832	3%	3%
Cadmium	700	479	3%	2%
Cobalt	1,966,469	747,427	1788%	679%
Copper	5,626,579	4,493,216	29%	23%
Dysprosium	11,524	7,299	640%	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%

Increases in production: lithium and tellurium

Annual primary demand for lithium for EVs and storage



Annual primary demand for tellurium for PV



Demand for battery metals continues to grow but slows down for PV metals

Key findings

- Potential large increases in demand for metals that have **only been mined in small amounts previously** and where **renewable energy 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 **recycling and increased efficiency** has the most potential to reduce demand, but cannot meet all demand
- Shifts in technology are underway that **can help reduce demand, but not in short term**
- Need to **design transport and energy systems to minimise batteries**, through promoting public/active transport and car-sharing and using storage only when needed.

Recycling & efficiency to offset demand

- Industry is already focused on improving efficiency, focus needs to shift to recycling

- **Batteries and EVs:**
  - Recycling of batteries happening to a degree because of economic value in the materials.
  - Not all types of metals are being recovered in recycling process (e.g. only highest value metals Co & Ni but not Li & Mn)

- **Solar PV:**
  - Recycling is a challenge for solar PV (technological difficulties in recycling & longer lifetimes)
  - Recycling focused on glass; silver and other trace metals not being recovered

- Policy interventions will be needed to encourage recycling to recover all metals

- Recycling also **not without social and environmental impacts** (especially rare earths)

Recycling is the most important strategy to reduce primary demand

LETTER TO THE WORLD BANK RE "CLIMATE-SMART MINING" SIGNED BY 60 ORGANIZATIONS FROM AROUND THE WORLD

April 30, 2019

Kristalina Georgieva
Chief Executive Officer
The World Bank
1818 H Street, NW
Washington, DC
20433 USA

Dear Dr. Georgieva,

The undersigned organizations support a just and rapid transition away from fossil fuels and towards a renewable energy economy. We recognize this essential shift is necessary in order to keep global temperature rise below 1.5 degrees and avert the most disastrous impacts even as new renewable energy infrastructure ramps up, we are concerned extracting minerals like copper, nickel, lithium and cobalt on communities,

We share the World Bank's concern that "significant challenges will likely emerge if the climate-driven clean energy transition is not managed responsibly and sustainably."[2] Yet we are also concerned that the World Bank's new "Climate-Smart Mining" Facility is seeking to promote new mining before promoting these other important solutions that must precede it. We urge the World Bank Group to prioritize recycling, efficiency, circular economy, public transit, and other non-mining solutions as the primary components of its "Climate-Smart" agenda. In addition, current IFC performance standards -- and minimal oversight of their implementation -- do not, unfortunately, provide meaningful guarantees that new mining promoted by the World Bank's Climate-Smart Mining Facility will meet credible safeguards to ensure protection of air, water, climate, human rights, livelihoods, worker safety and community health. Without these safeguards in place, mining promoted as "Climate-Smart" risks exacerbating the very issues it seeks to fix.

We are alarmed to note that the World Bank has closely partnered with mining companies in developing and launching its new Climate-Smart Mining Facility, putting mining company agendas and interests before protections to safeguard and benefit workers, communities and the environment. As a public financial institution, the World Bank has the responsibility to provide oversight to mining operations and impetus for improvements in mining practices.

We urge you to ensure that the World Bank helps to build climate change solutions that puts communities, workers and the environment first.

MAKING CLEAN ENERGY CLEAN, JUST & EQUITABLE: PLATFORM FOR CHANGE

- **Boost Recycling and Minimize Toxicity**
  - Scale up use of recycled minerals – corporate + policy shift
  - Product take-back requirements, design batteries and RE technologies for disassembly and efficient recycling
  - Prioritize health and safety for workers and communities.

- **Ensure Responsible Minerals Sourcing**
  - Where sourcing from new mining is absolutely necessary, operations must adhere to stringent environmental and human rights standards, such as those developed by the multi-stakeholder Initiative for Responsible Mining Assurance, with independent, third-party assurance of compliance.

- **Shift Consumption and Transportation**:
  - Rethink how we consume products and transport goods and people
  - Prioritize investments in electric-powered public transit
  - Equity in access to benefits of clean energy and transit
  - Can't tech fix out way out of this

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Alaskan wild salmon imperiled by Pebble mine