CONSORTIUM FOR
BATTERY
INNOVATION

CBI Proposal Preparation Guidelines

THE CONSORTIUM FOR BATTERY INNOVATION

The Consortium for Battery Innovation is the only global pre-competitive research organization funding innovation in lead batteries for energy storage and automotive applications.

Our work

+ **Research**

  Improving lead battery performance through pre-competitive research

+ **Marketing**

  Improving recognition of lead battery benefits in utility and renewable energy storage applications

+ **Testing / Standards**

  Ensuring lead battery merits are recognised in key global tests and standards

+ **Communication**

  Positioning lead batteries as a future, innovative technology

Our membership comprises the whole value chain associated with lead batteries, with over 130 members globally.

Contents

CBI RFP

1. Statement of Work – Energy Storage Systems

The needs of the world´s energy storage systems (ESS) are diverse. With ambitious climate targets being implemented across the globe, from regional commitments such as Europe´s climate-neutral aims by 2050 and the US pledge to reduce emissions by 50% by 2030, to smaller-scale installations in communities and homes to combine solar with storage, batteries are one of the big facilitators of this global shift to clean energy.

Battery energy storage systems (BESS) are an important solution for distribution/deferral for utility services and for residential/industrial services. The capabilities of batteries for these immature markets are great, and there is both ample opportunity and consistent strong growth in both markets. According to Avicenne Energy (CBI Market Report 2023), the ESS market is forecasted to grow globally from 237 GWh in 2022 to 616 GWh in 2030. As a result, there will be a significant increase in demand for batteries, a demand that will be so large it cannot be met by one battery technology alone. This means a range of battery technologies will be required in the future and this provides significant opportunities for growth of the lead battery market, as a potential technology that can meet all the technical requirements and on a mass market scale.

The industry must move toward a longer lasting and more energy dense lead batteries for utility, commercial, residential, and industrial ESS applications. Both EU and US performance targets are aggressive and require batteries with long lifetimes, high total energy throughput and low acquisition cost to meet the technoeconomic needs. Based on the current needs of lead batteries for such applications, the work proposal consists of two possibilities and one of the work proposals will be funded.

Work Proposal

Possibility 1 - Technoeconomic Documents and Demonstrations of Lead Battery ESS

The aim of this project is to initiate industry collaboration to provide technoeconomic documents and demonstrations of lead battery ESS. The problems and concerns in how lead battery systems are currently discussed need to be identified and the project team together with CBI shall stimulate greater awareness from a technical perspective.

The desired work will feature the following items:

Produce technoeconomic analysis (TEA) with a showcase on the true costs and benefits for different lead battery technologies, including

a. Tracking and developing levelized-cost-of-storage (LCOS) from known, offered examples. For instance, battery wiring, racking and enclosure should be focused. Ideally, LCOS calculations would cover the main technologies for ESS (12V AGM, 2V AGM or Gel, Bipolar).
b. Generating new representative examples.

c. Incorporating several factors into costing such as
   - Capital cost (e.g. DC storage block, power equipment and system integration)
   - Operation and maintenance (e.g. insurance, heating and ventilation)
   - End-of-life recycling and replacement
   - Performance metrics (e.g. round trip efficiency, cycle life, calendar life, $/kWh per cycle life vs. depth-of-discharge and cradle-to-cradle analysis)
   - Sensitivity (differences in the same battery type/model)
d. Emphasizing benefit package for lead batteries such as
   - CO_2 calculations (comparison to other battery technologies like lithium iron phosphate)
   - Performance in the first cycles (Li-ion batteries is known to degrade in initial cycles)
e. Any electrical tests such as cycle life test should include boundary conditions (e.g. temperature, depth-of-discharge, C-rates, etc.) for a clear test definition to align and compare the results of different parties.

Please keep in mind the above guidelines are the bare minimum, and additional input is encouraged.

