



UNITED STATES ADVANCED BATTERY CONSORTIUM LLC

**ADVANCED ANODE PRELITHIATION DEVELOPMENT FOR
ELECTRIC VEHICLE CELL TECHNOLOGY**

REQUEST FOR PROPOSAL INFORMATION (RFPI)

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ADVANCED ANODE PRELITHIATION DEVELOPMENT FOR ELECTRIC VEHICLE CELL TECHNOLOGY

REQUEST FOR PROPOSAL INFORMATION (RFPI)

1.0 Statement of Purpose/Objectives

The United States Advanced Battery Consortium (USABC), a subsidiary of USCAR, is a collaborative organization of FCA US LLC, Ford Motor Company and General Motors. USABC has carried out a number of battery development programs focusing on low-cost, long-life, high-energy, and high-power technologies. With this request the USABC intends to focus on the development of innovative materials, manufacturing processes, and associated cell designs, with the intent of achieving USABC cost objectives and performance goals.

The purpose of this RFPI is to identify developers having electrochemical energy storage technologies capable of meeting (or approaching) the USABC EV targets, as listed in the attached Appendix A. The USABC expects that this work will be partially funded by the US Department of Energy through a cooperative agreement awarded to the USABC. The intended R&D approach of this subcontract is to develop advanced anode prelithiation processes and then, if preliminary cell level data and integration experience warrant further work, to build and test full cells that meet or surpass the technical requirements in Appendix A. USABC is not seeking proposals for any particular chemistry or technology, but rather seeks achievement of USABC cost goals, and significant progress toward the complete set of end-of-life goals listed in the Appendix. Although project goals can be set that approach but not meet all of the USABC EV goals, a credible plan toward achieving all the USABC EV goals must be provided.

The Primary objective of this RFPI is to advance development efforts in the anode prelithiation processes for electrochemical energy storage systems, and particularly cells, in order to achieve the EV cost and performance goals set forth by the USABC. This objective is to be demonstrated by the calculated difference between the current State-of-the-Art and the proposed solution, as achieved through the respective materials changes, process costs, and capital savings. The secondary objective is to achieve the Cell-Level technical goals for the Energy Storage System, as provided by the USABC. Focus will be on the development of anode prelithiation methods, processes, and cell designs, aimed specifically at achieving the USABC EV cost and technical goals. The proposed work should complement cell development work to existing approved development programs. The primary performance target shall be to demonstrate a convincing level of improvement towards the USABC EV energy density and cycle life goals, and preferably a path to surpassing the USABC cell cost goal. A degradation of cell performance against the figures of merit, but with cost improvement, is not considered a desirable outcome, and will not be strongly considered by the USABC.

The USABC encourages the formation of multi-functional teams in order to achieve the proposed objectives. The Team shall include a cell manufacturer, with the capability to incorporate the proposed new prelithiation processes/designs, as well as materials and process developers. While it will be preferred that the cell manufacturer lead the program, it is not essential. The cell manufacturer must be able to deliver a minimum cell size of 10Ah. Deliverables to the USABC

will typically involve two or more separate builds of up to 30 cells each. If the cell developer is not the program lead, they must be an active participant in the cell design and development activities, and not a contractor or toll manufacturer. The Program Team Lead shall be responsible for the demonstration of the end deliverable cost assessment.

The developer shall demonstrate an ability to prelithiate to at least 15% anode areal capacity, provided in mAh/cm², to offset the cell Irreversible First Cycle Loss (IRCL), or that necessary so that the cell design can meet the USABC EV goals. The developer will also provide a demonstration of improvement in cell design performance against the USABC EV goals by using the prelithiation process; for example, in cell energy density, cycle life, calendar life, or other parameters.

2.0 Business Objectives

This USABC RFPI represents an opportunity for developers to leverage their resources in combination with those of the automotive industry and the federal government. For the auto makers, this type of pre-competitive cooperation minimizes duplication of effort and risk of failure, and maximizes the benefits of the government funds to the public.

Beyond the efficient and timely usage of resources, the auto makers recognize that successful commercialization of these technologies will only be completed when the supply base has been established for the selected components and subsystems. It is, therefore, a major business objective of USABC to enhance the supply base as the development progresses.

