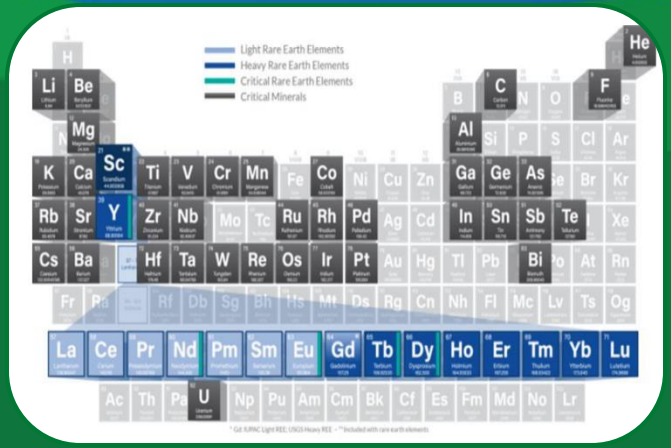
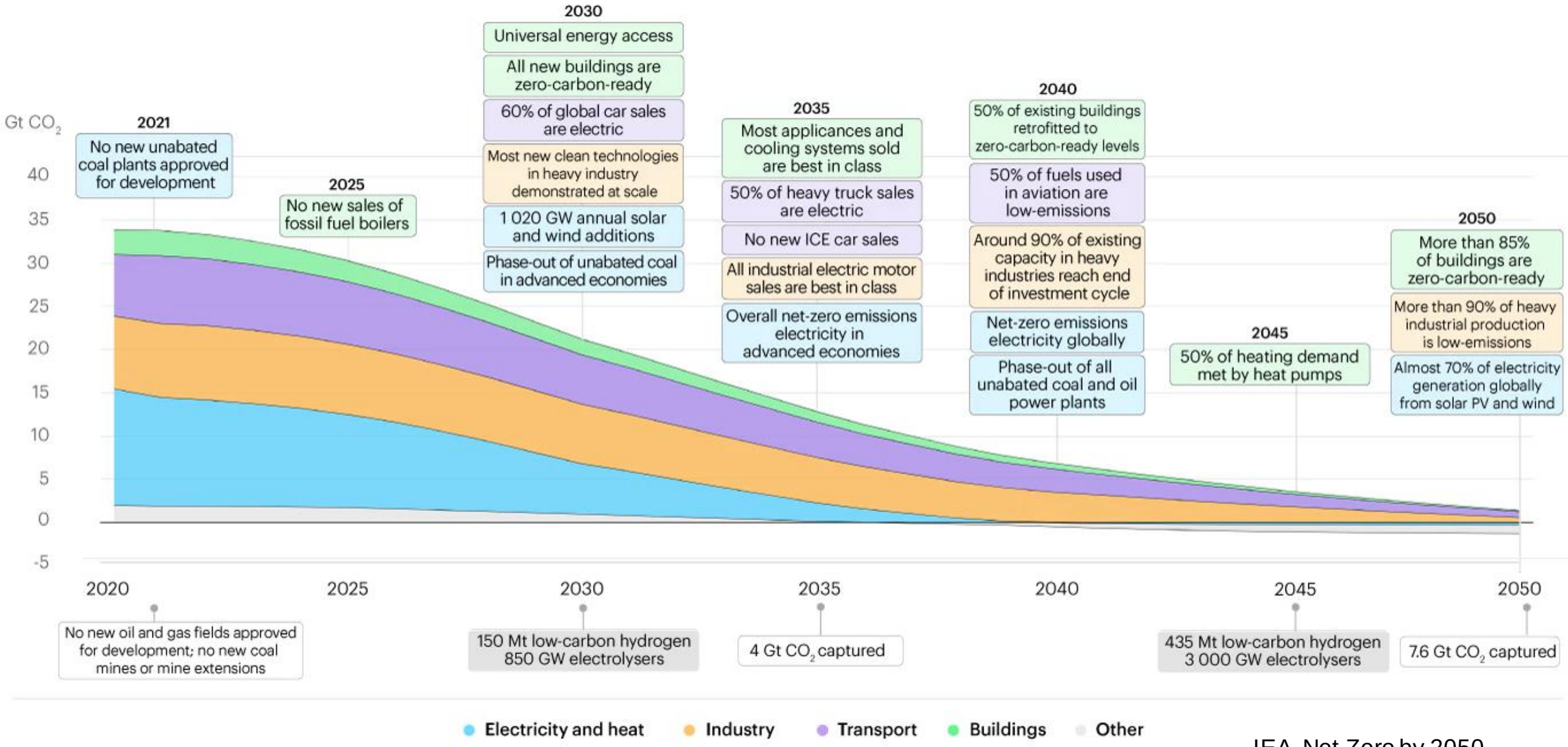
U.S. DEPARTMENT OF ENERGY
Fossil Energy and Carbon Management

