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April 14, 2021

Kelly Speakes-Backman, Acting Assistant Secretary
Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy
1000 Independence Avenue SW
Washington, DC 20585

Re: Response Request for Information (RFI) number DE-FOA-0002502 regarding the Risks in the High-Capacity Batteries, including Electric Vehicle Batteries Supply Chain

Dear Acting Assistant Secretary Speakes-Backman,

Please find the Zero Emission Transportation Association's (ZETA) responses to the Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) and the Vehicle Technologies Office (VTO), DE-FOA-0002502: Request for Information on Risks in the High-Capacity Batteries, including Electric Vehicle Batteries Supply Chain.

ZETA is an industry-backed coalition advocating for the shared goal of 100% electric vehicle (EV) sales in the United States by 2030. Our diverse set of members represent a range of experiences across the EV sector and have a deep understanding of the EV battery supply chain. There is enormous potential in EV manufacturing and material supply development for the United States, and if harnessed appropriately, EV development will benefit the American consumer, our economy, the environment, and our public health. We thank the Biden-Harris Administration for boldly recommending substantial investments to cultivate an expanded advanced vehicle sector and for initiating a constructive – and at times challenging – conversation about the choices we face to realize the promise of this new frontier.

Background

While the U.S. manufactures the best EVs in the world, China has tightened its control over the critical materials needed to produce vehicle batteries, consumer electronics, and national security infrastructure. If North American critical materials are not properly secured and prioritized, we will continue to be at the mercy of foreign supply chains for our battery, energy, and security demands.

Current events like the Suez Canal blockage and ongoing computer chip shortages are a red flag signaling the necessity of investing in and controlling the critical materials that will dominate our economic demands in the coming decades. To fulfill the Biden-Harris Administration's net-zero climate and robust economic development goals, we must pursue policies and incentives that develop strong EV consumer adoption, domestic manufacturing, and advanced material supply chains.

In particular, steps must be taken to prioritize domestic projects by setting criteria for project review based on the Administration's net-zero emission goals. This is not to suggest that production occurs with undue haste or outside of strong environmental review but to highlight that timely consideration during the federal permitting process is key. The stakes are high, and these critical materials are not simply a global commodity that can be blindly sourced without consideration for labor, environmental, and other security necessities. In addition, the more progress we can make in securing the North American supply chain, the quicker we can align our values in both labor and conservation.

(i) Critical materials including battery grade nickel, cobalt and lithium, underlying the supply chain for high-capacity batteries, including electric vehicle batteries;

Our ability to create a strong domestic supply chain is a question of American competitiveness with China, which currently leads in electric vehicle manufacturing and adoption. China's Ministry of Science and Technology conceded that directly competing with traditional European and U.S. automakers was a lost cause and initiated the 863 Program, a decades-old applied research and development collaborative to unify suppliers, universities, independent laboratories, and manufacturers to secure "New Energy Vehicle" supremacy. This culminated in substantial investments in developing and scaling sources of critical materials (such as nickel, cobalt, lithium, graphite, and manganese) required for manufacturing high-capacity batteries. In 2015, China took further steps to secure its critical mineral dominance with the "Made in China 2025" (MIC 2025) policy vision, which is intended to drive China's market share in critical and high-value commodities.[1]

China's progress stands in stark contrast to the United States' limited current lithium production. Domestic lithium is sourced primarily from Albemarle Corporation's Silver Peak mine, which produces 5,000 metric tonnes of lithium carbonate equivalent (LCE) per year. This is enough to manufacture a mere 100,000 EVs annually. If EVs were to represent 100% of new car sales – 17 million annually, in line with ZETA's primary goal – current LCE production would only meet 0.05% of total domestic EV battery pack demand.

Other lithium deposits exist in North America but opening new development and processing facilities is a time-prohibitive process; the required five years far exceed current battery or cell production timelines. Though most lithium is currently sourced from Australia, Chile, Argentina, and China, almost all of the raw materials are converted to battery-grade metal in China. While China does not have a distinct geological advantage (its lithium reserves are ranked 6th in the world), it has prioritized public policy and investment to create a competitive global advantage in processing and refining.