All developers submitting proposals will be required to demonstrate that they have the potential to develop a commercially viable business, which can produce sufficient volumes to meet automotive requirements, and provide engineering and testing support to meet automotive implementation requirements. Research organizations with affiliations with businesses that derive a majority of their income from related product sales will also be considered. At the time of submittal, all developers will be required to have demonstration hardware and test results available for USABC inspection. Testing performed in accordance with the USABC battery test procedures is preferred. Inspection and test of hardware by the USABC may be included in the selection process. Developers who do not have hardware and test results available for inspection by USABC at the time of submittal need not respond. Proposals should be meaningfully different from other proposals previously offered to USABC.

3.0 Developmental Timing

The proposals must be accompanied by a development time chart characterizing the following:

1. Length of time the technology has been under development by the developer
2. Length of time remaining to full scale, automotive cell prototype hardware availability
3. Time line for commercialization, including any preproduction phases that may be planned
4. Project Plan timing chart

4.0 Business Case

The submittal must be accompanied by a business case, divided into two sections. The first section shall state the cost assumptions used that will lead to the cost target listed in Appendix A. These assumptions should be in general terms, broken down by major components, including material cost, processing cost and other costs. These costs should be presented in sufficient detail such that they can be used by the USABC to build confidence that its cost targets can be met by the technology.

The second portion of the business case is to address the anticipated capital investment required to support this initial program investment, including anticipated non-automotive markets for the technology, sources of capital, etc. A copy of the USABC cost model spreadsheet is available on the USABC website:

http://www.uscar.org/guest/article_view.php?articles_id=143.

USABC will not provide funding for capital expenses.

5.0 Technical Challenges

Proposals must be accompanied by a clear description of the remaining technical challenges that the developer still needs to meet to commercialize the proposed technology and meet USABC's target criteria. The proposal will include processing issues, performance issues, and assembly and cost related issues such as commercial availability of materials required, and any special handling or assembly requirements. A narration of the technical challenges that have already been met to reach the present state of the demonstration hardware will also be useful. If a cell or system has already been constructed and tested at an early level of development, be sure to describe how the articles performed relative to expectations and how the results guide the work in this proposal. Any testing by USABC of pre-contract demonstration hardware will be done in accordance with the USABC battery test procedures. The procedures for all battery applications are published at: http://www.uscar.org/guest/article_view.php?articles_id=86

6.0 Information Requested

The information USABC is requesting from interested parties is specified in the following subsections. It includes: (1) a brief description of your company(s) background; (2) the advanced battery technology and/or process being proposed; (3) the development plan for the technology/process; (4) the proposed program deliverables, timing, and cost-share; (5) any formal or informal teaming arrangements planned; and (6) acknowledgement of export control compliance. This information should be submitted following the proposal template guideline shown in Appendix C.

All information shared between the Developers and USABC shall be non-proprietary.

USABC does not expect to award contracts on the sole basis of responses to this RFPI. All responses will be considered by representatives of the USABC and other participants and will be ranked in order of merit. The submitters of the most promising proposals will be contacted by USABC to enter into negotiations that may lead to firm contractual arrangements. If the

government and other funding become available, as now expected, USABC intends to award one or more development contracts. However, nothing herein should be interpreted as a commitment to award a contract. A Site Visit by USABC personnel to the Developer's site where the majority of work is to be carried out may be requested prior to the development of a Program Statement of Work (SOW).

Material required by the USABC, in support of due diligence activities during proposal and SOW development, can be found under "Related Documents" at:

http://www.uscar.org/guest/article_view.php?articles_id=87

Information requested below should be answered as thoroughly as possible within a maximum of twenty five pages, in total, for the response to the RFPI. Your submission package should be sent via electronic mail and shall contain a cover letter, a complete copy of your proposal and a signed copy of the RFPI Agreement. If you have any questions concerning the RFPI, please contact Oliver Gross @ (248) 219-3011 or Maureen LaHote @ (313) 910-3720..

