The Environmental Impact of Electric Vehicles vs. Internal Combustion Vehicles: A Production-Based Approach

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INTRODUCTION

Electric vehicles (EVs) have emerged as a commonly accepted "more sustainable" alternative to internal combustion engine vehicles. However, the environmental impacts of lithium extraction for lithium-ion batteries may compromise the sustainability merits of EVs. With the EV market expanding more rapidly than ever, it is imperative to compare the sustainability of resource gathering practices for the fuels powering both vehicle types to determine whether one is truly more "sustainable" than the other. Our project intends to present literature review-style research that would help facilitate that discussion.

LITHIUM

Hydrological Concerns

- Water extraction exceeds recharge capacity of water bodies in very arid areas where lithium is most abundant (dry areas become even drier)
- Immense evaporation of water by humans creates changes in natural water cycling

Physical/Biological Concerns

- Ecological concerns: habitat loss, biodiversity loss, species avoidance of lithium mining sites, vegetation removal
- Mining/extraction facilities can produce leachates containing toxic substances such as arsenic, uranium, and sulfate.

Policy/Regulation Concerns

- Most lithium is extracted in countries with less-stringent environmental regulations
  - ➢ Contributes to lack of data availability from lithium mining/extraction companies
  - ➢ Creates challenges in conducting large-scale research about lithium extraction

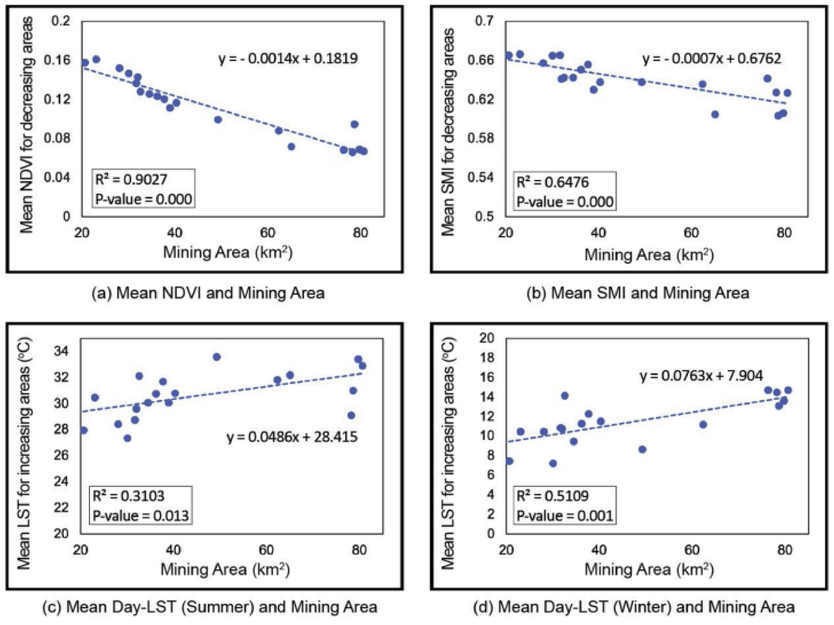

Figure 1. Data from breakthrough study of lithium mining expansion in Salar de Atacama, Chile (Liu et al., 2021)

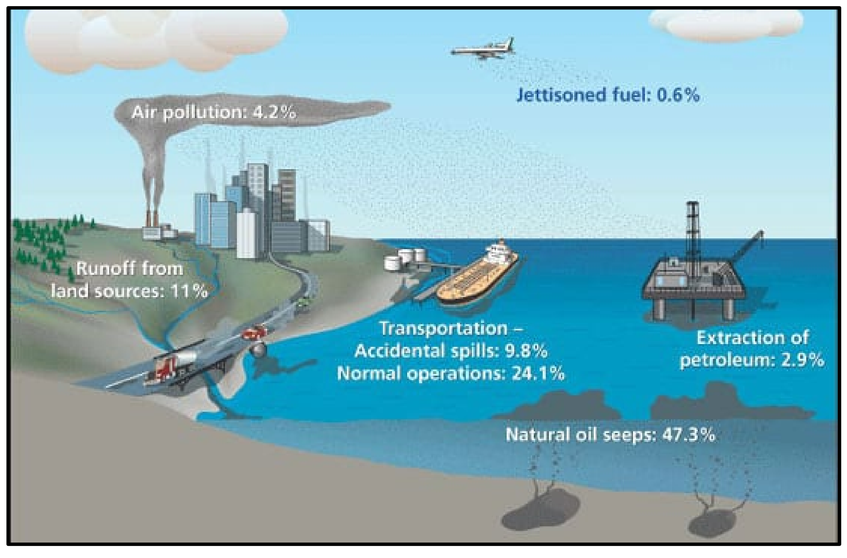

Figure 2. Visualization of different types of pollution created though the oil mining, transportation, and refinement processes (Farrington and McDowell, 2004)

GASOLINE

Drilling

- All types of exploration, drilling, and extraction activities are harmful to many aspects of the environments they occur in
- Impacts of oil-mining related activities include deforestation, chemical contamination of water, long-term harm to animal populations, human health, and displacement of indigenous communities
- This industry creates more waste than all other categories of municipal, agricultural, mining, and industrial wastes combined

Transport

- Because of the distance between where oil is mined and where oil is consumed, it must be transported great distances to refineries and consumer markets, requiring very complex transportation systems
- Due to the complexity of its transportation requirements, oil spills are quite regular, with smaller spills often going undocumented
- Oil pipelines are also a source of spills and leaks because they are highly prone to corrosion

Refining

- In order to be used, raw oil must be separated, converted, and refined before it can be used to power cars as gasoline
- Similar to mining, the areas where oil refineries exist are subject to air pollution, accidental chemical spills, thermal pollution, and hazardous waste

CONCLUSIONS

Resource extraction processes for both lithium and gasoline present significant environmental drawbacks. Some drawbacks such as habitat loss, biodiversity loss, and opportunities for toxic substance releases are shared between both types of resource extraction. As more scholarly research becomes available, the sustainability of resource extraction practices for both EVs and combustion engine vehicle fuels should continue to be compared.

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