Possibility 2 – Linkage between Failure of Lead Batteries in ESS and Mechanical Strength of Lead Battery Electrodes

The aim of this project is using material science approach to reveal if failure of lead batteries in ESS can be directly linked to the loss of mechanical strength of the battery electrodes. Currently, there is no collection of data providing basic information on lead battery electrode materials and mechanical properties.

The desired work will feature the following items:

The approach is to conduct a fundamental materials science benchmarking study to quantify failure in ESS.

a. Baseline study of lead battery electrodes from representative of ESS products such as
   - Young´s modulus of grids and formed electrodes
   - Hardness testing of electrodes (Mohrs, Rockwell and Brinell)
   - Direct shear test for cohesion
   - Relating fatigue to “aging” from electrical testing
b. Performing similar measurements for aged samples under different test sequences. Here, it is possible to produce a network of samples from batteries out in the field or in labs to facilitate “quick” measurements.
c. Analyzing microstructure of lead battery electrodes (e.g. scanning electron microscopy) and correlate them with mechanical properties.
d. Produce a model for degradation, mapping experimental results to machine learning and predictive failure modeling.

It is essential to characterize lead battery electrodes/grids in detail to find out whether battery lifetime can be predicted to a much higher degree. Establishing a structural-functional properties is a key for this project. The focus should be to produce baseline knowledge that could be applied to each lead battery electrode and to know the properties of the battery right out of manufacturing. It is strongly recommended to have a collaboration with research institute/university having expertise on conducting basic tests for measuring mechanical properties. Please keep in mind the above guidelines are the bare minimum, and additional input is encouraged.

2. General Guidelines

Advice for writing a proposal for CBI

1. CBI funds pre-competitive research for lead batteries. Precompetitive is underlined, because that is the mainstay of the organization and proposals that feature material that is obviously competitive (i.e. the body of work only benefits your organization) are unlikely to be funded.
2. Write your proposal with the idea that the person reviewing may not be an expert in a specific technique, methodology, or subject. Ultimately the proposals are reviewed first by a panel of experts and then by technical representatives of the CBI membership. This is your audience, write to them! Many are fully aware of the science and engineering involved for lead batteries but might not know much of your expertise.
    a. You must convey what the state-of-the-art is for your proposal. If you are suggesting a new method/material, in your introduction there should be a firm and referenced recount from literature providing precedent and reason to your work.
3. Construct your proposal to sell what you would like to do in the first 2 pages, the rest of the proposal is for detail.
4. Preliminary experiments are a huge plus.
    a. If you are looking to use a technique that has never been used for lead batteries, initial experiments will help demonstrate that your work is possible.
        i. **Precedent builds trust.**
    b. Refer to your experience and accomplishments in similar projects (this should be accentuated in the CV and background experience section).
5. Refer to the CBI innovation roadmap and use the key performance indicators as a guide to how your work can provide insight or a solution to a problem.
6. Gather a team, there are many leading institutions and companies in lead battery research. You may not know everything about lead battery science, and a team conveys that the proposal will be handled thoroughly and via a multi-disciplinary approach.

3. Proposal process

Please submit all proposals to matt.raiford@batteryinnovation.org.

In general, the proposals are due six weeks after issuing of a request. Following receipt of your proposal, a panel of experts will review the documents and ask for additional clarification. After this period, the proposals will be circulated and reviewed by CBI membership.

4. Review Process

The review process includes an expert panel that will consider your proposal based on each of their individual expertise as a lead battery scientist and grasp of lead battery research. Following their suggestions, the proposals for future review by CBI members.

The rankings will be discussed, and then principal investigators will be contacted with the status of their proposal.

5. Proposal Document

Generic rules for proposals

1. The proposal must be understandable, please proof-read for clarity and legibility. There are professional reviewers (e.g. American Journal Experts) that are a cost-effective way (~$400) to get valuable improvements overall, especially for the proposal summary.
2. Please use either Arial, Calibri, or Times New Roman, 12 font, single spaced, single columned.
3. Please include page numbers.
4. Literature references should be at the end of the proposal, started on a new page.

