

Agency Priority Goal Action Plan

Launch Critical Materials Recycling Prize

Goal Leader:

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Theme(s): National Resources and Environment

Overview

Goal Statement

- The DOE will pursue a focused research program to reduce supply chain risks posed by the limited availability of critical minerals and materials. This program will pursue 1) improvements in domestic production, 2) reuse and recycling, and 3) research into substitutes for critical minerals.
 - By the end of Q2 FY 2019, launch a Critical Materials Recycling Prize to spur innovative solutions to solve current challenges associated with collecting, storing, and transporting discarded lithium ion batteries for eventual recycling.
 - By the end of Q4 FY 2019, complete “Phase I: Concept Incubation” and select winners from Phase I who will compete in Phase II: Prototyping and Partnering.

Challenge

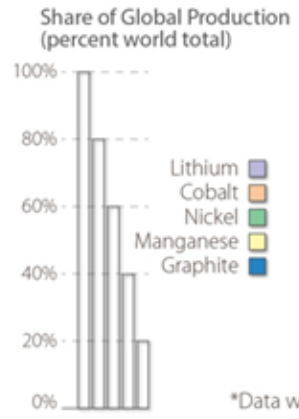
- There is growing demand for lithium ion batteries used in a variety of applications, including consumer electronics, defense, energy storage, and transportation. Lithium ion batteries contain a substantial amount of critical materials (e.g. – cobalt, lithium) that are both expensive and dependent on foreign sources for production. The President’s December 2017 Executive Order 13817 “A Federal Strategy To Ensure Secure and Reliable Supplies of Critical Minerals” directed Federal Agencies, including DOE, to take steps to “ensure secure and reliable supplies of critical minerals” by “increasing activity at all levels of the supply chain, including exploration, mining, concentration, separation, alloying, recycling, and reprocessing.”

Opportunity

- The Critical Materials Recycling Prize is designed to:
 - Leverage the power of competition to develop and demonstrate a process that, when scaled, has the potential to profitably capture the critical materials in at least 90% of all lithium based battery technologies in the United States for recycling;
 - Develop technologies and processes to potentially provide one third of our cathode material needs for lithium ion batteries by 2032 via recycled materials; and
 - Attract private, public, state, and local dollar investments to scale collection, storage, and transportation of discarded lithium ion batteries.

Lithium Ion Battery Raw Critical Materials – Current Production

In 2017, 32 countries accounted for all global production of Li, Co, Ni, Mn and Graphite, with 50% of production of each element originating in one or two countries.