The United States has a geographic advantage over China, and we can successfully scale existing processing and refining with strong public policy and investment. ZETA member companies produce many of the critical materials needed for the battery supply chain and are located throughout the country. Though each location has unique values and challenges, together they have the potential to make the U.S. a global leader in battery manufacturing. Examples of a

[1] "Is 'Made in China 2025' a Threat to Global Trade?" *Council on Foreign Relations*, https://www.cfr.org/backgrounder/made-china-2025-threat-global-trade. Accessed 13 Apr. 2021.

handful of North American companies equipped to bring the U.S. back into a position of leadership are outlined below.

Albemarle's lithium site in Silver Peak, Nevada has been in production since the 1960s. This site is the most productive lithium brine well field in the U.S. and produces lithium carbonate. Albemarle's domestic resources also include the historic 800-acre Kings Mountain, North Carolina lithium site, which is one of the richest spodumene ore deposits in the world and home to the company's global lithium technical center and piloting operations. Albemarle also operates lithium-containing brines in Arkansas.[2]

The Piedmont Lithium Project is located within the world-class Carolina Tin-Spodumene Belt (TSB) and trends along the Hallman Beam and Kings Mountain mines, which provided most of the western world's lithium from the 1950s through the 1980s. Located approximately 25 miles west of Charlotte, North Carolina, the TSB is one of the largest lithium regions in the world.

Livent Lithium has been a leader in lithium production and supply since the 1990s. Livent's largest manufacturing facility – which produces lithium hydroxide, butyllithium, and high purity lithium metal – is located in Bessemer City, North Carolina. Notably, their proprietary processing method results in 95% lithium purity.[3]

Lithium Americas Corporation's Thacker Pass Project is a pre-feasibility stage lithium project in Humboldt County, Nevada. The Project is situated at the southern end of the McDermitt Caldera, approximately 60 miles northwest of Winnemucca. In 2018, Lithium Americas completed a pre-feasibility study on a two-phase project with a production capacity designed to reach 60,000 tonnes of battery-grade lithium carbonate per annum and 46-year mine life.[4] In January 2021, a Record of Decision was granted by the Bureau of Land Management, which allows for the advancement to the construction stage. This is the first lithium asset permitted in the United States in over 50 years. Final feasibility engineering is progressing to support construction and will be complete this year.

Ioneer operates the Rhyolite Ridge Lithium-Boron Project. The Rhyolite Ridge is a large, shallow lithium-boron deposit located close to existing infrastructure in southern Nevada. The lithium and boron mineral resource is estimated at 146.5 million metric tonnes and includes an ore reserve of 60.0 million metric tonnes, which represents a 280% increase in reserves from the Pre-Feasibility Study. The company expects to process 63.8 million metric tonnes over the 26-year mine life at an average annual rate of 2.5 million metric tonnes per year.[5]

As was previously noted, both graphite and cobalt are facing reserve shortages. In fact, graphite is the largest input material by volume into lithium-ion batteries. High purity graphite powder is

[2] Albemarle Announces Expansion of Nevada Site to Increase Domestic Production of Lithium. Albemarle Corporation. https://investors.albemarle.com/news-releases/news-release-details/albemarle-announces-expansion-nevada-site-increase-domestic. Accessed 13 Apr. 2021.
[3] "Pursuing Advanced Lithium Technologies | Livent's History & Growth." Livent, https://livent.com/company-overview/history-of-livent/. Accessed 14 Apr. 2021.
[4] "Lithium Americas." *Lithium Americas*, /. Accessed 13 Apr. 2021.
[5] "Overview." *Ioneer Ltd (INR)*, 1 Feb. 2018, https://www.ioneer.com/rhyolite-ridge/overview.

used to make the anode of a lithium-ion battery and represents 10-15% of the cost of the battery cell. According to the USGS, approximately 1.1 million tons of graphite were produced in 2020, with 650,000 tons from China and zero tons from the United States. NOVONIX is an advanced battery materials and technology company with synthetic graphite manufacturing operations based in Chattanooga, Tennessee. They are set to support 10,000 tonnes of synthetic graphite anode production by 2023 and have plans to expand capacity to 40,000 tonnes by 2025 and 150,000 tonnes by 2030.