Importance of Responsible Critical Materials Development to Decarbonization

An Opportunity to Facilitate Resilient Domestic Critical Material Supply Chains

June 28, 2022



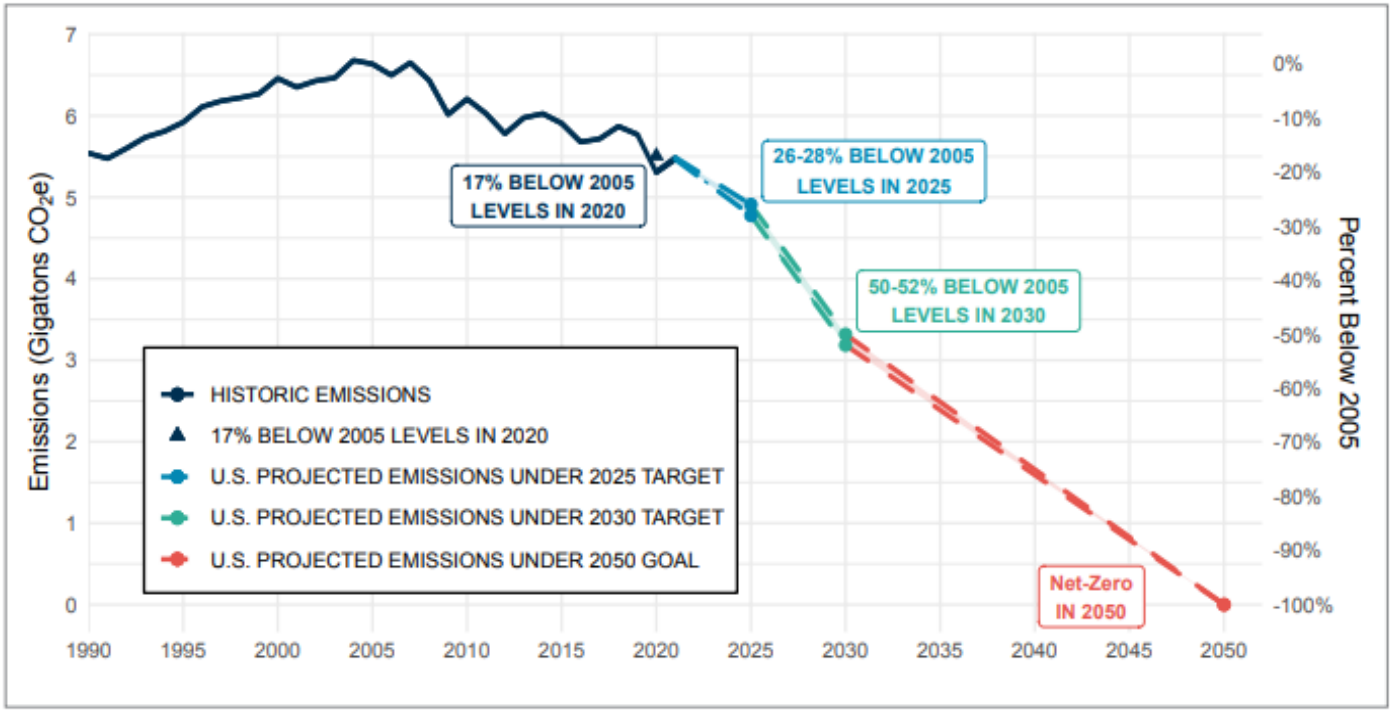


IEA, Net Zero by 2050

Critical minerals and climate action

Reaching the goals of the Paris Agreement 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 **6x** more mineral inputs in 2040 than today



US Long Term Climate Strategy

Which minerals?

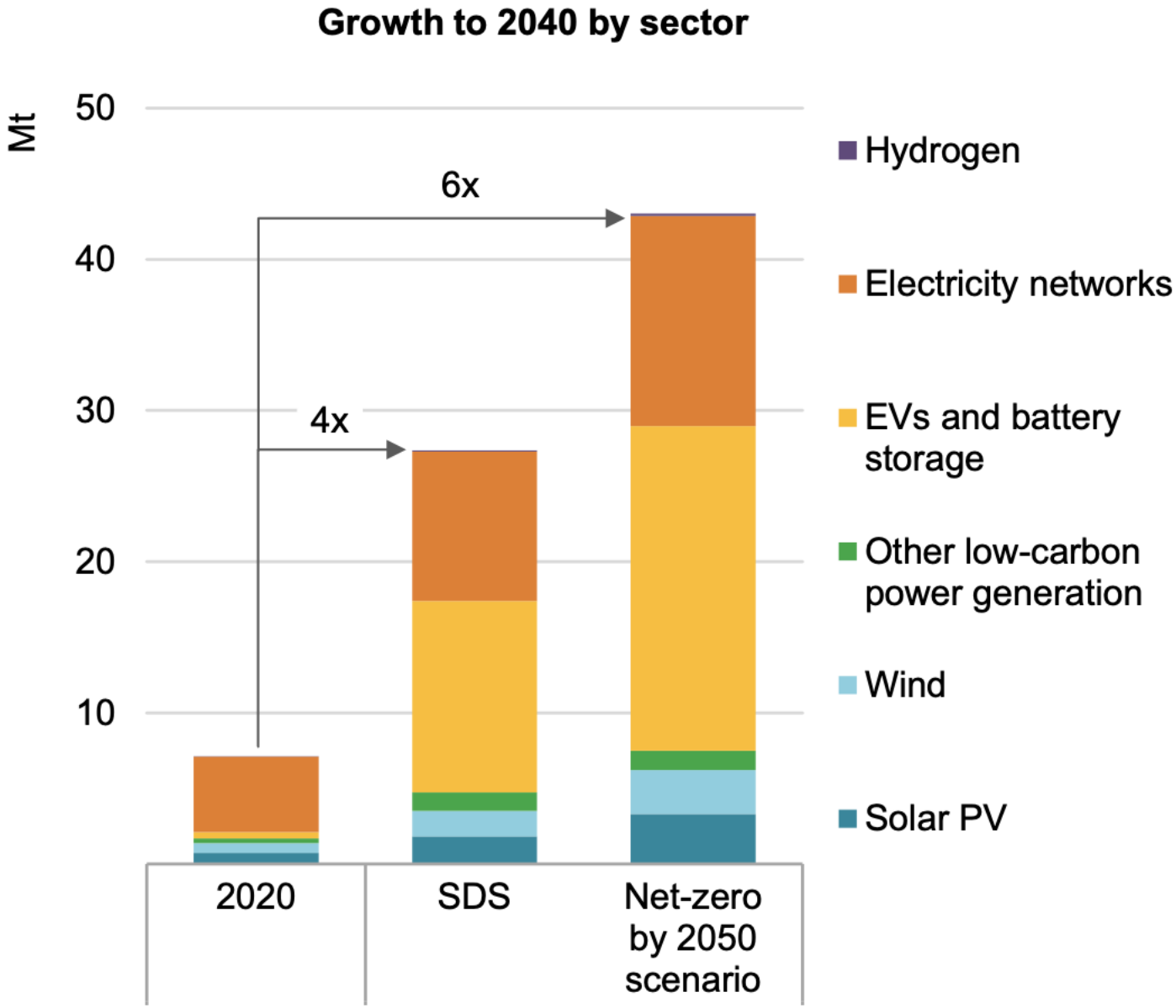
Silver, platinum, indium, tellurium, rare earth elements, iridium, gallium, germanium

