



Critical Materials Institute
AN ENERGY INNOVATION HUB

CALL FOR OPEN INNOVATION PROJECTS

June 2020

Modification 0001

Key Dates for Open Innovation Call	
Call Release Date	June 5, 2020
Webinar	June 11, 2020
Concept Papers Due	July 1, 2020
Concept Paper Decision	July 20, 2020
Invited Full Proposals Due	August 21, 2020
Funding Notification	September 30, 2020
Anticipated Start Date	January 1, 2021

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1. Introduction and Goals

The [Critical Materials Institute \(CMI\)](#) is a Department of Energy (DOE) Innovation Hub with a mission to advance research and development (R&D) targeting materials and processes that provide better assurance to U.S. industry reliant on critical materials. CMI is funded and managed by the Office of Energy Efficiency's Advanced Manufacturing Office.

The intent of this Call for Proposals is to seek out new opportunities to accelerate the transformational advances in science and engineering necessary to reduce material criticality for energy innovation, with specific emphasis on industrial relevance, participation, and adoption. These topics are focused on challenges that currently limit the establishment of domestic supply chains for critical materials. Innovation generated from projects selected in response to this Call for Proposals will be leveraged to improve and/or transform current practices and solve industry-relevant challenges. Industrial institutions are invited to propose new ideas, ~~working with current CMI Affiliates and/or Team Members~~, with the intent to allow for the evolution of the [CMI research and development portfolio](#) to address scientific and technical challenges of industry relevance.

It is intended that work funded by this Call will be applied research. Applied research is defined as systematic study to gain knowledge or understanding necessary to determine the means by which a recognized and specific need may be met. It is expected the applied research will address scientific and technical challenges necessary to transition innovation. This call will not directly fund demonstration and pilot projects; however, we encourage such activities as part of a cost share contribution to the total project scope.

2. CMI Mission and Strategy

The mission of the Critical Materials Institute is to accelerate the development of technological options that assure supply chains of materials essential to energy technologies – enabling innovation in U.S. manufacturing and enhancing energy security. Over its 7-year history, CMI has focused on those materials important for electric generation, electric mobility and electricity storage. Referring to Table 1, the current R&D focus is technology areas related to rare earth elements used for vehicle electrification and offshore wind energy generation; Li, Co and graphite for electricity storage; and gallium, indium, and tellurium for solar energy and electronics. Additional target elements of importance to technology areas include Mn, V and Platinum Group Metals (PGMs).

Table 1: Critical elements important to clean energy technologies currently included in the scope of R&D activities of the Critical Materials Institute. (* graphite)

	REEs	Li	Co	C*	Ga	In	Te	Mn	V	PGM
Vehicles	X	X	X	X				X	X	X
Electrical Storage		X	X	X				X	X	
Energy Generation Solar Wind	X				X	X	X			
Targets								Potential Targets		

For each critical element, the [CMI R&D portfolio](#) addresses the needs of the supply chain through application of three strategies: Diversifying Supply, Developing Substitutes or Driving Reuse and Recycling. A fourth focus area develops crosscutting tools, scientific or economic, that assist the other focus areas in accelerating technical innovations and assessing economic and environmental impacts. These strategies are directly aligned with DOE critical materials priorities and *A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals*.¹

3. Topics of Interest

CMI is interested in receiving concept papers in the following topic areas. These topics are oriented to specific supply chain problems where there continues to be scientific and technical challenges where innovative solutions to these challenges would enable establishment of domestic supply chains for critical materials. Proposed projects should introduce innovative solutions that advance and/or transform current practices and address industry-relevant challenges. One such industry-relevant challenge is permitting. CMI is interested in R&D solutions to this challenge through improving the environmental footprint of processes. Examples of such R&D solutions include, but are not limited to, dewatering, process intensification, and reducing wastes.

Unlocking unconventional sources

CMI is looking to fund extractive and recovery projects that develop novel processes that address recovery of critical materials from dilute or unconventional sources with a goal of obtaining full extractive value from the process stream.

Unconventional resources for critical elements are those in which the element is present in a source stream but where it is not currently feasible to extract and recover the element due to either technical or commercial challenges. Examples of unconventional resources include silicate minerals containing rare earths and geothermal brines containing lithium. Other possible sources for critical materials are wastes generated during conventional primary mineral processing, such as tailings and metallurgical residues, recycling scrap streams generated during manufacturing, and end-of-life products. Specific examples of process wastes identified as possible sources of critical materials include byproducts from fertilizer production, wastewaters from oil and gas production (containing Li), and wastes from production of major metals such as aluminum, copper and zinc (containing Co, Ga, Ge, In, Te, etc.).

