LCA Using BW2 and PREMISE for Lithium Production's: Current and Future GHG Impact from Publicly Available Technical Reports

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Context and objectives

Importance and Demand of Lithium

- The European Union has banned the sale of thermal vehicles by 2035, leading to **increased demand** for electric vehicles[1].
- Lithium is classified as a **critical raw material** by the European Commission, raising concerns about lithium refining, battery production, and environmental impacts in Europe[2].
- Lack of studies with clear and transparent LCI data, and existing studies often relying on **confidential or outdated data**.

Objective

- Quantify the environmental impact of Li_2CO_3 and $LiOH{\cdot}H_2O$, in current and in the future.

Method

- Use only **publicly available data** to assess the GHG emissions of lithium from Atacama brine[3].
- Employ the modular open-source LCIA software **Brightway2**[4], along with the **Activity Browser**[5] and **PREMISE**[6], to model future environmental impacts as lithium demand increases.

Goal and scope / System Boundary

System studied

- Production of Li_2CO_3 and $LiOH{\cdot}H_2O$ from Atacama Brine in Chile

Scope Definition

- **Functional unit:** 1 tonne of final product (Li_2CO_3 and $LiOH{\cdot}H_2O$)
- **Foreground data**: Sociedad Química y Minera de Chile 2022 technical report
- **Background data**: Ecoinvent 3.9.1 [3]
- **Prospective scenario**: SSP2 IMAGE 2.6
- **Impact category studied:** Climate change
- **LCIA method:** EF3.1 (IPCC 2021)

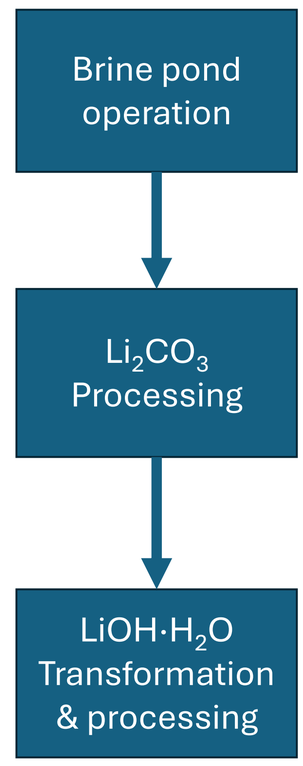

Figure 1: Basic Flowsheet of lithium production from Atacama Brine[3]

Inventory and Results

Li_2CO_3 →

Exchange Name	Amount	Unit
Heat Diesel	20050	MJ
Electricity, high voltage Cl	944.59	kWh
Ethanol	6	Kg
Heat Natural gas	20050	MJ
Kerosene	12	Kg
Quicklime	872	Kg
Sulfuric acid	41	Kg
Ultrapure Water	5224	Kg

$LiOH{\cdot}H_2O$ →

Exchange Name	Amount	Unit
Heat Diesel	5184.3	MJ
Electricity, high voltage Cl	456.76	kWh
Heat Natural gas	3400	MJ
Hydrochloric acid	160	Kg
Quicklime	36	Kg
Soda ash	2063	Kg
Ultrapure Water	11390	Kg

