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Environmental impact assessment of the lithium supply chain: from extraction to processing, using Life Cycle Assessment

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The European Union has banned the sale of thermal vehicles by 2035, which has increased the demand for electric vehicles and, consequently, the demand for critical battery materials such as lithium. In this context, lithium refining and Lithium-ion battery production in Europe are subjects of global interest and sovereignty concerns. In this context, there has been a rise in new integrated and non-integrated lithium projects worldwide. Several actors, including the European Union, are also interested in the environmental impact of battery components. EU has created several regulations to quantify the environmental impact of battery components. Chemical and process-based industries, such as those involving lithium, are liable for specific environmental legislation and sustainable practices. In lithium production, the process selected is related to the feedstock impurity profile and the required purity of the final product. As a result, environmental impacts vary depending on the feedstock type and the processes employed, which can be evaluated using Life Cycle Assessment (LCA) methodology. There is a general lack of studies on the environmental impact of lithium with clear and transparent Life Cycle Inventory (LCI) data. This is the case for lithium hydroxide production from hard rock and lithium carbonate conversion to lithium hydroxide. Lithium hydroxide monohydrate has increased demand in recent years due to its use in high-nickel-manganese-cobalt (NMC811) batteries, which are crucial for high-performance electric vehicles. While there are numerous studies on the environmental impact of lithium carbonate, there is a notable lack of research on the environmental impact of $LiOH{\cdot}H_2O$ used in NMC 811 batteries. Moreover, there are very few prospective LCAs for future lithium extraction and processing projects. This study evaluates the environmental impact of lithium hydroxide production. The latter has been compared with different lithium hydroxide production LCAs in the literature. Data from academic and technical documents have been used to collect inventory data. Brightway 2 (and Activity Browser) has been used to evaluate the environmental impact of lithium hydroxide. A sensitivity analysis has also been conducted to examine the potential prospective impacts.