Lithium, copper, nickel, magnesium, cobalt, etc.

Total demand for clean technologies by 2040 will require…

- 40% increase of copper and rare earth elements
- 60-70% for nickel and cobalt
- 90% for lithium

What will these materials be used for?



IEA The Role of Critical Minerals In Clean Energy Transitions

Strategies for obtaining critical minerals

Open new mining sites

Recycle materials

Identify substitutes

Unconventional sources such as wastes and byproducts

These all have different social implications

Example of frameworks for looking at social implications: Projections for EV batteries

Table 1. The amounts of elements needed for EV batteries compared to the 2019 mined, global, and domestic reserves amounts of those elements.[23]

Cathode element	Needed for 20% EV sales (tonne)	Needed for 100% EV sales (tonne)[24]	Material mined in 2019 (tonne)	Global reserves (tonne)	U.S. Reserves (tonne)
Nickel[25]	254,530	1,272,650	1,000,000[26] (Class 1)	89,000,000 (Class 1 & 2)	110,000 (Class 1 & 2)
Lithium	37,750	188,700	77,000	17,000,000	630,000
Cobalt	31,820	159,800	140,000	7,000,000	55,000
Manganese	29,660	148,300	18,500,000	810,000,000	NA

White House Building Resilient Supply Chains 100-Day Report

There are impacts throughout the supply chain

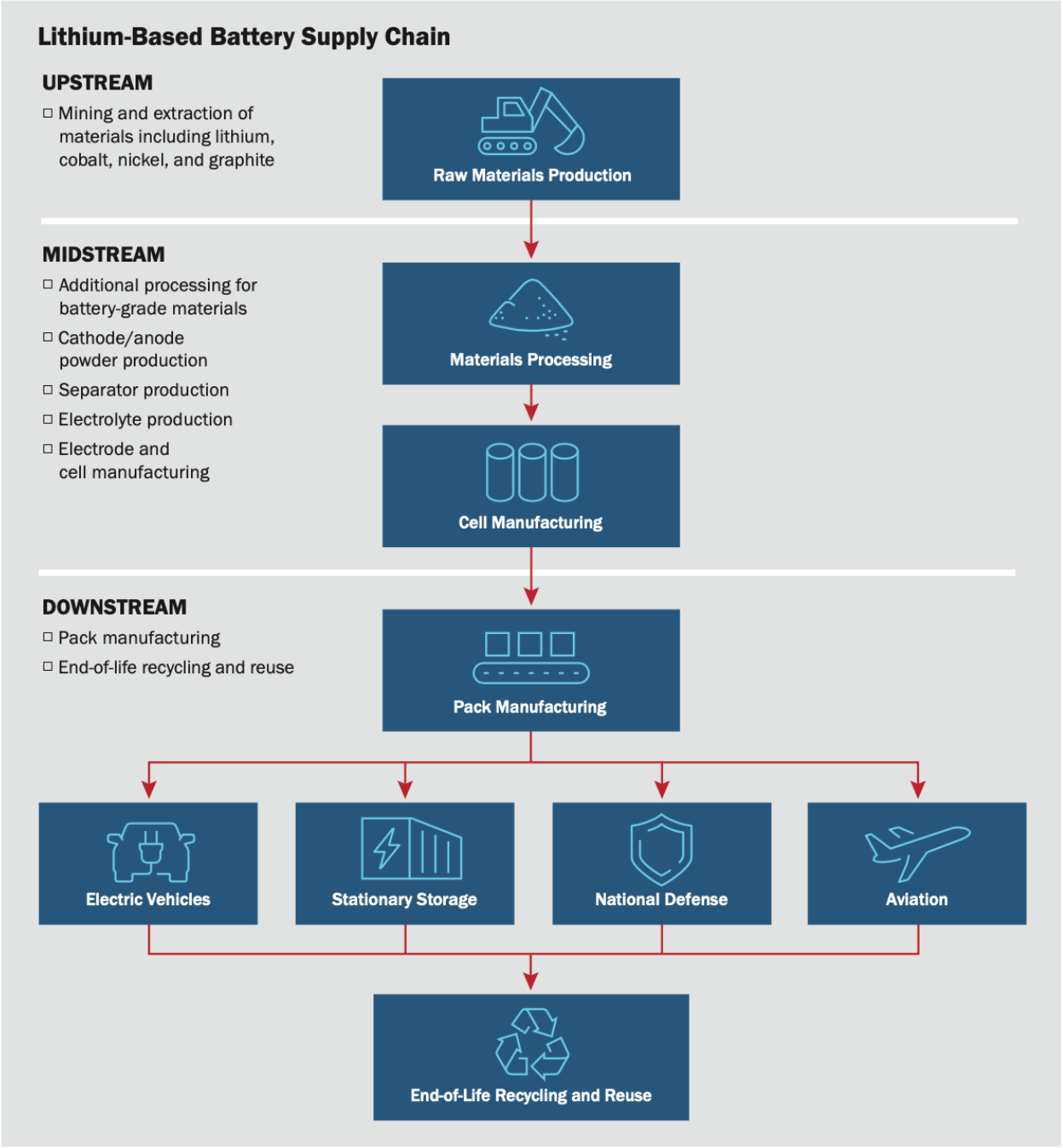


FIGURE 5. Steps in the lithium-battery material supply chain.

FCAB National Blueprint for Lithium Batteries

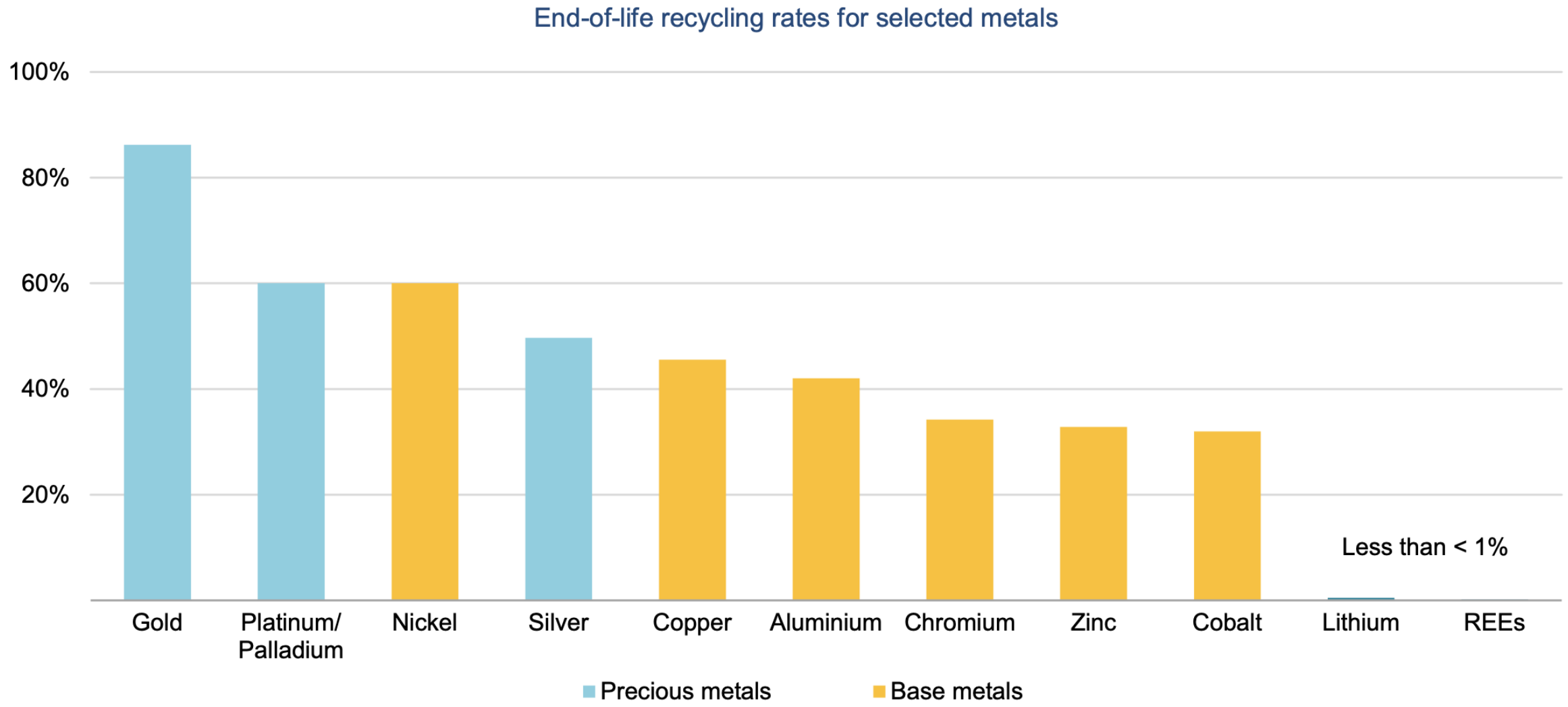
Social considerations and impacts - Mining

- Gaston County, NC – rural and suburban community 45 minutes from Charlotte, NC
- Proposed lithium project
- Concerns about dropping water table and property values
- Estimates of 300-500 jobs and salaries of $80,000 per year
- Some criticism from county officials for late public and stakeholder engagement

Signs like this one opposing Piedmont Lithium's proposed pit mine mark the roadsides of Gaston County.

BRIAN BLANCO FOR HUFFPOST

Today's recycling rates vary by metal depending on the ease of collection, price levels and market maturity



Sources: Henckens (2021); UNEP (2011) for aluminium; Sverdrup and Ragnarsdottir (2016) for platinum and palladium; OECD (2019) for nickel and cobalt.

