

THE

BATTERY

CHRONICLES



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Life Cycle Assessment: Decreasing Carbon Emissions, Increasing Collaboration

My name is Anna Doninger, and I am the Government Relations Manager at American Energy Technologies Company (AETC). At AETC, I have had the pleasure of working on a plethora of both domestic and foreign government-based projects, to include both European Horizon Consortia, STREAMS and SAFELoop. I have worked quite closely with STREAMS and SAFELoop partners at Enviva and Imperial College of London (ICL), who are responsible for the life cycle analyses and Techno-economical assessment research conducted throughout the project.

The work that is being done within consortia, specifically as it relates to life cycle analysis research, is vital to any future developments within the critical minerals processing and advanced battery industry. At AETC, we have developed an innovative lithium-ion battery recycling process which can safely and effectively disassemble and either downcycle, recycle or upcycle battery materials, irrespective of the lithium-ion battery chemistry which enters the recycling process. As we were going through and developing the most efficient way to disassemble the end-of-life batteries, we were consistently taking life cycle inventories, to be used as data feeds for the research being done by Enviva. Through the consistent inventories, we were able to identify specific processes or pieces of equipment or instrumentation which were not the most carbon-efficient, and added on to our overall emissions of the process. For example, one of the processes within the line utilizes a precision machine shop lathe. The lathe was originally equipped with a tungsten carbide tip, used for cutting open the stainless-steel battery casings.

However, after it was analyzed and identified as a large contributing source of carbon dioxide emissions (due to its processing and manufacturing), we made the decision to switch to a diamond tip tooling instead, decreasing our overall carbon emissions by a considerable factor. Also, a switch-over to diamond bids ended up being more cost efficient since they have a much longer life expectancy than the tungsten carbide tools.

The life cycle assessment work that we have done with our European partners had led to many carbon-efficient decisions which were implemented on a full scale level at AETC, and has helped to maximize on the discoveries made throughout the process of experimenting and establishing the novel recycling line at AETC. Inventories were collected and provided to our partners at Enviva based on three separate lithium-ion cathode chemistries, LFP, NMC, and NCA. Significant work was performed for the NCA and NMC cathode chemistries, and were the driving force for much of the research which occurred at AETC for the LCA and TEA. I am particularly proud of having become a co-author of a high profile publication in Resources, Conservation and Recycling which was a joint paper between Imperial College London, London, United Kingdom, Universidad de Santiago de Compostela, Santiago de Compostela, Spain and AETC of Wheeling, Illinois, USA as part of their participation in the EU Horizon STREAMS Project.

This research heralded unique opportunities for AETC, as it allows us the opportunity to span our research beyond the recycling line, to other processes we utilize in our carbon processing work. It was very exciting for us to have the opportunity to work with the STREAMS and SAFELoop LCA groups, not only so we can better benefit the European EV battery market through upgrading our direct recycling line, but also to discover the merits behind performing LCA-based research in general.

When it comes to life cycle analysis, it remains incredibly important to support the credibility of the value which the research adds to any one given process, especially in the industry of renewables. It is not a secret that traditional methods of battery production and assembly are not the most LCA and SE-LCA friendly, from the impact attributed from the mining required for battery assembly, to that of the carbon processing. As we continue to move forward and push the boundaries for what can be made to be more carbon efficient and what can be improved, the LCA and TEA research will remain a cornerstone in ensuring that any process will allow for an efficient way forward in any industry, whether it be battery-related, with a focus on renewables and green technology, or more so related to the SE-LCA impact of the advanced technology industry, ensuring that the impact on human life, culture, and economy decreases or becomes negligible.

We at AETC are looking forward to continuing our work with Enviva and ICL, through STREAMS and SAFELoop, so that we can continue to make a positive contribution to the industry both individually and as a consortium.



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