Cobalt is critical to the performance and stability of EV batteries and helps to mitigate thermal runaway, making it a difficult-to-replace component in the cathodes of these batteries. China also dominates the supply of refined cobalt products, controlling around 80% of global cobalt refining capacity. Jervois Mining USA Limited, a Nevada-registered corporation, is proposing to build what will be America's only primary cobalt production operation in the heart of the Idaho Cobalt Belt, which stretches 40 miles near the town of Salmon, Idaho. Jervois' production could represent 15-20 percent of U.S. annual consumption and will directly counter risks that China could use it predominate position in the cobalt supply chain to the detriment of the U.S.

While not given the same attention as a defined critical material, it is important to recognize the value of copper to EVs and EV infrastructure. The average EV battery pack uses 183 lbs. of copper, compared to internal combustion engines (48 lbs.) and hybrid EVs (88 lbs.). Additionally, copper is essential to charging stations; a charging port from 3.3 kW to 200 kW contains between two to 17 pounds of copper. As we seek to drive domestic supply chains, ZETA sees copper development as an important part of our security considerations.

Despite these opportunities, China's current control over a majority of critical minerals allows Beijing to set world prices. According to U.S. government research, China produced more than 60% of the world's graphite in 2019. Internationally, China has led not only in processing of raw materials for advanced batteries but also in constructing lithium battery plants. According to data released from Benchmark Mineral Intelligence, 101 of the 136 lithium-ion battery plants in the pipeline to 2029 are based in China.[6]

U.S. battery manufacturers have the ability to secure North American supply chains – especially lithium operations – at the scale needed to achieve a zero-emissions transportation sector. This can occur only if we take swift action to make up ground that has been lost in recent years. ZETA's membership reflects the range of operations along the supply chain, from extraction to recycling. With coordination, smart incentives, and appropriate policies, the U.S. can regain a competitive advantage in domestic battery manufacturing and electric vehicle production.

[6] "China Controls Sway of Electric Vehicle Power through Battery Chemicals, Cathode and Anode Production." *Benchmark Mineral Intelligence*, https://www.benchmarkminerals.com/membership/china-controls-sway-of-electric-vehicle-power-through-battery-chemicals-cathode-and-anode-production/. Accessed 13 Apr. 2021.

(ii) Manufacturing and other capabilities necessary to produce high-capacity batteries, including extraction of raw materials, refining, production of advanced cathode and anode powders, separators, electrolytes, current collectors and advanced recycling technologies for high-capacity batteries;

The U.S. can make substantial progress in terms of materials sourcing. However, the potential to reroute the processing supply chain, drive economic development, and lead with American sustainability and stewardship are all especially fertile opportunities. By developing and processing North American raw materials domestically, the U.S. can avoid compounding tariffs, lower transportation emissions, and protect U.S. companies against unnecessary disruptions.

Battery recycling is a promising American innovation that can help free us from reliance on China. Recycling technology is already delivering on a promise to reclaim 95% of critical materials in a commercially competitive way. ZETA member companies – including the American Battery Technology Company (ABTC), Redwood Materials and Li-Cycle – utilize cutting-edge recycling technologies to separate and process these minerals from used batteries and convert them to storage cells and new EV batteries. While over 69% of the world's lithium battery recycling occurs in China,[7] ABTC is currently permitting and building a lithium-ion battery recycling facility in Fernley, Nevada. This facility would quadruple the current annual U.S. LCE supply to 20,000 metric tonnes a year. By recovering critical materials and selling high-quality metals back into the battery market, ABTC and others in this sector are forging a path for sustainability and supply chain security.

