HELIOS

High-pErformance moduLar battery packs for sustainable urban electrOmobility Services

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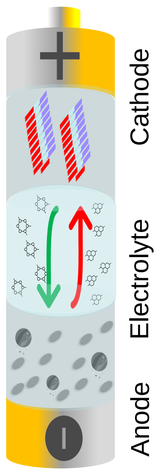
Introduction

The HELIOS project, co-funded by the EU's H2020 Programme, aims to create lighter and more efficient hybrid Li-ion battery packs for electric vehicles (EVs).

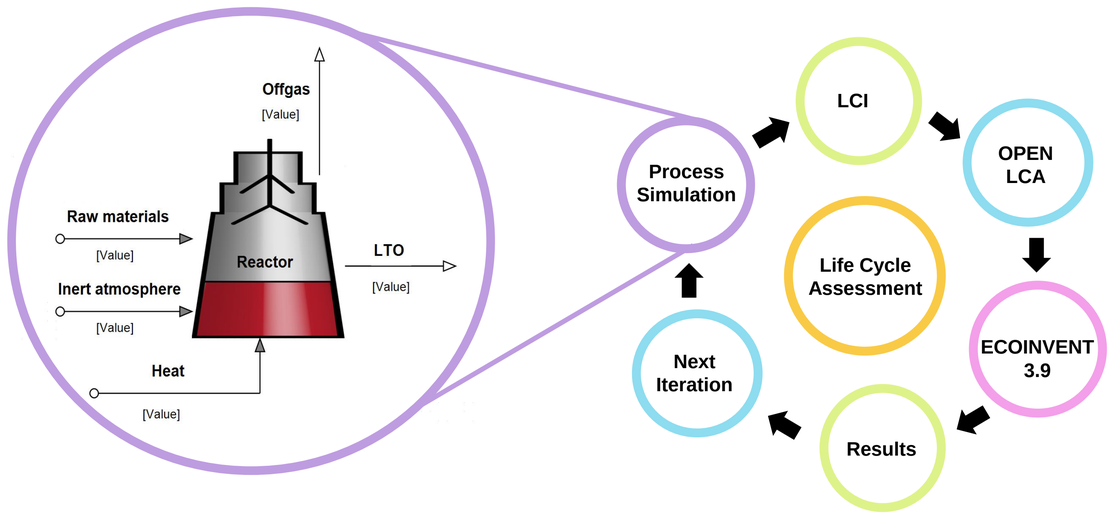
- Research is currently focusing on developing more efficient, sustainable, and eco-friendly battery chemistries, based on recent advancements in Li-ion battery materials technologies.



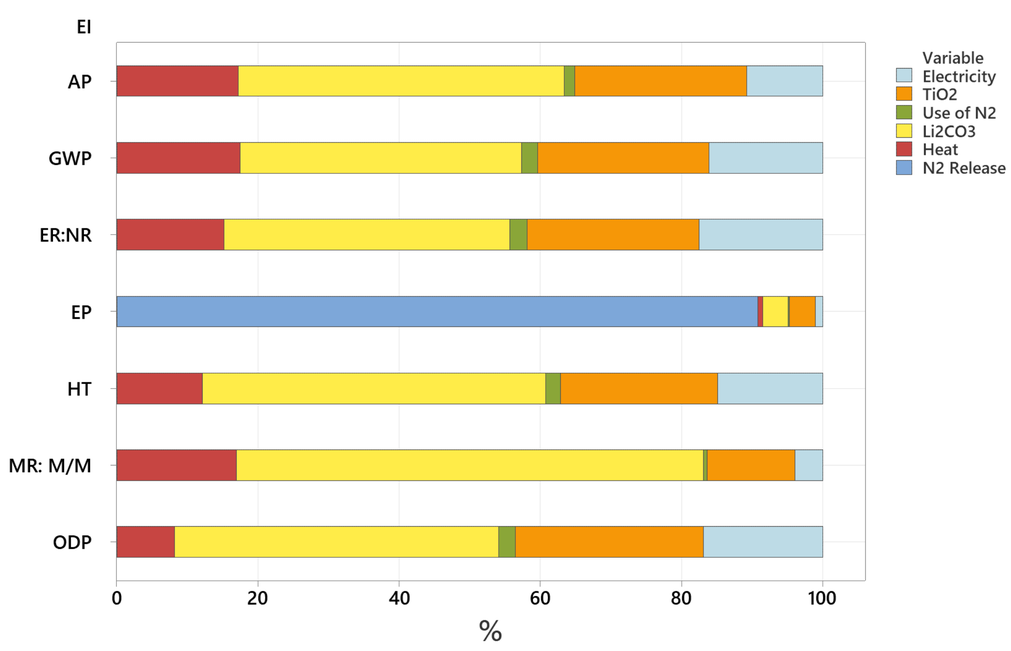
- Newer anode chemistries - like lithium titanate oxide (LTO) - have been under intensive research due to their enhanced stability, safety, and rapid charging characteristics. Nevertheless, there remains uncertainty about LTO's environmental impacts (EI) and how these compare with more typical used graphite-based anode materials.