Opportunities for recycling

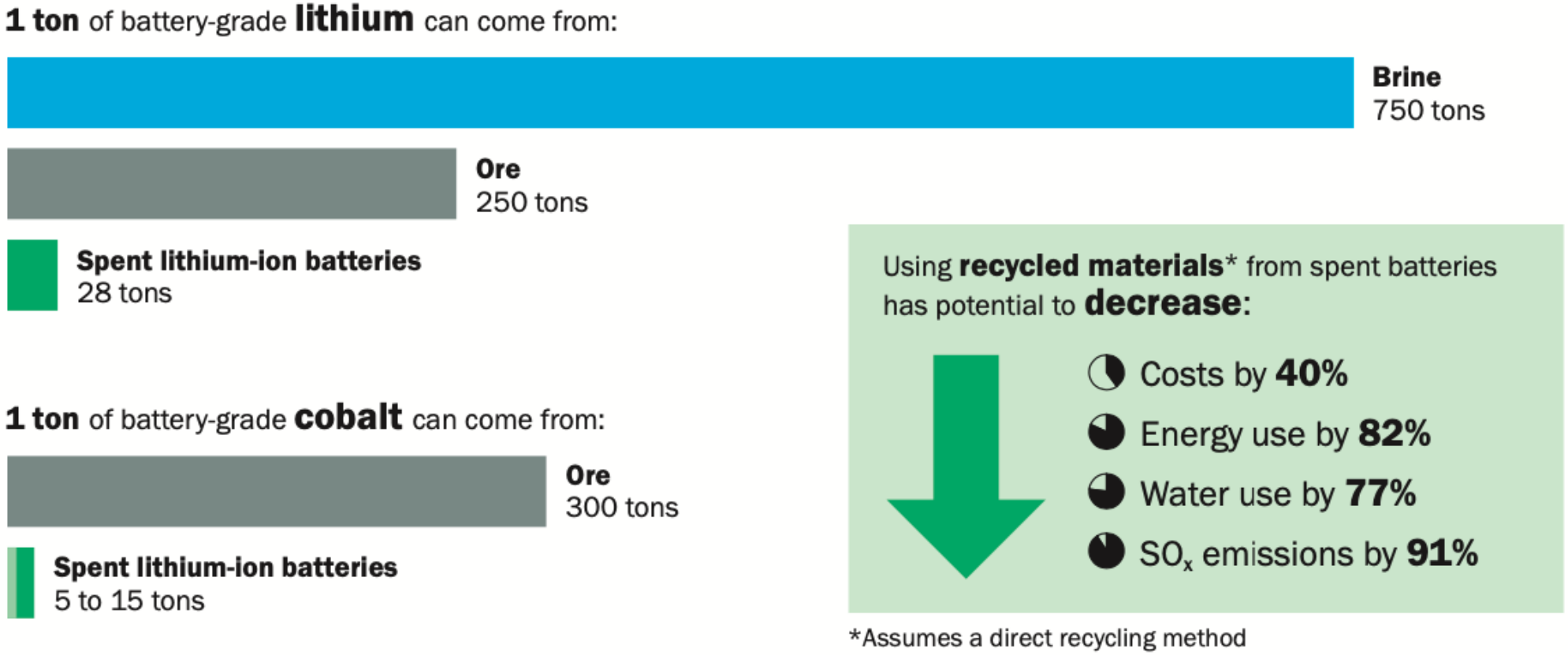


FIGURE 7. Benefits of recycling for lithium-ion batteries. Data from Argonne National Laboratory's ReCell Center, 2019.[33]

FCAB National Blueprint for Lithium Batteries

Recycling of EV batteries is small but growing

- Pretreatment - mechanically shredding and sorting plastic and metal materials
- Secondary treatment – separating highest value materials in cathode from aluminum collector foil with a chemical solvent
- Final step – separating cathode materials through leach chemicals, electrolytic reactions, and/or heat treatment

Recycling the cobalt, lithium, and other critical materials in electric vehicle batteries will help meet increased demand for materials as vehicle sales grow in future years and reduce the need to mine new materials. Recycling facilities are currently few and far between—Li-Cycle (shown above) is one of just 10 or so in the world operating today—underscoring the need for policies to help promote increased recycling.