Additionally, Enel is embarking on Second Life, a partnership with Nissan Leaf. This initiative disassembles batteries at the end-of-life and repurposes them for large stationary storage systems.[8] Rivian too is designing their batteries for both first-life vehicle application and a post-vehicle second life in energy storage. The Department of Energy (DOE) should engage in public-private partnerships to develop and deploy repurposed batteries, use sustainable materials in battery manufacturing (i.e. reclaimed/recycled rare earth metals), and standardize battery module design and build for easier disassembly, repair or recycling. These are key examples of successful public-private partnerships, and these companies have engaged with DOE to develop and scale their technology to drive results.

(iv) Risks or contingencies that may disrupt the high-capacity batteries supply chain (including defense, intelligence, cyber, homeland security, health, climate, environmental, natural, market, economic, geopolitical, human-rights or forced labor risks):

Significant risks exist that may disrupt the high-capacity battery supply chain in the near term. In particular, ZETA recognizes environmental, economic, and geopolitical risks to be of utmost concern to the supply chain as the EV sector is primed for exponential growth over the next decade.

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[7] How China Is Cornering the Lithium-Ion Cell Recycling Market. https://www.greentechmedia.com/articles/read/how-china-is-cornering-the-lithium-ion-cell-recycling-market. Accessed 13 Apr. 2021.

[8] Melilla Second Life, Recycled Batteries forStorage.https://www.enel.com/media/explore/search-news/news/2019/01/batteries-second-life-melilla. Accessed 13 Apr. 2021.

For example, class 1 nickel and cobalt are both facing reserve shortages.[9] As the global demand for metal resources begins to expand beyond existing uses for consumer electronics and national security architecture, our deficiencies in upstream domestic supply become more apparent.[10]

According to the U.S. Geological Survey (USGS), the United States has more lithium reserves than China. Though the U.S. lithium reserves are ranked fourth globally, the development of domestic resources has not yet been realized. As the market continues to shift toward rapid EV adoption, the U.S. government must do more to provide certainty and drive investment for domestic production of raw materials to counteract the potential geopolitical and national security risks tied to foreign dependence on these critical minerals.[11]

While the Coronavirus pandemic laid bare the insecurity in the global supply chain in many sectors, there was a significant impact on the supply of lithium-ion batteries given the Asian market dominance in the sector. This experience has showcased the pressing need for a strong domestic supply chain in the event of unexpected and far-reaching supply disruptions.

(a) Risks resulting from lack of or failure to develop domestic manufacturing capabilities, including emerging capabilities;

Reliance on foreign sources for critical minerals makes the U.S. more vulnerable and concedes economic trade leverage to competitors and adversaries. This creates disruption risks from foreign suppliers in the event of a trade war and leads to economic vulnerabilities that could be avoided. In addition, U.S. reliance on foreign supply chains enables unchecked and unenforced labor and environmental practices that counter our own values – particularly for cobalt.

For example, each year some in Congress offer amendments that falsely present transportation electrification as a choice between supporting business-as-usual ICE vehicles or encouraging unethical mining practices in the Global South. However, EVs can be produced ethically and responsibly while creating American jobs. By fostering more robust domestic supply chains, we can employ thousands and promote economic security while breaking down the artificial choices opponents continue to present. If we cultivate a strong domestic development and manufacturing base, coupled with robust battery recycling infrastructure, we can solve these problems and put ourselves on a path to economic security."

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[9] "The U.S. Is Worried about Shortages of Critical Minerals for Electric Vehicles, Military Tech." PBS NewsHour, 13 Apr. 2021, https://www.pbs.org/newshour/nation/the-u-s-is-worried-about-shortages-of-critical-minerals-for-electric-vehicles-military-tech.

