Environmental Impacts and Social Implications of Onshoring the Lithium-ion Battery Supply Chain, an LCA approach

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ABSTRACT

The US recently has passed federal legislation promoting domestic production and deployment of decarbonized energy technologies and electrification, and lithium-ion batteries (LIB) are a key component in this effort. The Inflation Reduction Act (IRA), enacted in 2022, includes financial incentives for US companies to produce and deploy LIBs in utility-scale energy storage (BESS), thereby reducing China's significant market share within the different segments of the LIB supply chain. A cradle-to-gate life cycle assessment (LCA) was conducted to compare the environmental impacts associated with a fully US based supply chain versus the current supply chain for the lithium iron phosphate (LFP) LIB through China. We then assessed the US supply chain within a socio-economic context, to better understand the communities most likely to be affected by the opening and operation of LFP-related facilities. We assessed multiple scenarios for the US chain, changing locations of facilities across the supply chain. Results indicate the US chain both outperforms and underperforms the traditional route in nine each of the 18 LCA impact categories. Generally, the US chain outperforms in air-related impacts (e.g. particulate matter), whereas the China chain outperforms in more water-related impacts (e.g. freshwater ecotoxicity). For the US chain, impacts from manufacturing BESS components are dominated by freshwater ecotoxicity, global warming potential, terrestrial toxicity, particulate matter, and human health toxicity. Results show that about 50% of facilities across the US chain are in census block groups with environmental justice concerns, based on EPA EJScreen ratings, and 22% of facilities are located in IRA Energy Communities – specific areas eligible for a bonus tax credit. Census blocks with BESS facilities are more likely populated by White persons than the national average (~70% versus ~61%). In locations with cell component manufacturing facilities, Black populations are larger, on average, in the surrounding blocks than the national average (18.5% versus ~12%). In locations with extraction operations, indigenous populations are larger on average (~3% versus 1%).

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