Source: UCS Fact Sheet, EV Batteries

Environmental justice

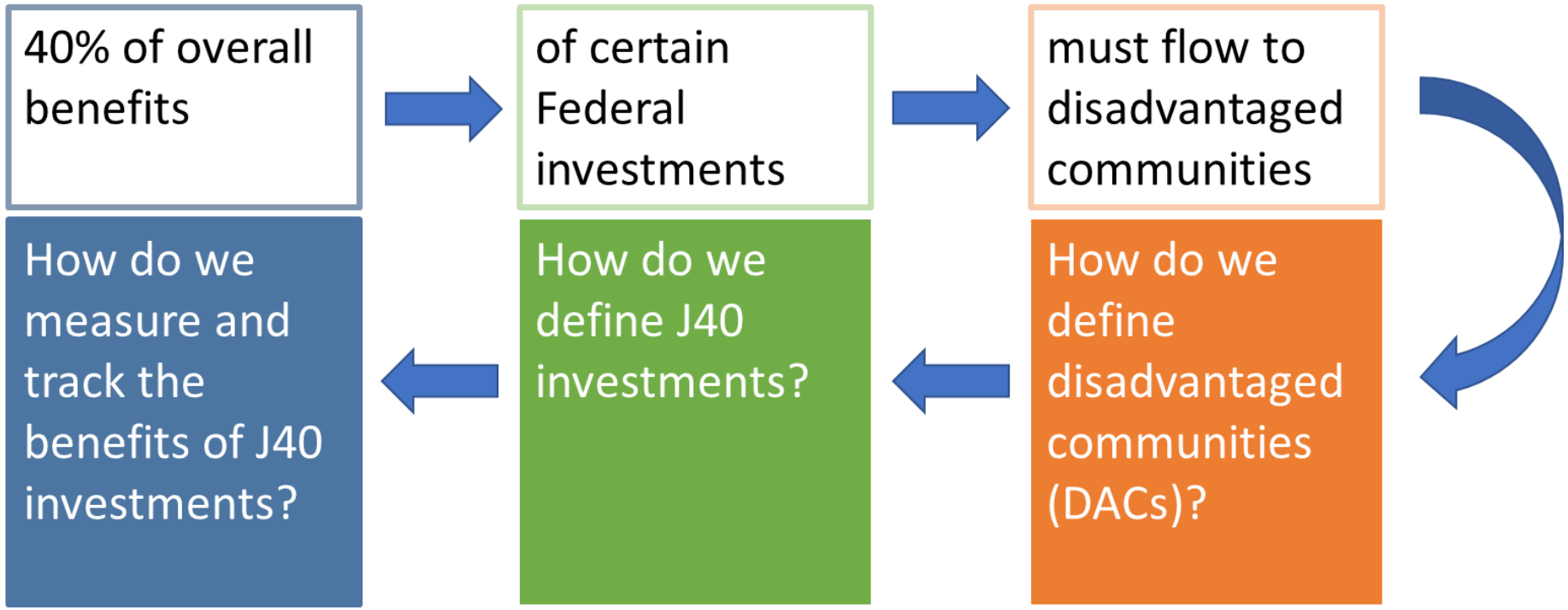
- Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. This goal will be achieved when everyone enjoys:
- The same degree of protection from environmental and health hazards, and
- Equal access to the decision-making process to have a healthy environment in which to live, learn, and work.

Energy justice

- Energy justice seeks equity in the social and economic participation in the energy system
- While remediating social, economic, and health burdens on frontline communities, explicitly centering their concerns
- Aims to make energy more accessible, affordable, clean, and democratically managed for all communities.

Justice40 Initiative

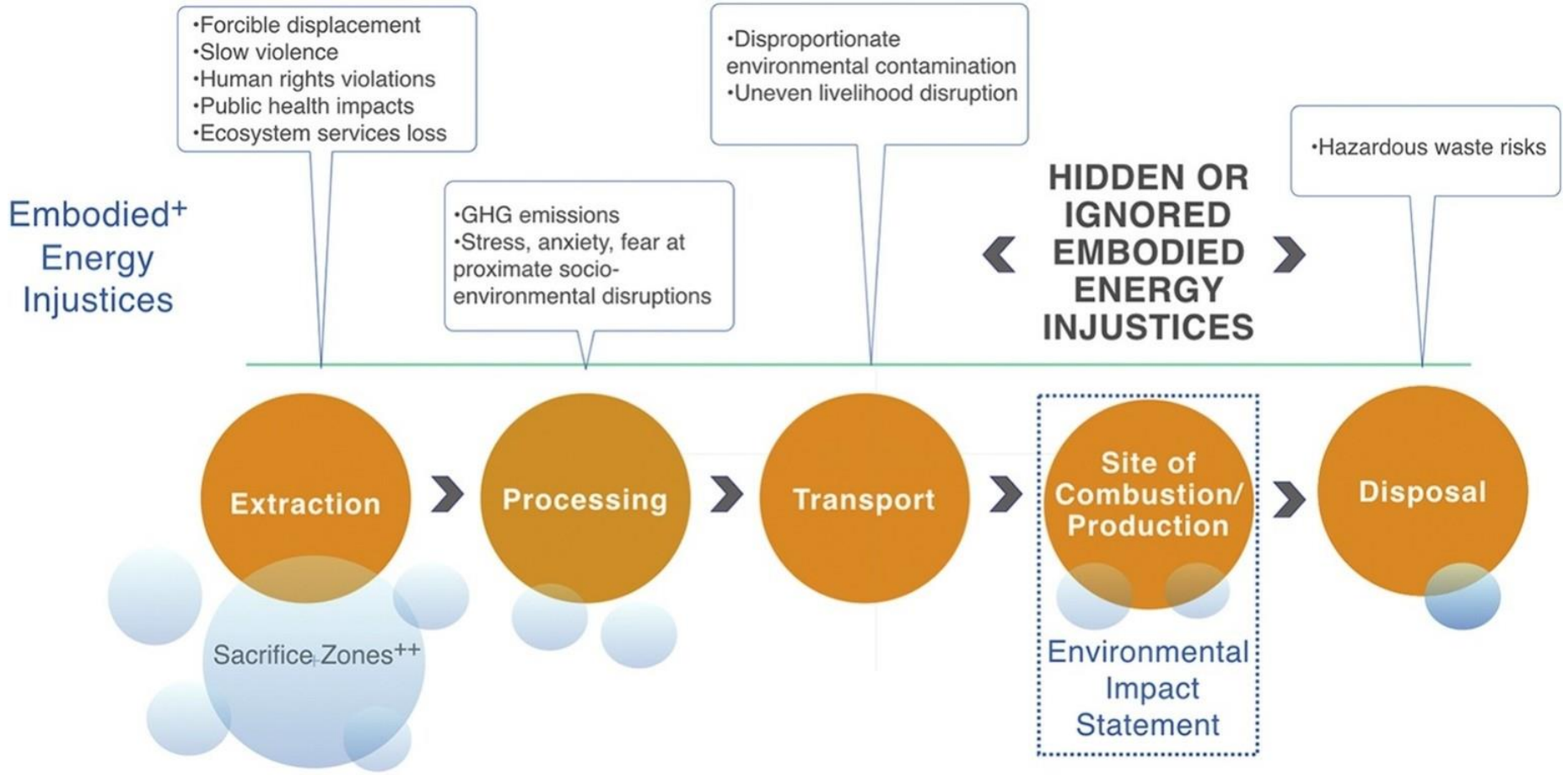
Executive Order 14008, *On Tackling the Climate Crisis at Home and Abroad,* **establishes a goal that 40% of the overall benefits of certain federal investments flow to disadvantaged communities.**