[10] Massif Capital. Risks and Opportunities in the Battery Supply Chain. May, 2019. https://cdn2.hubspot.net/hubfs/4518141/Risks%20and%20Opportunities%20in%20the%20Battery%20Supply%20Chain.pdf.

[11] United States Geological Survey (USGS). Lithium Data Sheet- Mineral Commodity Summaries 2020. https://pubs.usgs.gov/periodicals/mcs2020/mcs2020-lithium.pdf

(v) The resilience and capacity of the high-capacity battery supply chain to support national and economic security and emergency preparedness, including: (f) Need for research and development capacity to sustain leadership in the development of goods and materials critical or essential to high-capacity battery manufacturing;

China leads in EV supply chains because of its early and strategic government investments. Unlike others, China recognized the potential of “New Energy Vehicles" quickly and invested extensively in research and domestic supply chain development via the 863 Program and the MIC 2025 plan.[12] In total, China has invested over $60B to support their EV industry. Through MIC 2025, EV manufacturing and related supply chains benefited from substantial government support – including nationwide EV subsidies with domestic content provisions, joint government ventures with Chinese automakers and most critically, government and economy-wide efforts to domesticize the supply chain.[13] As a result of these investments, China boasts 47% of the world’s EV drivers and operates the majority of the 500,000 electric buses in circulation.[14] Furthermore, China now holds the world’s dominant up-stream battery supply chain – specifically, its leadership in critical mineral production and processing.

A similar story of government investment explains the dominance of other global EV leaders. Germany, Norway, and Japan have all invested heavily in their battery manufacturing supply chains. Recognizing this opportunity to build out our domestic battery supply chain, ZETA recommends establishing a DOE Office of Transportation Electrification. Modeled after the SunShot Initiative, an Office of Transportation Electrification would be charged with reducing barriers and costs along the entire transportation electrification value chain.

In 2011, the Department of Energy launched the SunShot Initiative to reduce the total costs of solar energy by 75 percent by 2020, the benchmark by which solar would become cost competitive with other energy sources. In 2017, the solar industry achieved SunShot’s original 2020 cost target of $0.06 per kilowatt-hour (kWh) for utility-scale photovoltaic (PV) solar power three years ahead of schedule, dropping from about $0.28 to $0.06 per kilowatt-hour.[15] In the 2020 IEA World Energy Outlook report, solar was celebrated as the cheapest electricity in history. This would not have been achieved if it were not for the SunShot Initiative and similar government investments worldwide.

The SunShot Initiative’s aim at solving a challenge related to solar energy is instructive in helping us navigate the EV landscape. Today, public investment and cross-department collaboration is needed to break down the barriers and costs inhibiting domestic production advancements. Through the establishment of a DOE Office of Transportation Electrification, the U.S. government could invest in each phase of the domestic battery value chain. With the help of

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[12] Black, Erin. “Why China Is so Far Ahead of the U.S. in Electric Vehicle Production.” *CNBC*, 24 Mar. 2021, https://www.cnbc.com/2021/03/24/why-china-is-so-far-ahead-of-the-us-when-it-comes-to-ev-production-.html.
[13] “How China Beat the US in Electric Vehicles.” *Issues in Science and Technology*, 10 Feb. 2021, https://issues.org/china-us-electric-vehicles-batteries/.
[14] “Global EV Outlook 2020 – Analysis.” *IEA*, https://www.iea.org/reports/global-ev-outlook-2020. Accessed 13 Apr. 2021.
[15] “SunShot 2030.” *Energy.Gov*, https://www.energy.gov/eere/solar/sunshot-2030. Accessed 13 Apr. 2021.

this office, the U.S. can establish a supply chain defined by ethical labor and environmental standards that will drive U.S. adoption and global leadership in EV production.

(vii) Policy recommendations or suggested executive, legislative, regulatory changes, or actions to ensure a resilient supply chain for high-capacity batteries

ZETA has developed a policy platform to recommend executive and legislative actions that will benefit the U.S. consumer, battery supply chain, and economy as a whole.