→ **EF3.1**

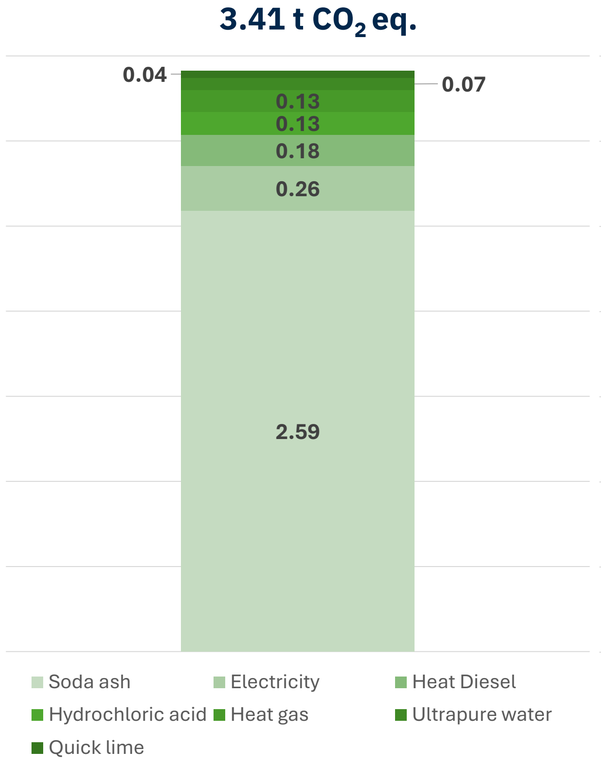

Figure 2: GHG emission of Li_2CO_3 Production

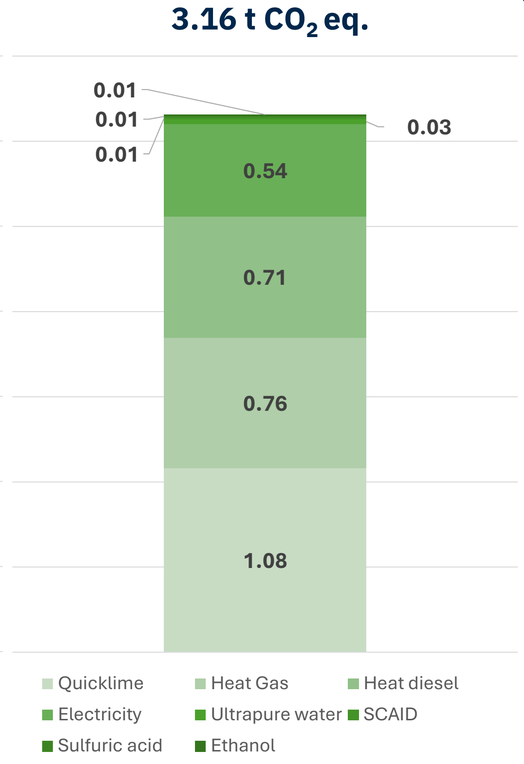

Figure 3: GHG emission of $LiOH{\cdot}H_2O$ Production

PREMISE Prospective LCA for 2050 and 2100

Static vs. Future Scenarios:

Static: Current scenario stands at 6.57 CO_2-eq, highlighting the substantial potential for emission reductions in future scenarios.

Long-term Impact:

Continuous decline in emissions, aligning with the expected shift towards renewable energy and process electrification.

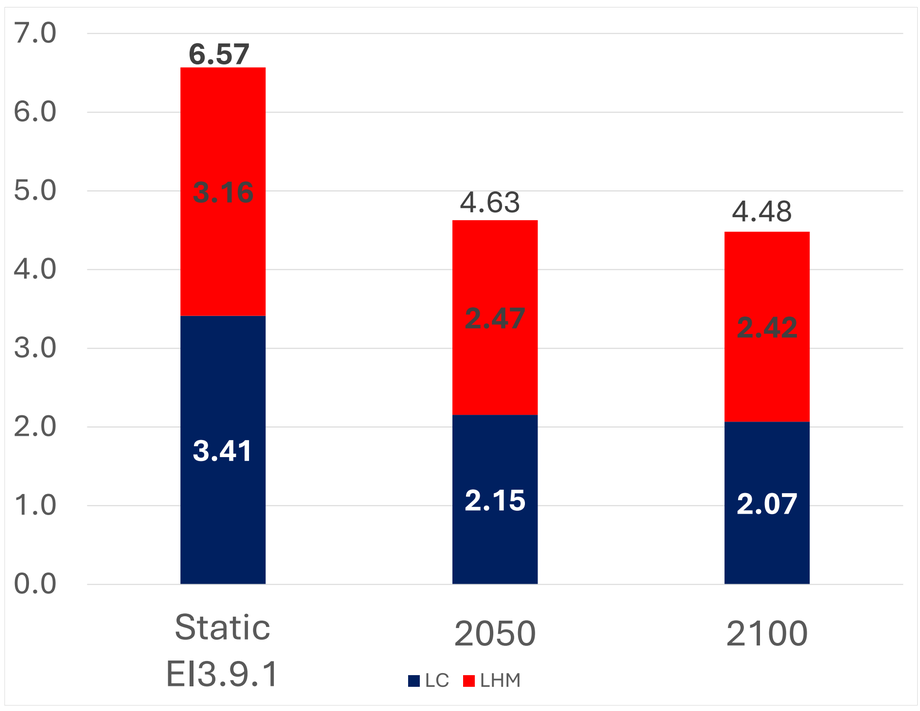

Figure 4: Prospective GHG emission of Li_2CO_3 and $LiOH{\cdot}H_2O$ production

Conclusion and recommendation

Conclusion:

Similar to previous studies[7], this research identifies soda ash and quicklime as the main contributors to GHG emissions in the production of Li_2CO_3 and $LiOH{\cdot}H_2O$.
Projections suggest a 30% reduction in emissions by 2050.

Recommendations:

Improve data detail: Provide more detailed LCI data to identify specific process improvements.
Electrify Processes: Focus on electrification of hydrometallurgical production to further reduce GHG emissions.
Update Regularly: Continuously update LCAs to reflect new data and technologies.

Reference:
1: European commission (2019), Regulation (EU) 2019/631 of the European Parliament and of the Council of 17 April 2019 setting CO2 emission performance standards for new passenger cars and for new light commercial vehicles, and repealing Regulations (EC) No 443/2009 and (EU) No 510/2011
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3: Sociedad Química y Minera de Chile (2022) TECHNICAL REPORT SUMMARY OPERATION REPORT SALAR DE ATACAMA WSP-SQM0011 URL: https://s25.q4cdn.com/757756353/files/doc_news/2022/4/25/96.1-Salar-de-Atacama-Technical-Report-Summary.pdf
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Questions ? Let's connect !