Methods

- HSC-SIM module software was utilized to generate the life cycle inventory (LCI) of LTO.
- OpenLCA and Ecoivent 3.9 was the used to generate an LCA to compare the EI for the production of 1 kg of LTO vs. 1 kg of battery grade anode graphite.

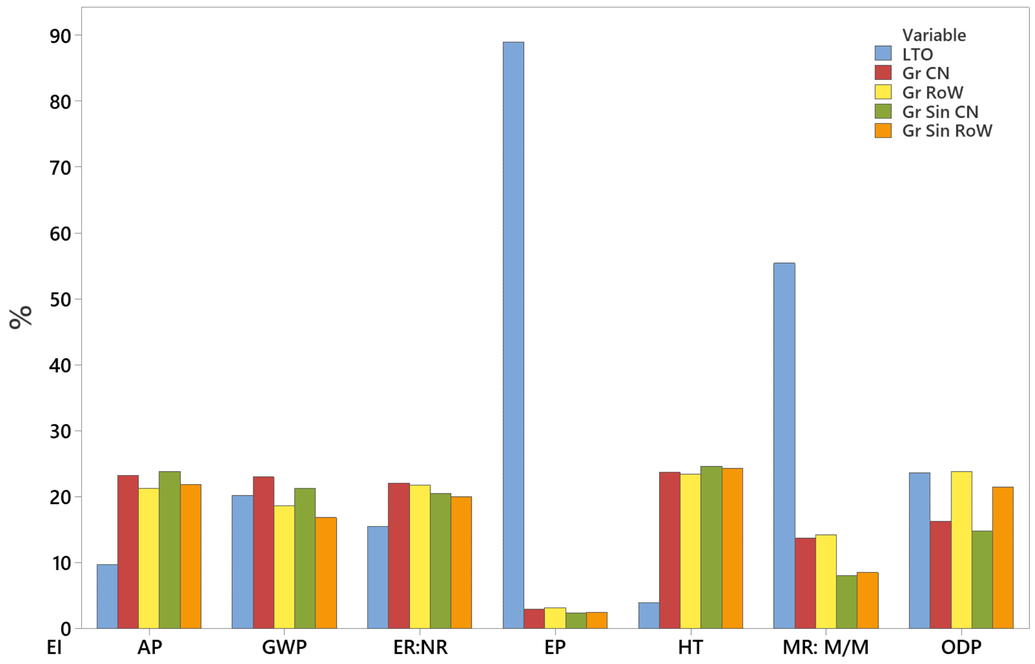


Results



AP = Acidification [kg SO_2-Eq], GWP= Climate Change [kg CO_2-Eq], ER:NR Energy resources = non-renewable [MJ], EP = Eutrophication [kg PO_4-Eq] HT = Human toxicity [kg 1,4-DCB-Eq], MR: M/M = Material resources: metals/minerals [kg Sb-Eq], ODP= Ozone depletion [kg CFC-11-Eq]

Fig. 1 Environmental Impacts of LTO manufacturing



LTO = Lithium titanate oxide anode, Gr:CN = Graphite (China), Gr RoW = Graphite (Rest of the World), Gr Sin CN= Synthetic graphite (China), Gr Sin RoW = Synthetic graphite (Rest of the World)

Fig. 2 Environmental Impacts of LTO Vs Graphite

Remarks and Conclusions

- **When compared to conventional graphite, LTO manufacturing results in a considerable contribution to eutrophication due to the associated levels of inert N_2 released.**
- **Further research is needed to determine new LTO production approaches that can mitigate the level of N_2 emissions.**
- **Additionally, LTO anode was linked to a material source: metals/minerals due to the use of Li_2CO_3 in the anode.**
- **Overall, this study indicates further research related to LCA of battery cell manufacture and more appropriate Functional Units—based on KWh rather than kg—are needed to provide a more detailed assessment of the environmental aspects related to battery manufacture.**

References

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