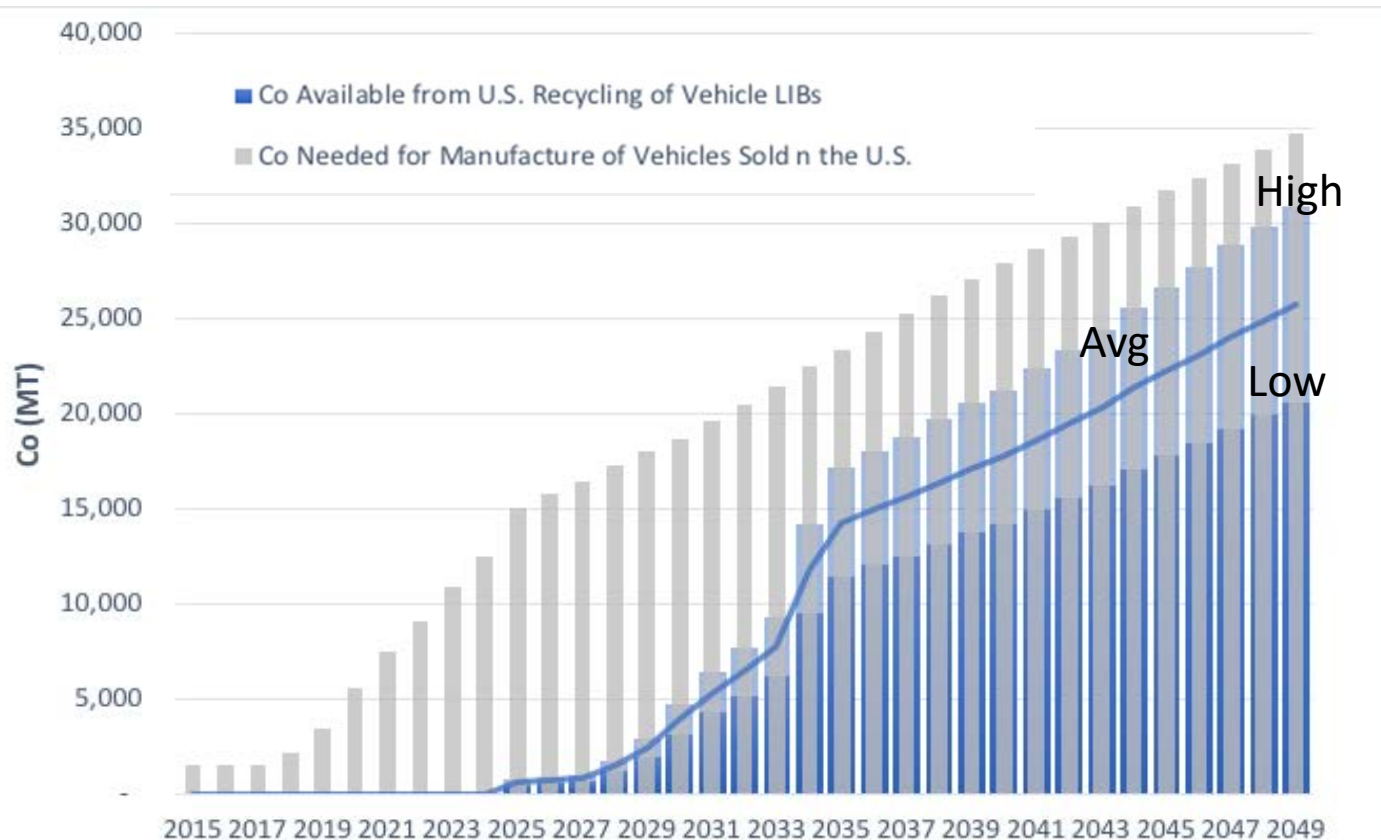


In 2017, 32 countries accounted for all global production of key NMC materials

- **43,000 tons lithium:** 44% Australia 34% Chile, Argentina 13%
- **1.2 million tons natural graphite :** 67% China, 13% India, Brazil 8%
- **2.1 million tons nickel:** 11% Philippines, 10% Canada, 9% Russia, 9% Australia
- **16 million tons manganese:** 33% South Africa, 16% China, 14% Australia
- **110,000 tons cobalt:** 59% Democratic Republic of Congo, 5% Russia, 5% Australia

Lithium Ion Battery Recycling Supply Chain Model Development

Amount of battery raw materials that could be derived from recycling of lithium ion batteries
U.S. Sources Only



Spent batteries from vehicles sold in the U.S. could supply U.S.-based recycling operations. The amount of material recovered depends on:

- Battery chemistry at the time the batteries were manufactured
- The number of batteries manufactured
- Battery collection efficiency
- Recovery of material from recycling processes

Goal Structure & Strategies

The Goal is structured around the successful launch and execution of the Prize. To meet this goal, DOE will:

- Work with the National Renewable Energy Laboratory (NREL) to establish prize evaluation criteria and the phase I solicitation for concept papers.
 - The rapid iteration prize structure includes a series of down-selecting phases.
 - Only U.S. citizens and/or domestic entities will be eligible to participate.
- Secretary Perry announced the Prize on January 17, 2019 at the Bipartisan Policy Center's American Energy Innovation Council
- Assistant Secretary Simmons launched the Lithium Ion Battery Recycling Prize at an event at Argonne National Laboratory on February 15, 2019.
- By the end of Q4 FY 2019, complete "Phase I: Concept Incubation" and select winners from Phase I who will compete in "Phase II: Prototyping and Partnering."