End-of-life products include those discarded by households as well as businesses, such as e-wastes, spent industrial catalysts, and dead batteries. In addition to the previously mentioned critical metals that are a focus for CMI, these end-of-life products may contain metals such as platinum group metals, V and Mn. They also often contain metals (e.g., Au, Ag, Cu, Ni) that are not designated as critical by CMI, but whose co-production can improve the economics of CMI critical material recovery. CMI is not considering proposals on extraction of critical materials from coal or coal by-products.

¹ A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Materials. U.S. Department of Commerce. June 2019. Available online at: https://www.commerce.gov/sites/default/files/2020-01/Critical_Minerals_Strategy_Final.pdf.

Highly selective separation processes from industrial and end-of-life waste streams

Innovative methods for mechanical or chemical processing are sought to provide selective recovery of critical materials for both mineral processing separations and processing of industrial and end-of-life waste streams.

End-of-life products are a complex mixture of materials. The value of recovered materials is enhanced when materials are processed in ways that allow for separation of high value products. For example, the economics of Li-ion battery recycling are greatly improved when recovery of the individual components (anode, cathode and electrolyte) can be realized.

Similar challenges exist for devices and motors containing permanent magnets.

CMI is seeking projects that address the challenges of separating components from electric motors and other devices containing permanent magnets and from spent Li-ion batteries.

Conversion of critical minerals into high value end products

CMI is looking for novel, energy efficient and environmentally-benign downstream processes to convert raw and recycled materials into end-of-life products (metal or specialty chemicals) for cost-effective (re-)insertion into the materials supply chain.

Often raw and recycled materials need processing before being used in components or finished products. These materials are typically processed in successive stages of (1) mineral or end-of life product processing, (2) critical material separation, (3) chemical/metal production, and (4) end-use alloy manufacturing. Progress is being made to improve all of these stages of production; however, chemical/metal production is lagging and is often viewed as separate from earlier and latter stages.

For example, large-scale conversion of rare earth oxides and other intermediates to metals is absent from North America, representing a significant strategic weakness for both civilian and defense applications. This process step is carried out almost exclusively in China for the majority of critical minerals, even for ores mined in the U.S., presenting a persistent gap in the U.S. supply-chain. Conventional processes for converting RE oxides into metal can be hazardous for the environment and workers, and difficult to establish wherever there are stringent regulatory requirements. *CMI is seeking innovative solutions for conversion of RE oxides into pure metals, compounds or alloys for direct use in metallurgical processing for permanent magnets or other RE-containing alloys.*

Another example is developing Li processing chemistry for the direct production of LiOH as the final product. Current processing chemistry often results in the preparation of lithium carbonate with subsequent processing required to convert to LiOH. *CMI is looking for projects where developments in chemical processing reduce process steps and energy density necessary to attain the desired end product.*

4. Topics not of Interest

CMI scope of R&D efforts are focused on science and technology development for mineral processing beginning at the beneficiation stage processing and does not involve earlier stages of

critical mineral activity including the geosciences of critical materials, mineral explorations or mining operations. Proposals on these topics will be considered out of scope. CMI is also not soliciting topics on developing substitutes for permanent magnets; PGM replacement in catalysts, and substitutes for Li-ion battery materials (anodes, cathodes and electrolytes). Furthermore, CMI is not considering proposals on extraction of critical materials from coal or coal by-products. Concept papers on these topics will be considered non-responsive.

5. Coordination with CMI and other DOE activities

DOE has broad interest in this funding area. This funding announcement has been specifically coordinated with the Advanced Manufacturing Office (AMO) in DOE's Office of Energy Efficiency and Renewable Energy (EERE). There are extensive opportunities for synergistic exchange of information among the sponsored projects for a greater leverage of knowledge emerging from fundamental research and from research and development at higher technology readiness levels. CMI's current portfolio of R&D projects can be found [here](#).

The responses to this call should take into consideration possible leverage with the programs supported by other offices. Projects funded by this call are encouraged to explore opportunities to coordinate with projects funded by DOE Program Offices, including the Office of Science Basic Energy Sciences program, Advanced Research Project Agency (ARPA-E) and Office of Fossil Energy, and DOE funded programs, including the REMADE Institute and ReCell Center, in order to maximize the scientific and technological impact.