NOTWITHSTANDING PROPOSER'S MARKINGS TO THE CONTRARY, ALL INFORMATION SUBMITTED IN RESPONSE TO THIS USABC RFPI SHALL BE TREATED ON A NON-CONFIDENTIAL BASIS.

ALL PROPOSALS ARE TO BE SUBMITTED TO THE CONSORTIUM IN ACCORDANCE WITH THE ATTACHED RFPI AGREEMENT WHICH MUST BE EXECUTED WITHOUT MODIFICATION AND ACCOMPANY THE PROPOSAL. NO PROPOSAL SHALL BE EVALUATED BY THE CONSORTIUM WITHOUT PRIOR EXECUTION OF SUCH RFPI AGREEMENT.

SEND, VIA ELECTRONIC MAIL, YOUR PROPOSAL (including signed RFPI Agreement) TO:

**Maureen LaHote
Business Manager
United States Advanced Battery Consortium
E-mail: mlahote@uscar.org**

6.1 Company Background

In order to become fully familiar with your company(s), the USABC needs information about your business. If your proposal is for a team, furnish the requested information for each company that makes up your team. Please answer/furnish the following information:

- Company structure and ownership, last year's financial statements
- Experience bringing relevant product lines to market; in particular for automotive OEMs
- Manufacturing, research and product development locations
- Summary of total resources available for use in this proposed project

- Experience successfully executing R&D programs with DOE, other funding agencies, or in-house

In preparing a reply to the RFPI please provide a response to each of the following points. A thorough technical review of each proposed technology is required prior to the award of any contract for development.

Provide a brief technical description of the proposed technology that will meet the USABC Cell-Level Energy Storage System (ESS) criteria listed in Appendix A. Note the method used for the determination of each entry in the Appendix (USABC or other methods). Please indicate if the system numbers indicated are estimates.

6.2 Technology Program Introduction

1. Technology description and statement of project objective.
2. What distinguishes this from other technologies and/or approaches?
3. Proposed program, length, cost, and value.
4. End of Program Objectives in relation to USABC goals
5. Technology Background
 - a. Current Technology Status including analysis and test results
 - i. Physical, performance, and life characteristics
 - b. Technical challenges addressed
 - i. Challenges to be addressed during course of project work
 - c. Constraints or limitations that will not meet USABC goals in this project (if any)
 - i. Packaging, safety, manufacturing, recycling, quality etc

6.3 Program Description

1. Gap analysis comparing current state of technology with USABC targets (Appendix A)
 - a. Gap chart (see appx. A) with current status and planned end of program status
 - b. Gap Analysis
2. Clearly state program goals and objectives and compare to USABC goals
3. Provide Program Development plan
 - a. High level Work Breakdown Structure -Include main tasks and any identified subtasks, also include deliverables included in your timeline
 - b. Describe the work proposed for all key elements (tasks) of the plan
 - c. Describe contingency plans for critical aspects of the project
 - d. Note: For selected projects, this section will be the focus of SOW development to reach a well-defined, high value program for the developer and for USABC.
4. Provide a cost estimate or model for the technology, the USABC cost model a required program deliverable) is available at http://www.uscar.org/guest/article_view.php?articles_id=143

6.4 Proposed Prelihtiation Technology Development Plan

Propose how the material/component/subsystem/process technology would be developed to meet the USABC technical criteria including:

- Barriers that must be overcome (should be closely based on the provided gap chart)
- Task objectives needed to overcome the barriers, including the approaches, contingency plans, success criteria, and demonstration tests. A work breakdown structure is helpful but not required.
- Feasibility and scale-up issues that must be resolved
- Transition from feasibility demonstration to prototype hardware

Separately propose how the prelithiation technology could be produced in high volume. Define the raw materials, processes, capital equipment, and labor required at the desired production levels. Discuss the overall timing required to achieve initial production, including prove-out. Define any intermediate steps required to reach initial rated production including pilot plants, technical challenges regarding the manufacturing process, and their time frame.

Define any additional technical issues, and their possible resolution, concerning the proposed prelithiation technology relevant to a USABC ESS application. Propose a warranty structure for the subsystem corresponding to the initial commercial production level.