We recommend that DOE continue investing in and de-risking development, processing, and recycling capabilities. Congress and the Administration should enhance federal investment in research, development, and deployment of related technologies by coordinating and aligning federal science and technology research efforts at the Department of Commerce, Department of Defense, Environmental Protection Agency, Department of the Interior, Department of Transportation, and ARPA-E within DOE. In addition, support for congressional efforts to provide investment tax credits for the entire battery supply chain – from extraction to recycling – is a crucial step to commercializing these key breakthroughs at scale.

This investment includes the establishment of an Office of Transportation Electrification within the DOE modeled after the Sunshot Initiative. This office would coordinate between technical offices within EERE and develop competitive grant programs to continue investment in innovation in the battery development space.

ZETA also fully supports legislative efforts by Senators Stabenow, Manchin, and Daines to revive the 48C tax incentive to drive domestic manufacturing. In addition, ZETA recommends creating a refundable advanced battery manufacturing tax credit that would provide a 30% Investment Tax Credit (ITC) for each step of the battery supply chain, including mineral processing, cathode and anode production, cell and pack manufacturing, and battery recycling. ZETA also urges Congress to create an EV Manufacturing Credit Facility to deploy federal support to help manufacturers achieve sufficient scale, effectively compete, and further de-risk projects. This credit facility should include loan guarantees, forgivable loans, and low-interest financing to transportation electrification supply chains.

ZETA also recommends expanding the Advanced Technology Vehicle Manufacturing (ATVM) program to support MHDEVs, off-road and other nontraditional vehicle electrification, and domestic expansion of the end-to-end advanced battery supply chain. Including materials supply support within ATVM is especially important to help drive scale for the domestic battery supply chain and to lower the cost of cells.

Several of ZETA's members in the battery reuse and recycling industry have proposed policies that would increase logistical and processing capacity. To increase the production and supply of recycled batteries, Congress should introduce tax incentives to propel the use of circular and sustainable materials like reclaimed nickel, cobalt, and graphite. To streamline this process, Congress should standardize and incentivize disassembly, repair, and recycling. To that end, ZETA also recommends additional financial support for facilities and programs that produce repurposed or recycled batteries.

(viii) Any additional comments relevant to the assessment of the high-capacity batteries manufacturing and advanced packing supply chains required by E.O. 14017.

Policies implemented for E.O. 14017 should consider the entire EV supply chain and the decarbonization goals necessary to avoid the worst impacts of runaway greenhouse gas emissions. In other words, ZETA believes that the imperative to outcompete foreign commercial interests extends beyond the critical materials themselves. We only need to look back to 2007 for a lesson in what will happen to the American automotive industry if more competitive and fuel-efficient foreign imports dominate the automotive landscape.

While EVs have lower lifecycle emissions than their Internal Combustion Engine (ICE) counterparts, EVs will only grow cleaner with a renewable energy-based power grid and more sustainable domestic materials sourcing and production. It is important to recognize that a supply-side approach to reclaiming materials and automotive leadership takes time. It is critical for us to advance our manufacturing capabilities and drive EV adoption in concert.

While we must move quickly, we should sequence domestic content and manufacturing requirements to avoid overly stringent conditions that slow down our goal of achieving 100% sales of EVs by 2030. To avoid this outcome, ZETA recommends ramping up content requirements over time. This will give manufacturers and suppliers enough time to adjust their processes and to explore development and production partnerships with countries like Canada, that import U.S. products and hold geological advantages.

ZETA is confident that our recommendations will position the U.S. to lead the global EV market. However, the U.S. will only succeed with a dedicated effort to bolster domestic critical mineral development and processing. North American companies are primed for progress, and we must harness our potential advantages over other global competitors. By working together, we can build a robust domestic supply chain by enacting strong policies that support manufacturers and help realize our full domestic potential. We thank you for your consideration.

Sincerely,

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