Summary of Progress – Final

- Worked with the National Renewable Energy Laboratory (NREL) in Q1 of FY 2019 to establish prize evaluation criteria and the phase I solicitation for concept papers.
- Secretary Perry announced the Prize on January 17, 2019 at the Bipartisan Policy Center's American Energy Innovation Council.
- Assistant Secretary Simmons launched the Lithium Ion Battery Recycling Prize at an event at Argonne National Laboratory on February 15, 2019.
- On April 10th, DOE and NREL hosted an informational webinar for the prize that had 150 attendees.
- DOE helped organize a lithium ion battery recycling workshop in coordination with the National Alliance for Advanced Transportation Batteries, held 7/9-7/10 in Buffalo, NY.
- DOE hosted government outreach meetings with the Environmental Protection Agency, the Department of Transportation, and the Defense Logistics Agency to coordinate interagency efforts.
- DOE selected 15 phase I winners of the Lithium-ion Battery Recycling Prize. Winners were announced by Assistant Secretary Daniel R Simmons at an announcement event on September 25, 2019 at the NREL in Golden, Colorado. Each phase I winner will receive \$67,000 and an opportunity to compete in phase II and phase III.

Statement of Goal Achievement and Next Steps

Goal Statement:

- The DOE will pursue a focused research program to reduce supply chain risks posed by the limited availability of critical minerals and materials. This program will pursue 1) improvements in domestic production, 2) reuse and recycling, and 3) research into substitutes for critical minerals.
 - By the end of Q2 FY 2019, launch a Critical Materials Recycling Prize to spur innovative solutions to solve current challenges associated with collecting, storing, and transporting discarded lithium ion batteries for eventual recycling. **Met**
 - By the end of Q4 FY 2019, complete “Phase I: Concept Incubation” and select winners from Phase I who will compete in Phase II: Prototyping and Partnering. **Met**

APG Status: **Achieved**

Next Steps:

- Does DOE have an FY 2020-2021 APG in this topic area? **No**
- If no, does DOE have an annual performance measure in this topic area? DOE has numerous GPRA goals related to critical minerals though none are specific to battery recycling.

Key Milestones

A successful launch comprises announcing the Prize by a senior DOE official, issuing the Prize rules, and collecting initial concept papers for review in February 2019.

Milestone Summary			
Key Milestone	Milestone Due Date	Milestone Status	Comments
Identify National Lab Support for the Critical Materials Recycling Prize	Q4, FY2018	Complete	NREL was selected to administer the prize based on their experience in executing previous Prize Competitions.
Development of Prize Evaluation Criteria and selection process.	Q1, FY2019	Complete	Evaluation criteria for the Prize were developed. Selection process was developed by EERE's Vehicle Technologies Office and Advanced Manufacturing Office.
Announce and Launch Prize Completion	Q2, FY2019	Complete	Assistant Secretary Simmons launched the Lithium Ion Battery Recycling Prize at an event at Argonne National Laboratory on February 15, 2019.
Start to collect initial concept papers for evaluation	Q3, FY2019	Complete	The competition is was open for Concept Paper submissions through August 1, 2019. 51 concept submissions were received.
Complete "Phase I: Concept Incubation" and select awardees to enter "Phase II: Prototyping and Partnering"	Q4, FY 2019	Complete	15 contestants, totaling \$1M, were selected to compete in Phase II.

Data Accuracy and Reliability

- The requirements, baseline objectives, and evaluation criteria were published in the Federal Register and will serve as the basis for DOE to evaluate and select contest concepts.
- The winners will be selected based on published evaluation criteria, which were made public when the Prize rules were issued in February 2019.

Additional Information

Contributing Programs

Organizations:

- U.S. Department of Energy, Energy Efficiency and Renewable Energy, Vehicle Technologies Office (VTO) and the Advanced Manufacturing Office (AMO)

Program Activities:

- Funding and programmatic oversight and direction

Regulations:

- Resource Conservation and Recovery Act (RCRA), 40 CFR Parts 260–273
- Hazardous Materials Regulation (US DOT), 49 CFR 173.185
- UN Transportation Testing of Lithium-Ion Batteries, UN 38.3

Stakeholder / Congressional Consultations

Fall 2018 – EERE initiated discussions with the Consumer Technology Association (CTA) on the national need to address critical materials recycling. Once the Secretary approved the Prize, EERE and CTA agreed to collaborate once the Prize is launched.

December 11, 2018 – EERE, NREL, and ANL staff toured the lead acid recycling facility of East Penn Manufacturing in Lyons PA; also discussed recycling infrastructure.