Developers must clearly identify their milestone objectives. The setting of major milestones and timing will be reviewed and agreed upon between each USABC Work Group and the corresponding subsystem developer/supplier team. It is anticipated that there will be intensive interaction between both parties in setting program milestones. The involvement of all team member organizations in the setting of program milestones is strongly encouraged

The proposals must be accompanied by a development time chart characterizing the following:

1. Length of time the prelithiation technology has been under development by the developer
2. Length of time remaining to full scale, automotive cell prototype hardware availability
3. Time line for commercialization, including any preproduction phases that may be planned
4. A table of milestones and deliverables with specific timing quantified for each

6.5 Proposed Cost, Budget and Cost Sharing

Provide a projected cost breakdown of the proposed prelithiation technology, including costs projected for the desired production volumes. Costs related to warranty and/or replacement, and recycling should be clearly indicated. The manner in which the projected costs, volumes and time schedules are expected to be achieved should also be provided.

Developers are expected to contribute or cost share in the developmental costs. The developer should submit proposals indicating cost sharing as a percentage of the total proposed program development amount. The extent of cost sharing may be negotiated between USABC and the

development team, taking into consideration whether the company is domestic, foreign, or foreign controlled, rights to license background and foreground technology, benefits to US economy, and other factors. However, a minimum of 50 percent developer cost share is contractually required. The Developer will agree that at least 75% of the direct labor billed to the USABC for this project will be incurred within the United States.

The proposer shall provide cost breakdown between labor, materials, indirect costs, etc. and a separate analysis of total costs for each major task. The tasks that each subcontractor will complete and the funding they will receive should be clearly indicated in the cost breakdown.

Contractors will provide quarterly reports to USABC, including test data and development progress. A final report will be submitted to USABC at the end of the contract period.

6.6 Program Management and Corporate Relationships

The proposal should indicate any additional resources that may be required beyond those of the contractor to achieve program goals. This would include the development of cooperative relationships between component developers, component manufacturers, process developers, and subsystem integrators. Other cooperative relationships could involve National Laboratories or Universities for materials research, test facility development, test and analytical procedures, or other techniques available only at specialized locations.

- Provide list of any outside companies or organizations who will contribute to program goals
- Provide list of key personnel, in particular program manager, and percentage of time allocated to the project
- Provide a brief resume of key personnel to be assigned to the project

6.7 Export Control Compliance

The proposer will be required to acknowledge that export control rules limit or prohibit the transfer of covered technology to foreign nationals and agrees to establish and maintain internal controls and procedures adequate to insure accurate determination by the proposer of whether and when its technology falls within the ranges and definitions of the currently effective export control regime.

6.8 Signed RFPI Agreement (Appendix B)

RFPI Agreement is included in Appendix B – Proposal Template (page 15). Sign and date RFPI Agreement and submit with proposal.



APPENDIX A - USABC Goals for Advanced Batteries for Electric Vehicle Applications

End of Life Characteristics at 30°C	Units	System Level	Cell Level
Peak Discharge Power Density 30 s Pulse	W/L	1000	1500
Peak Specific Discharge Power, 30 s Pulse	W/kg	470	700
Peak Specific Regen Power, 10 s Pulse	W/kg	200	300
Useable Energy Density @ C/3 Discharge Rate	Wh/L	500	750
Useable Specific Energy @ C/3 Discharge Rate	Wh/kg	235	350
Useable Energy @ C/3 Discharge Rate	kWh	45	N/A
Calendar Life	Years	15	15
DST Cycle Life	Cycles	1000	1000
Cost @ 250k Units	\$/kWh	125	100
Operating Environment	°C	-30° to +52°	-30° to +52°
Normal Recharge Time	Hours	< 7 Hours, J1772	< 7 Hours, J1772
High Rate Charge	Minutes	80%ΔSOC in 15 min	80%ΔSOC in 15 min
Maximum Operating Voltage	V	420	N/A
Minimum operating Voltage	V	220	N/A
Peak Current, 30 s	A	400	400
Unassisted Operating at Low Temperature	%	>70% Useable Energy @ C/3 Discharge Rate at -20°C	>70% Useable Energy @ C/3 Discharge Rate at -20°C
Survival Temperature Range, 24 Hr.	°C	-40° to +66°	-40° to +66°
Maximum Self-discharge	%/month	<1	<1

*Based on a 10Ah li-ion cell.