6. Eligibility for Open Innovation Project Proposals

- a. CMI is asking for proposing teams to consist of a minimum of two organizations. The team must contain one member of industry. ~~and at least one of the organizations must be a current CMI [Team Member](#) or [Affiliate](#).~~ Industry-led proposals are preferred but not required.
 - Lead Investigator must be an employee of the lead institution.
 - Lead Institution must be a domestic institution.
 - All institutions participating in a proposal, including subcontracted institutions, selected for funding must be eligible and willing to become a full CMI Team Member and accept the terms and conditions of the CMI Master Non-Disclosure Agreement and Intellectual Property Management Plan upon award.
- b. Lead institutions are limited to one submission.
- c. All submissions require a minimum 50% cost share. Cost share is 50% of total project cost (Federal funds + cost share). Cost share must be in-kind and must be from a non-federal source. Each project team is free to determine how best to allocate the cost share requirement among the team members. The amount contributed by individual project team members may vary if the cost share requirement for the project as a whole is met.
- d. Period of Performance: CMI anticipates making awards up to 12 months in length with the possibility of an additional 12 months of funding. The expected start date for projects is January 1, 2021.

7. Financial Support, Allowable Costs, Required Cost Share and Budget

Anticipated Funding Amount: The CMI expects to make available approximately \$4M over the next two years. All projects selected are subject to DOE approval and subject to availability of funds from DOE through the CMI award.

Estimated Number of Awards: 4 to 6

The number of awards will be dependent upon the degree to which proposals meet the solicitation goals and merit review criteria. Initial awards will be made for up to one year, and the proposed budget (exclusive of cost share) may vary between \$300K and \$500K (max) per year.

Allowable Costs

- a. All expenditures must be allowable, allocable, and reasonable in accordance with the applicable federal cost principles. Refer to the following applicable federal cost principles for more information:
 - [Federal Acquisition Regulation \(FAR\) Part 31](#) for For-Profit institutions; and
 - [2 CFR Part 200 Subpart E](#) - Cost Principles for all other non-federal institutions.
- b. Capital equipment requests are unallowable and will not be considered.
- c. Cost share must come from non-federal sources. Applicants are encouraged to refer to [2 CFR 200.306](#) and [2 CFR 910.130](#) for additional allowable cost share information.

8. Proposal Guidelines

Concept Papers are required.

- a. Concept paper submissions are due no later than 5 p.m. CDT on July 1, 2020, and should be emailed to cmioip@ameslab.gov.
- b. Notification of proposal encouragement is planned for July 20, 2020.
- c. Concept papers – No more than 2 pages in length; one-inch margins and Times New Roman font size 12. Concept papers should indicate the Lead institution, participating institutions, and the names of the Lead Principal Investigator (PI) and the Co-PIs.
- d. A concept paper template can be found [here](#).

Full Proposals

- a. Full proposals will only be accepted from encouraged Concept papers.
- b. Proposal submission are due no later than 5 p.m. CDT on August 21, 2020, and should be emailed to cmioip@ameslab.gov.
- c. Guidelines for proposal preparation can be found [here](#). Technical narrative for the proposals are limited to 5 pages. Appendices ([Budget](#), [Budget Justification](#), PIs/CoPIs [Biographical](#)

[Sketches](#), [Current and Pending Support](#), and [Facilities/Equipment](#)) do not count against the 5-page limit. Proposal should use the following format: 1-inch margins and Times New Roman font size 12.

- d. Award selection and notification is anticipated by September 30, 2020.

9. Proposal Review Criteria

Proposals should address and will be reviewed using the following criteria:

- a. Novelty – Is the idea fundamentally different and unproven compared with current technologies? (10%)
- b. Scientific and Technical Merit – Does the proposal address topics of interest and support the research directions and priorities of the Department of Energy and the Critical Materials Institute? What will the impact be on the supply chain if the proposed work is successful? (40%)
- c. Relevant and Impactful – How is the idea relevant to CMI’s material palette and, if successful, does it mitigate risks to energy supply chains? (30%)
- d. Does the team have the resources (including cost share commitment) and expertise to carry out the work? (10%)
- e. Does the project execution take advantage of the Hub concept by favoring collaborations over stand-alone projects? (10%)

Please direct questions regarding the CMI call to OIPquestions@ameslab.gov. For more information on the CMI, please see our website at <https://www.ameslab.gov/cmi>.