RISK ANALYSIS OF A MARKET WIDE SCALE TRANSITION TO ELECTRIC VEHICLES
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Background
The transportation sector generates the largest share of greenhouse gases (GHG) from burning fossil fuel.
Transportation manufacturers are attempting to join the line of supply in electric vehicle (EV) manufacturing to meet upcoming demand.
New mines opening up to meet demand for battery metals cause concern for upcoming surge of e-waste and human rights abuses (Fig. 1).
Several industry leaders have dedicated resources to identifying risks associated with EV battery usage using cradle-to-cradle approach.
Cradle-to-cradle approach acknowledges the life cycle of products with the intention to create zero waste.
There’s currently a lack of regulation and standardization to mitigate negative impacts that come from EV industry in the United States.

Research Question
What are the best practices for a cradle-to-cradle approach for electric vehicle batteries?

Internship & Methods
Interned with King County Metro Transit by beginning the research for risks and outcomes for Metro’s transition to fully electric fleet.
Obtained qualitative data through literature reviews on EV ethical/sustainable risks and interviews with transportation experts, environmental nonprofits and academia.

Results

![Image of Cobalt Suppliers By Country](chart1.png)

![Image of Lithium Suppliers By Country](chart2.png)

Material demand for Li-ion batteries (million tons) vs 2019 production (horizontal red lines). Both Li and Co may exceed the current production capacity within the next 10 years.

![Image of Development of alternate approaches using LFP or US will significantly reduce the demand for Co and N (stashed lines)](chart3.png)

The leading suppliers of EV battery materials have a record of labor abuse and environmental destruction (Fig. 2).

Takeaways

Without increasing recycling capabilities, EV battery material demand will exceed supply in the next 10 years (Fig. 3).

Only 20-30% of EV battery life is extracted before they must be replaced for safety reasons.

EV batteries vary in shape, size and components, making them difficult to recycle.

Best Practice: Use third party verification to ensure ethical and sustainable sourcing of materials.

Best Practices:
- Create industry standards for EV battery shape and composition
- Invest in alternative chemistries and newer recycling facilities

Implications

Industry leaders must use supply chain pressures to enforce third party verification and ensure ethical sourcing and recycling requirements are met.
There is a need for federal policies and programs to provide guidance for ethical and sustainable EV battery life cycles.
As informal standardization is unlikely due to leading EV battery producers not wishing to relinquish market power, federal and/or international standards must be put in place.

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