(Appendix B)

RFPI AGREEMENT

NOTWITHSTANDING PROPOSER'S MARKINGS TO THE CONTRARY, ALL INFORMATION SUBMITTED IN RESPONSE TO A UNITED STATES ADVANCED BATTERY CONSORTIUM (USABC) REQUEST FOR PROPOSAL INFORMATION (RFPI) SHALL BE TREATED ON A NON-CONFIDENTIAL BASIS.

AGREED:

BY _____

TITLE _____

PROPOSER _____

DATE _____

APPENDIX C – USABC PROPOSAL TEMPLATE

Brief Company Background / Overview

1. Company structure and ownership, last year's financial statements
2. Experience bringing relevant product lines to market; in particular for automotive OEMs
3. Manufacturing, research and product development locations
4. Summary of total resources available for use in this proposed project
5. Experience successfully executing R&D programs with DOE, other funding agencies, or in-house

Technology Program Introduction

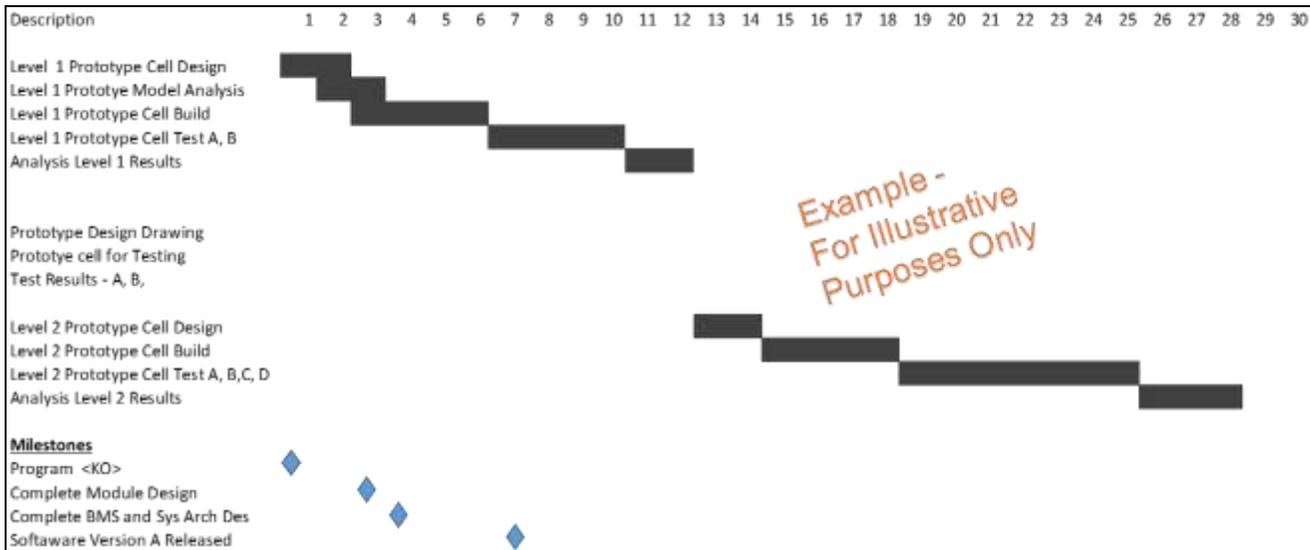
1. Technology description and statement of project objective.
2. What distinguishes this from other technologies and/or approaches?
3. Proposed program, length, cost, and value.
4. End of Program Objectives in relation to USABC goals
5. Technology Background
 - a. Current Technology Status including analysis and test results
 - i. Physical, performance, and life characteristics
 - b. Technical challenges addressed
 - i. Challenges to be addressed during course of project work
 - c. Constraints or limitations that will not meet USABC goals in this project (if any)
 - i. Packaging, safety, manufacturing, recycling, quality etc.