5. One-page summary

These sections should be included on a one-page summary of the proposal.

1. Title – do not make this a paragraph. The title should describe the approach and subject, not the objectives.
2. Principal investigator and contact info
    a. Example:

        Matthew Raiford, matt.raiford@batteryinnovation.org
        Consortium for Battery Innovation, 2530 Meridian Parkway

Suite 115, Durham, NC 27713

3. Proposal summary
    a. The summary should convey the innovation and goal for your proposal. In terms of the innovation be direct in what your proposal aims to do to improve lead battery performance.
    b. Include objectives for your proposal as a bulleted list within the summary. Save technical detail for the proposal.

4. Keywords
    a. What applications (if any) are you focusing on? Automotive batteries? Industrial?
    b. What performance indicators from the roadmap will be improved?
    c. Techniques used
5. Duration and financial info
    a. Please list:
        i. Duration of project
        ii. Cost for CBI and any cost share that you will provide.

6. Body of work

For the rest of the proposal include technical detail about your innovation. If you use terms or acronyms specific to the discipline or techniques utilized, please define them. Make sure to caption, number, and describe figures, graphics, and any tables.

7. Introduction

1. The introduction should provide a technical background for the area of lead battery science that is the focus of your proposal (i.e. negative active material additives, *in situ* studies, materials science of the phases, etc.) This section should be supported by research in journal articles, conferences, patents, etc. Make sure to summarize what the state-of-the-art is for the subject, what is currently being done.
2. Cover the background of any specific technique or method that you are bringing into the work. Not from the basis of how the technique works, but why the technique may be useful and any similar precedence in the literature.
3. **PRELIMINARY EXPERIMENTS**
    a. In the case of utilizing a new method or technique to lead battery science, **conducting preliminary experiments is a major advantage to the proposal.** These would be proof-of-concept type of experiments that describe validity and probability of success for your innovation.

b. This is not restricted to more fundamental science-based work. For instance, if exploring a new type of lead battery electrode, initial electrical testing in test cells or electrochemical evaluation could be preliminary experiments.

8. Technical discussion of work

Ultimately, the innovative aspects and technical details of your proposal should be organized effectively.

1. Describe your thought process, why you think your proposal could help the performance of lead batteries.
2. Please include graphics and figures that describe important steps of your work plan.
3. A work plan **must** be included showing a timeline for deliverables and major milestones in the program.
    a. For instance, a Gantt chart can be effective (just an example).

9. Duration, budget, cost share

1. Duration
    a. Please choose an appropriate duration for the work and describe in the work plan why the project will take so long.
2. Budget
    a. Please outline all of the costs of the project in detail.
        i. Labor, materials, instrument time, **travel**, outside testing (if applicable), overhead, etc.
3. Cost share
    a. CBI is a non-profit organization that funds pre-competitive research for lead battery science and any cost share is a major plus.
    b. This can be calculated by describing labor or facilities that will be utilized that won't be a cost to CBI.
        i. In the case of university-based proposal teams, time from assisting faculty and staff, instrument use that is "in-house", etc.
    c. Note: if your team pays for more than 50% of the project, the IP will stay within your organization.

10. Literature referencing guidelines

Please use the same format for the references, American Chemical Society, Elsevier, and other formats are acceptable. Please include the DOI or link for your resources.

11. Experience

In this section you would describe the experience of every person involved in the project, their company or institution and include a curriculum vitae and/or resumé for each contributor. Also, for industrial partners or co-leaders, please add contact information.

Try to specify how the team experience and expertise will strengthen the probability of success for the proposal.

12. Supporting Information

If the introductory or technical work sections feature lengthy data sets, please include a representative piece of data in the proposal and include the rest of the data in a supporting information section.

Contact:

For further information please contact CBI Senior Technical Manager Dr Matt Raiford: matt.raiford@batteryinnovation.org

Contact us

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