DOE Justice40 Policy Priorities

1. Decrease energy burden in disadvantaged communities.
2. Decrease environmental exposure and burdens for disadvantaged communities.
3. Increase parity in clean energy technology access and adoption in disadvantaged communities.
4. Increase access to low-cost capital in disadvantaged communities.
5. Increase clean energy enterprise creation (MBE/DBE) in disadvantaged communities.
6. Increase the clean energy job pipeline and job training for individuals from disadvantaged communities.
7. Increase energy resiliency in disadvantaged communities.
8. Increase energy democracy in disadvantaged communities.

Embodied energy injustices



\+ The injustices listed can occur anywhere along the supply-chain but typically are most prevalent around sites of extraction.
++ Sacrifice zones are areas poisoned or destroyed for the supposed greater good of economic progress.

Healy et al. (2019)

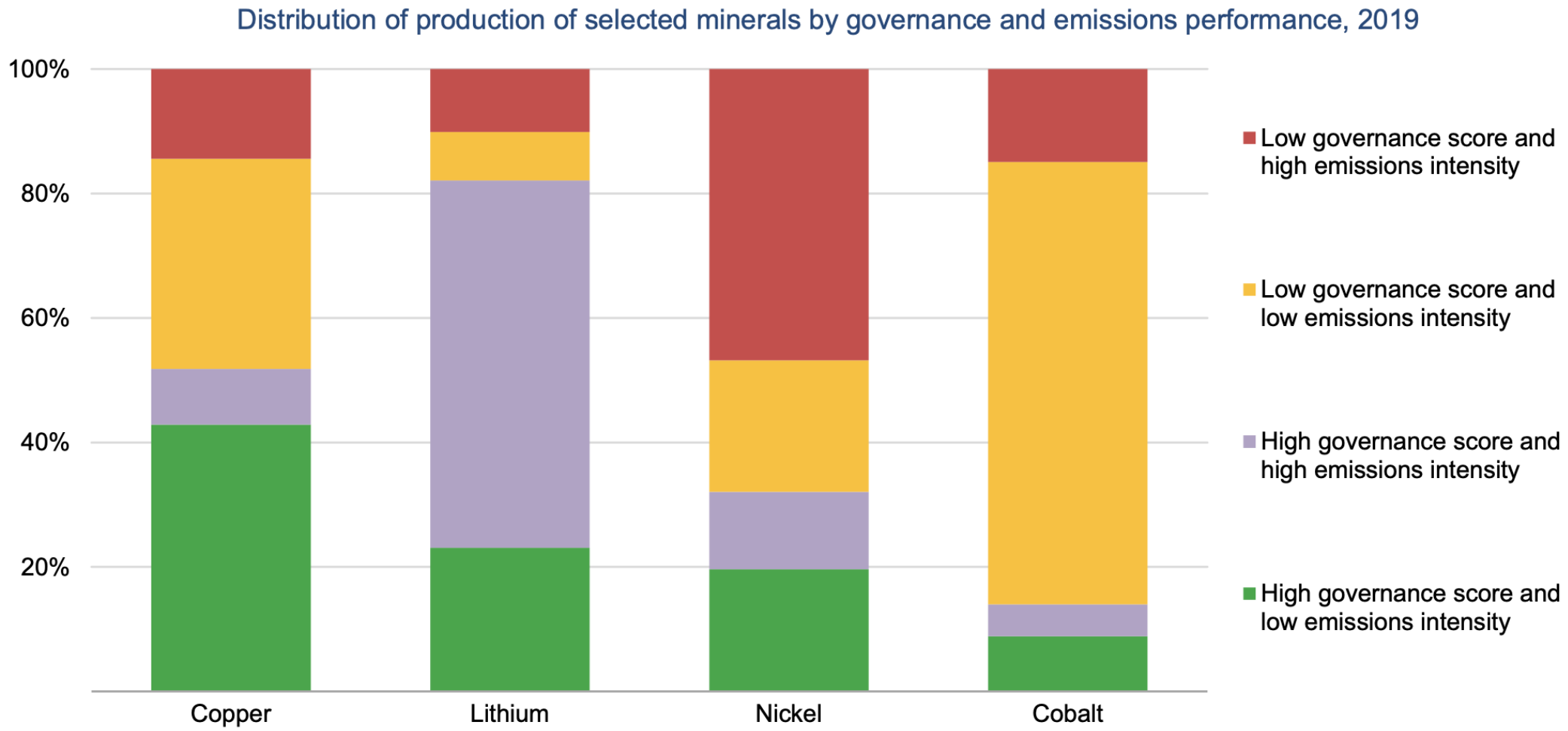
Critical mineral production today and global environmental justice

