



ZERO EMISSION
TRANSPORTATION
ASSOCIATION

April 3, 2022

United States Department of Energy
Advanced Research Projects Agency-Energy
1000 Independence Avenue S.W.
Washington, D.C. 20585

RE: Docket No. DE-FOA-0003027
RFI on Achieving Circularity Of The Domestic Battery Supply Chain
Submitted Electronically to: ARPA-E-RFI@hq.doe.gov.

The Zero Emission Transportation Association (ZETA) is an industry-backed coalition of over 60 member companies advocating for 100% electric vehicle (EV) sales. Our membership spans the entire EV supply chain. Notably, our members include leading innovators in the battery manufacturing, battery recycling, and critical materials sectors committed to achieving battery sector circularity. ZETA also represents charging manufacturers and providers, utilities, and auto manufacturers, among others. ZETA is dedicated to ensuring that the United States wins the global clean transportation race and that American workers and consumers benefit as the EV industry expands.

Background

ZETA recognizes that battery supply chain circularity is a critical component of both national security and our clean transportation future. At present, transportation is the single largest emitter of greenhouse gasses (GHG) in the United States, accounting for 27% of overall emissions in 2020¹. The transition to a zero-emission transportation sector will drastically reduce emissions, improve air quality and public health, and directly create hundreds of thousands of jobs for Americans. As we work to onshore the upstream sectors of the electric vehicle supply chain, battery manufacturing, refurbishing, and recycling will be critical drivers of job growth and national security.

Benchmark Minerals Intelligence forecasts that scrap will account for 78% of the pool of recyclable materials in 2025. The value of the global market for EV battery recycling alone is estimated to reach \$8.6 billion in the next five years. This growth is largely driven by the growing number of EVs approaching their end-of-life (EOL). The volume of EOL batteries from EVs and large storage applications is less than 2GWh today but could reach 100 GWh by 2030

¹ <https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions>

and 1.3TWh by 2040². While recycling and second-life battery applications will not be enough on their own to get the United States to full critical mineral independence, they are a crucial component in reducing the Nation’s dependence on foreign countries for the critical minerals needed for widespread EV and clean energy deployment.

ZETA extends its gratitude to the Department of Energy (DOE) and the Advanced Research Project Agency—Energy (ARPA-E) for the opportunity to provide input on the advancement of strategies to achieve circularity in the U.S. battery industry. ZETA recognizes supply chain circularity as a central component of achieving transportation sector emissions reductions and securing our energy future. Our membership is committed to pushing the envelope on new, innovative battery technologies and has long been an active voice in support of federal battery recycling programs. ZETA applauds the Biden-Harris Administration for continuing to advance federal support for this industry and recommends ARPA-E resources be used to bolster the ReCell Center’s battery design for recycling.

Technology

ZETA encourages ARPA-E to advance projects that will unlock vehicle battery recycling at a large scale. The Department of Energy ReCell Center, in a collaboration between Argonne National Laboratory, Oak Ridge National Laboratory UC San Diego, National Renewable Energy Laboratory, Worcester Polytechnical Institute, Michigan Technical University, and the Vehicle Technologies Office, has demonstrated breakthroughs in materials separation technology. ZETA recommends ARPA-E enable the continued development of work through ReCell to address the current roadblocks to large-scale recycling.

This project was expanded at the Argonne National Lab Materials Engineering Research Facility and aimed to create battery cell designs that enable researchers to rejuvenate spent cells with minimal energy loss and extend battery life by relithiating cathodes.³ To do so, the ReCell center sought new designs to flush off solid electrolyte interphase (SEI) components and reduce cell polarization. Researchers sought to determine optimal rejuvenation conditions and extend cycle life in rejuvenated cells.⁴

The ReCell Center also addresses the issue of materials separation required to recycle cathodes of varying chemistries. By innovatively utilizing froth flotation technology, this technology, once scaled, could be used to separate “lithium cobalt oxide, lithium nickel manganese cobalt oxide, lithium nickel cobalt aluminum oxide, lithium iron phosphate”, and other chemical elements

² https://assets.bbhub.io/professional/sites/24/2022-COP27-ZEV-Transition_Factbook.pdf?utm_source=newsletter&utm_medium=email&utm_campaign=newsletter_axiosgenerate&stream=top

³ https://www.energy.gov/sites/default/files/2021-06/bat467_Li_2021_o_5-14_426pm_KF_TM.pdf

⁴ https://www.energy.gov/sites/default/files/2021-06/bat467_Li_2021_o_5-14_426pm_KF_TM.pdf

from cathodes to make recycling a variety of battery chemistries through the same process feasible.⁵

According to a progress report from ReCell, several challenges remain that would benefit from further research and testing through support from ARPA-E. Identified challenges include “leakage at the connection”, “low solubility of SEI in carbonate solvents,” and difficulty rinsing cells under high pressure.⁶ Researchers intend to continue exploring materials suitable for mitigating leakage and “investigate liquid flow in electrodes with various microstructure.” ZETA supports the use of ARPA-E to further bolster the ReCell Center.

Conclusion

ZETA strongly supports ARPA-E and other government initiatives to advance circularity of the battery supply chain. We encourage ARPA-E to support the DOE ReCell Center’s cutting edge exploration of battery circularity. Robust federal support will ensure a sufficient and guaranteed stream of recycled materials to justify continued private-sector investment in the battery recycling industry. Improved recycling processes will not only reduce dependence on other sources of critical minerals but will also prevent potentially hazardous materials from entering conventional waste streams. ZETA once again thanks DOE for the opportunity to comment.

Sincerely,



Albert Gore
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⁵ <https://onlinelibrary.wiley.com/doi/full/10.1002/ente.202100468>

⁶ https://www.energy.gov/sites/default/files/2021-06/bat467_Li_2021_o_5-14_426pm_KF_TM.pdf