Program Description

1. Gap analysis comparing current state of technology with USABC targets (Appendix A)
 - a. Gap chart (see appx. A) with current status and planned end of program status
 - b. Gap Analysis (?)
2. Clearly state program goals and objectives and compare to USABC goals
3. Provide Program Development plan
 - a. High-level Work Breakdown Structure -Include main tasks and any identified subtasks, also include deliverables included in your timeline
 - b. Describe the work proposed for all key elements (tasks) of the plan
 - c. Describe contingency plans for critical aspects of the project
 - d. Note: For selected projects, this section will be the focus of SOW development to reach a well-defined, high-value program for the developer and for USABC.
4. Provide a cost estimate or model for the technology, the USABC cost model (a required program deliverable) is available at http://www.uscar.org/guest/article_view.php?articles_id=143

Development Timing Plan

1. Timing Chart
Example Timing Chart:



2. Table of Milestones and Deliverables

- Quantified deliverables and specific timing required (see example)

Event # (keyed to WBS tasks)	Event Class	Event Title	Planned Month
M1.1.1	Milestone	Buy needed cells	2
M1.1.2	Milestone	Complete Module design	3
M1.2.1	Milestone	Complete BMS and system architecture design	4
M1.2.2	Milestone	Software Revision A Released	8
M1.2.3	Milestone	Software Revision FINAL Released	15
M1.3.1	Milestone	Release Feasibility Plan	1
D1.3.1	Deliverable	Feasibility Study Report	15
D1.4.1	Deliverable	Ship 3 ea Modules to national labs for Baseline tests	5
D1.4.2	Deliverable	Ship 18 ea improved Modules to national labs for Final tests	18
M1.5.1	Milestone	CAD model of Prototype Module	12
D1.5.1	Deliverable	Module Design & Analysis Report	13
D1.6.1	Deliverable	12V SS Cost Model – Final	16
M2.1	Milestone	Baseline Cell Configuration	4
M2.1.1	Milestone	cell electrolyte formulation identified	15
M2.2	Milestone	Final Cell Configuration	15
M2.2.1	Milestone	Packaging design freeze	14
D2.1	Deliverable	Final Cell Technical Report	18
D2.4.1	Deliverable	Ship 5 ea cells to national labs for Baseline tests	5
D2.4.2	Deliverable	Ship 20 ea cells to national labs for Final tests	19
M2.5.1	Milestone	cell Cost Model – Prototype	12
D2.5	Deliverable	cell Cost Model – Final	15
M0.1	Milestone	Kickoff Meeting	1
M0.2	Milestone	Program Gate Review Meeting	13
D0.1	Deliverable	Quarterly Program Reports	Every 3
D0.2	Deliverable	DOE Annual Progress Reports	Annual
D0.3	Deliverable	Final Program Report	19

Program Cost, Budget and Cost Sharing

1. Project cost table broken down by task; if subcontractors are included in the proposal include costs broken down by subcontractor as well.

- a. Note: Awarded projects must fill in the EERE 335 Budget form (http://www.uscar.org/guest/article_view.php?articles_id=87); it may be used in the proposal if desired.
 - b. Note: For budgeting purposes be aware that a set of baseline cells, possibly one or more sets of midterm cells, and a final set of cells are normally required for testing in USABC projects, depending on project length. Testing is done both at the national labs and to a large extent the same tests are conducted at the supplier. Accordingly, a minimum of 20 to 40 cells will typically need to be built at each of these points.
2. A table or graph of predicted cumulative spending rate over project period
 3. Describe proposed cost share (a minimum of 50 percent developer cost share is contractually required and is recommended)
 4. Provide confirmation that at least 75% of the direct labor billed to USABC for this project will be incurred within the United States

Program Management / Corporate Relationships

1. Provide list of any outside companies or organizations who will contribute to program goals
2. Provide list of key personnel, in particular program manager, and percentage of time allocated to the project
3. Provide a brief resume of key personnel to be assigned to the project

Export Compliance

1. Provide acknowledgement that export control rules limit or prohibit the transfer of covered technology to foreign nationals
2. Establish and maintain internal controls and procedures adequate to insure accurate determination by the proposer of whether and when its technology falls within the ranges and definitions of the currently effective export control regime.