In many places, critical minerals are produced under conditions that are harmful for workers and the environment

When consumers and companies based in the global North reap the benefits, and producers and communities in the global South bear the harms, this is an example of global environmental injustice

image: MONUSCO/Sylvain Liechti

Scrutiny of ESG issues: The majority of current production volumes come from regions with low governance scores or high emissions intensity



Notes: Analysis using the World Bank Worldwide Governance Indicator (as a proxy for governance) and electricity CO_2 intensity (as a proxy for emissions performance). Composite governance rank scores below 50 were classified as low governance; electricity CO_2 emissions intensity above 463 g CO_2/kWh (global average value in 2019) was classified as high emissions intensity.

Source: World Bank (2020), IEA (2020).

Dimensions of environmental justice

Procedural

Broad and meaningful participation in the decision-making

Recognition

Respect and honor of divergent cultural and local knowledge

Distributive

Equitable distribution of environmental benefits and burdens

Restorative

Repair harms done to communities and the environment

Critical materials and procedural justice

- What are the opportunities to participate in decision-making? Who is at the table, and whose recommendations are acted upon?

- Meaningful community engagement and Tribal engagement is key

- Right of Indigenous peoples to provide or withhold free, prior, and informed consent in relation to projects that will affect their lives, as recognized under the UN Declaration of the Rights of Indigenous Peoples

Critical materials and recognition justice

Talon Metals Corp. signed deal with Tesla for new mine to supply nickel in Minnesota

Tamarack is within a watershed that affects two federally recognized tribes, the Mille Lacs Band, which cultivate wild rice in federally protected waters

Recognition justice involves recognizing cultural values and practices, as well as Tribal rights

Talon is monitoring water to have a baseline, and sharing the data with regulators and the wider community; also working on how to make a smaller surface footprint than other sulfide mines in Minnesota, and researching a carbon sequestration system

What is needed to further recognition justice?

A drill rig at the Tamarack site. Photographer: Adam Minter/Bloomberg

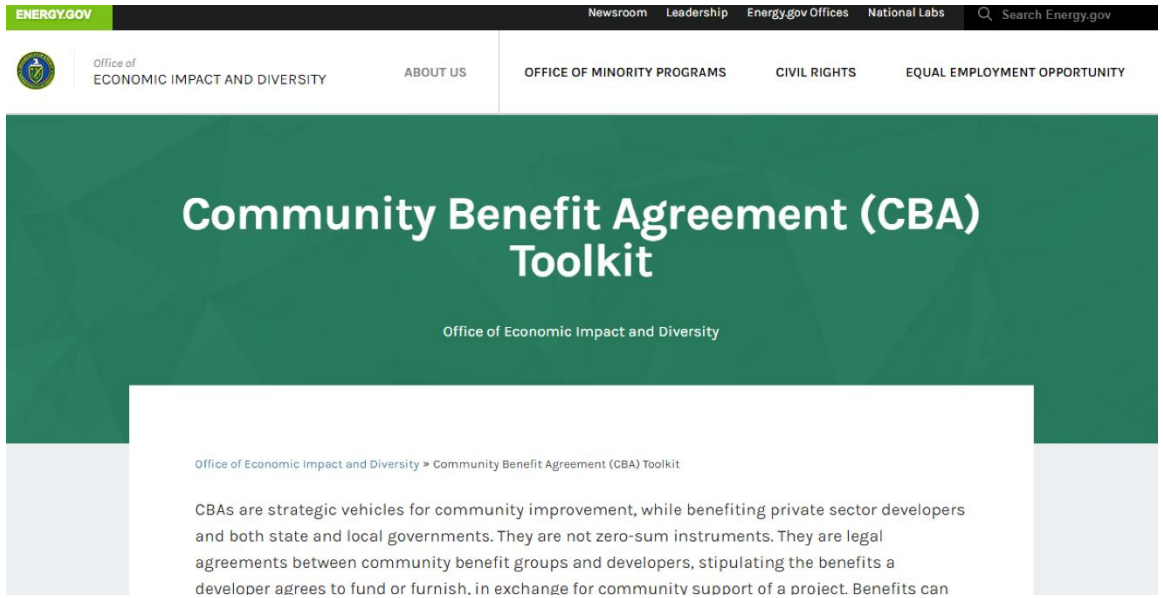
Critical materials and distributive justice

- Imperial Valley, California – potential source of lithium from geothermal brine
- Population ~180,000, concentrated land ownership, 85% Latino, median HHI under $45,000 compared to $71,000 in CA
- Existing air pollution burden and health disparities – 15% affected by asthma
- **How will the benefits from the projects be distributed?**

Critical materials and restorative justice

- Restorative justice focuses on the needs of people and places which have been harmed
- Using mining and processing coal-based waste streams offer potential to remediate legacy fossil activities – but may be hazardous and requires protections for workers
- Also relevant for new projects that need to be planning for eventual closure and remediation

Approaches for ensuring responsible development of critical minerals



- **Transparency efforts** like the Extractive Industries Transparency Initiative (EITI); forums like the Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development and Energy Resource Governance Initiative
- **Community Benefits Agreement** / Impacts Benefits Agreement
  - Legally-binding contract for all parties that stipulate community benefits
  - Works best when the coalition really represents the community

U.S. DEPARTMENT OF ENERGY

Fossil Energy and Carbon Management

Thank you